Transnet Rail Infrastructure Manager

an Operating Division **TRANSNET SOC LTD**

[Registration Number 1990/000900/30]

REQUEST FOR PROPOSAL (RFP)

FOR THE REFURBISHMENT OF 2 X 20MVA TRACTION TRANSFORMERS AT VARIOUS SUBSTATION ON THE NORTH CORRIDOR SHUTDOWN.

RFP NUMBER	**: SIM25002CIDB(ERAC-RCB-50234)**
ISSUE DATE	**: 06 JUNE 2025**
COMPULSORY BRIEFING SESSION	**: 13 JUNE 2025**
CLOSING DATE	**: 20 JUNE 2025**
CLOSING TIME	**: 12H00 PM**
TENDER VALIDITY PERIOD	**: 12 WEEKS**

Contents

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T1.1 TENDER NOTICE AND INVITATION TO TENDER

SECTION 1: NOTICE TO TENDERERS

1. INVITATION TO TENDER

Responses to this Tender [hereinafter referred to as a **Tender**] are requested from persons, companies, close corporations or enterprises [hereinafter referred to as a Tenderer].

DESCRIPTION	**FOR THE REFURBISHMENT OF 2 X 20MVA TRACTION TRANSFORMERS AT VARIOUS SUBSTATION ON THE NORTH CORRIDOR SHUTDOWN.**
TENDER DOWNLOADING	**This Tender may be downloaded directly from the National Treasury eTender Publication Portal at www.etenders.gov.za and the Transnet website at https://transnetetenders.azurewebsites.net (please use Google Chrome to access Transnet link) FREE OF CHARGE.**

COMPULSORY TENDER CLARIFICATION MEETING	A Compulsory Tender Clarification Meeting will be conducted at RBCT Substation at Richards Bay the GPS coordinates are Lat: 28°48'14.19"S Long:32° 0'59.47"E **on the 13 JUNE 2025,** at **10:00am [10 O'clock]** for a period of ± 3 (Three) hours. [Tenderers to provide own transportation and accommodation]. The Compulsory Tender Clarification Meeting will start punctually, and information will not be repeated for the benefit of Tenderers arriving late. **A Site visit/walk will take place, tenderers are to note**: • Tenderers are required to wear safety shoes, goggles, long sleeve shirts, high visibility vests and hard hats. • Tenderers without the recommended PPE will not be allowed on the site walk. • Tenderers and their employees, visitors, clients and customers entering Transnet Offices, Depots, Workshops and Stores will have to undergo breathalyser testing. • All forms of firearms are prohibited on Transnet properties and premises. • The relevant persons attending the meeting must ensure that their identity documents, passports or drivers' licences are on them for inspection at the access control gates.

	Certificate of Attendance in the form set out in the **Returnable Schedule T2.2-01** hereto must be completed and submitted with your Tender as proof of attendance is required for a **compulsory** site meeting and/or tender briefing. **Tenderers are required to bring this Returnable Schedule T2.2-01 to the Compulsory Tender Clarification Meeting to be signed by the Employer's Representative.** **Tenderers failing to attend the compulsory tender briefing will be disqualified.**
CLOSING DATE	**12:00pm on** the **20 JUNE 2025** Tenderers must ensure that tenders are uploaded timeously onto the system. **If a tender is late, it will not be accepted for consideration.**
VALIDITY PERIOD	**Twelve (12) weeks from Closing Date** Tenderers are to note that they may be requested to extend the validity period of their tender, at the same terms and conditions, if the internal evaluation process has not been finalised within the validity period. However, once the adjudication body has approved the process and award of the business to the successful Tenderer(s), the validity of the successful Tenderer(s)' bid will be deemed to remain valid until a final contract has been concluded. Should a bidder fail to respond to a request for extension of the validity period before it expires, that bidder will be excluded from tender process.

2. TENDER SUBMISSION

Transnet has implemented a new electronic tender submission system, the e-Tender Submission Portal, in line with the overall Transnet digitalization strategy where suppliers can view advertised tenders, register their information, log their intent to respond to bids and upload their bid proposals/responses on to the system.

a) The Transnet e-Tender Submission Portal can be accessed as follows:

Log on to the Transnet eTenders management platform website (https://transnetetenders.azurewebsites.net);

- Click on "ADVERTISED TENDERS" to view advertised tenders;
- Click on "SIGN IN/REGISTER – for bidder to register their information (must fill in all mandatory information);
- Click on "SIGN IN/REGISTER" - to sign in if already registered;

- Toggle (click to switch) the "Log an Intent" button to submit a bid;
- Submit bid documents by uploading them into the system against each tender selected.
- **Tenderers are required to ensure that electronic bid submissions are done at least a day before the closing date to prevent issues which they may encounter due to their internet speed, bandwidth or the size of the number of uploads they are submitting. Transnet will not be held liable for any challenges experienced by bidders as a result of the technical challenges. Please do not wait for the last hour to submit. A Tenderer can upload 30mb per upload and multiple uploads are permitted.**

b) The tender offers to this tender will be opened as soon as possible after the closing date and time. Transnet shall not, at the opening of tenders, disclose to any other company any confidential details pertaining to the Tender Offers / information received, i.e. pricing, delivery, etc. The names and locations of the Tenderers will be divulged to other Tenderers upon request.

c) Submissions must not contain documents relating to any Tender other than that shown on the submission.

3. CONFIDENTIALITY

All information related to this RFP is to be treated with strict confidentiality. In this regard Tenderers are required to certify that they have acquainted themselves with the Non-Disclosure Agreement. All information related to a subsequent contract, both during and after completion thereof, will be treated with strict confidence. Should the need however arise to divulge any information gleaned from provision of the Works, which is either directly or indirectly related to Transnet's business, written approval to divulge such information must be obtained from Transnet.

4. DISCLAIMERS

Tenderers are hereby advised that Transnet is not committed to any course of action as a result of its issuance of this Tender and/or its receipt of a tender offer. In particular, please note that Transnet reserves the right to:

4.1. Award the business to the highest scoring Tenderer/s unless objective criteria justify the award to another tenderer.

4.2. Not necessarily accept the lowest priced tender or an alternative Tender;

4.3. Go to the open market if the quoted rates (for award of work) are deemed unreasonable;

4.4. Should the Tenderers be awarded business on strength of information furnished by the Tenderer, which after conclusion of the contract is proved to have been incorrect, Transnet reserves the right to terminate the contract;

4.5. Request audited financial statements or other documentation for the purposes of a due diligence exercise;

4.6. Not accept any changes or purported changes by the Tenderer to the tender rates after the closing date;

4.7. Verify any information supplied by a Tenderer by submitting a tender, the Tenderer/s hereby irrevocably grant the necessary consent to the Transnet to do so;

4.8. Conduct the evaluation process in parallel. The evaluation of Tenderers at any given stage must therefore not be interpreted to mean that Tenderers have necessarily passed any previous stage(s);

4.9. Unless otherwise expressly stated, each tender lodged in response to the invitation to tender shall be deemed to be an offer by the Tenderer. The Employer has the right in its sole and unfettered discretion not to accept any offer.

4.10. Not be held liable if tenderers do not provide the correct contact details during the clarification session and do not receive the latest information regarding this RFP with the possible consequence of being disadvantaged or disqualified as a result thereof.

4.11. Transnet reserves the right to exclude any Tenderers from the tender process who has been convicted of a serious breach of law during the preceding 5 [five] years including but not limited to breaches of the Competition Act 89 of 1998, as amended. Tenderers are required to indicate in tender returnable [T2.2-19, [**Breach of Law**] whether or not they have been found guilty of a serious breach of law during the past 5 [five] years.

4.12. Transnet reserves the right to perform a risk analysis on the preferred tenderer to ascertain if any of the following might present an unacceptable commercial risk to the employer*:*

- *unduly high or unduly low tendered rates or amounts in the tender offer;*
- *contract data of contract provided by the tenderer; or*
- *the contents of the tender returnables which are to be included in the contract.*

5. Transnet will not reimburse any tenderer for any preparatory costs or other work performed in connection with this Tender, whether or not the Tenderer is awarded a contract.

6. NATIONAL TREASURY'S CENTRAL SUPPLIER DATABASE

Tenderer are required to self-register on National Treasury's Central Supplier Database (CSD) which has been established to centrally administer supplier information for all organs of state and facilitate the verification of certain key supplier information. The CSD can be accessed at https://secure.csd.gov.za/. Tenderer are required to provide the following to Transnet in order to enable it to verify information on the CSD:

Supplier Number…… and Unique registration reference number……(Tender Data)

Transnet urges its clients, suppliers and the general public

to report any fraud or corruption to

TIP-OFFS ANONYMOUS: 0800 003 056 OR Transnet@tip-offs.com

RFP CLARIFICATION REQUEST FORM

RFP No: SIM25002CIDB(ERAC-RCB-50234)

RFP deadline for questions / RFP Clarifications: **17 JUNE 2025 @ 12:00pm**

TO: Transnet SOC Ltd
ATTENTION: Governance, Transnet Freight Rail Tender Office
EMAIL Prudence.Nkabinde@transnet.net
Cc Samukelisiwe.Mhlanga2@transnet.net
DATE: _____
FROM: _____
_____

Indicate whether this query is general in nature and applicable to all service categories Yes ☐ No ☐

1. For all clarification questions **prior** to the tender closing date and time, direct the communication to the RFP Administrator at **Samukelisiwe.Mhlanga2@transnet.net**
2. For all clarification questions **after** the tender closing date and time, direct the communication to:

TO: Transnet SOC Ltd
ATTENTION: Governance, Transnet Freight Rail Tender Office
EMAIL Prudence.Nkabinde@transnet.net
Cc Samukelisiwe.Mhlanga2@transnet.net
DATE: _____
FROM: _____

REQUEST FOR RFP CLARIFICATION

_____
_____
_____
_____
_____
_____

SIGNED at _____ on this _____ day of _____20___

_____ _____
SIGNATURE OF TENDERER SIGNATURE OF WITNESS

_____ _____
NAME OF TENDERER NAME OF WITNESS

T1.2 TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in Annex C of the CIDB Standard for Uniformity in Engineering and Construction Works Contracts. The Standard for Uniformity in Construction Procurement was first published in Board Notice 62 of 2004 in Government Gazette No 26427 of 9 June 2004. It was subsequently amended in Board Notice 67 of 2005 in Government Gazette No 28127 of 14 October 2005, Board Notice 93 of 2006 in Government Gazette No 29138 of 18 August 2006, Board Notice No 9 of 2008 in Government Gazette No 31823 of 30 January 2009, Board Notice 86 of 2010 in Government Gazette No 33239 of 28 May 2010, Board Notice 136 of 2015 in Government Gazette 38960 of 10 July 2015 and Board Notice 423 of 2019 in Government Gazette No 42622 of 8 August 2019.

This edition incorporates the amendments made in Board Notice 423 of 2019 in Government Gazette 42622 of 8 August 2019. (see www.cidb.org.za).

The Standard Conditions of Tender make several references to Tender data for detail that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross-referenced in the left-hand column to the clause in the Standard Conditions of Tender to which it mainly applies.

Clause		Data
C.1.1	The *Employer* is	**Transnet SOC Ltd** **(Reg No. 1990/000900/30)**
C.1.2	The tender documents issued by the *Employer* comprise:	
	Part T: The Tender	
	Part T1: Tendering procedures	T1.1 Tender notice and invitation to tender T1.2 Tender data
	Part T2 : Returnable documents	T2.1 List of returnable documents T2.2 Returnable schedules
	Part C: The contract	
	Part C1: Agreements and contract data	C1.1 Form of offer and acceptance C1.2 Contract data (Part 1 & 2)
	Part C2: Pricing data	C2.1 Pricing instructions C2.2 Price List
	Part C3: Scope of work	C3.1 Service Information
	Part C4: Affected Property	C4.1 Affected Property

C.1.4	The Employer's agent is:	Procurement Officer
	Name:	Samukelisiwe Mhlanga
	Address:	150 Commissioner Street, Johannesburg 2001
	Tel No.	011 584 1071
	E – mail	Samukelisiwe.Mhlanga2@transnet.net

C.2.1 Only those tenderers who satisfy the following eligibility criteria are eligible to submit tenders:

1. **Stage One - Eligibility with regards to attendance at the compulsory clarification meeting:**

   An authorised representative of the tendering entity or a representative of a tenderering entity that intends to form a Joint Venture (JV) must attend the compulsory clarification meeting in terms C2.7

Any tenderer that fails to meet the stipulated eligibility criteria will be regarded as an unacceptable tender.

2. **Stage Two - Eligibility in terms of the Construction Industry Development Board:**

a) Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, designation of **2EP or higher** class of construction work, are eligible to have their tenders evaluated.

b) Joint Venture (JV)

Joint ventures are eligible to submit tenders subject to the following:

1. every member of the joint venture is registered with the CIDB;
2. the combined Contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a 2EP or higher class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations
3. The tenderer shall provide a certified copy of its signed joint venture agreement.

3. Stage Three - Functionality:

Only those tenderers who obtain the minimum qualifying score for functionality will be evaluated further in terms of price and the applicable preference point system. The minimum qualifying for score for functionality is 70 points.

The evaluation criteria for measuring functionality and the points for each criteria and, if any, each sub-criterion are as stated in C.3.11.3 below.

Any tenderer that fails to meet the stipulated eligibility criteria will be regarded as an unacceptable tender.

C.2.7	The arrangements for a compulsory clarification meeting are as stated in the Tender Notice and Invitation to Tender. **Tenderers must complete and sign the attendance register.** Addenda will be issued to and tenders will only be received from those tendering entities including those entities that intends forming a joint venture appearing on the attendance register. Tenderers are also **required to bring their RFP document to the briefing session and have their returnable document T2.2-01 certificate of attendance** signed off by the Employer's authorised representative.
C.2.12	No alternative tender offers will be considered.
C.2.13.3	Each tender offer shall be in the **English Language.**
C.2.13.5 C2.15.1	The *Employer*'s details and identification details that are to be shown on each tender offer package are as follows: Identification details: The tender documents must be uploaded with: ▪ Name of Tenderer: ▪ Contact person and details: The Tender Number: SIM25002CIDB(ERAC-RCB-50234) The Tender Description: For The Refurbishment Of 2 X 20MVA Traction Transformers at Various Substation on The North Corridor Shutdown Documents must be marked for the attention of: ***Employer*'s Agent: Samukelisiwe Mhlanga**
C.2.13.9	Telephonic, telegraphic, facsimile or e-mailed tender offers will not be accepted.
C.2.15	The closing time for submission of tender offers is: Time: **12:00pm** on the **20 JUNE 2025**

	Location: The Transnet e-Tender Submission Portal: (https://transnetetenders.azurewebsites.net); **NO LATE TENDERS WILL BE ACCEPTED**
C.2.16	The tender offer validity period is **12 weeks** after the closing date. Tenderers are to note that they may be requested to extend the validity period of their tender, on the same terms and conditions, if Transnet's internal evaluation and governance approval processes has not been finalised within the validity period.
C.2.23	The tenderer is required to submit with his tender: 1. A valid Tax Clearance Certificate issued by the South African Revenue Services. **Tenderers also to provide Transnet with a TCS PIN to verify Tenderers compliance status**. 2. A **valid B-BBEE Certificate** from a Verification Agency accredited by the South African Accreditation System [**SANAS**], or a **sworn affidavit** confirming annual turnover and level of black ownership, in line with the code of good practice, together with the tender; 3. A valid CIDB CSR number in the correct designated grading; 4. Proof of registration on the Central Supplier Database; 5. Letter of Good Standing with the Workmen's compensation fund by the tendering entity or separate Letters of Good Standing from all members of a newly constituted JV. **Note:** Refer to Section T2.1 for List of Returnable Documents
C3.11	The minimum number of evaluation points for functionality is: **70** The procedure for the evaluation of responsive tenders is Functionality, Price and Preference:

C.3.11. Only tenders that achieve the minimum qualifying score for functionality will be evaluated further in accordance with the 80/20 preference points systems as described in Transnet Preferential Procurement Policy (TPPP).

80 where the financial value of one or more responsive tenders received have a value below R50 million, inclusive of all applicable taxes,

Thresholds	Minimum Threshold
Functionality	70

Evaluation Criteria	Final Weighted Scores
Price	80
Specific goals - Scorecard	20
TOTAL SCORE:	**100**

Up to 100 minus W_1 tender evaluation points will be awarded to tenderers who complete the preferencing schedule and who are found to be eligible for the preference claimed. **Should the evidence required for any of the Specific Goals applicable in this tender not be provided, a tenderer will score zero preference points for that particular "Specific Goal".**

In terms of Transnet Preferential Procurement Policy (TPPP) and Procurement Manuals, the following preference points must be awarded to a bidder who provides the relevant required evidence for claiming points

Selected Specific Goal	Number of points allocated (20)
B-BBEE LEVEL 1 OR 2	5
Entities that are at least owned by 30% Black Women	5
Entities that are at least owned 50% Black Youth	5
Entities that are owned People living with Disabilities	5
Non-Compliant and/or B-BBEE Level 3-8 contributors	0

The following Table represents the evidence to be submitted for claiming preference points for applicable specific goals in a particular tender:

Specific Goals	Acceptable Evidence
B-BBEE LEVEL 1 OR 2	B-BBEE Certificate / Sworn-Affidavit B-BBEE Certificate (in case of JV, a consolidate scorecard will be accept) as per DTIC guidelines
Entities that are at least owned by 30% Black Women	Certified copy of ID Documents of the Owners and B-BBEE Certificate / Sworn- Affidavit / B-BBEE CIPC Certificate (in case of JV, a consolidated scorecard will be accepted) as per DTIC guideline
Entities that are at least owned 50% Black Youth	Certified copy of ID Documents of the Owners and B-BBEE Certificate / Sworn- Affidavit / B-BBEE CIPC Certificate (in case of JV, a consolidated scorecard will be accepted) as per DTIC guideline
Entities that are owned People living with Disabilities	Certified copy of ID Documents of the Owners / Doctor's note and /or EEA1 form confirming the disability

The maximum points for this bid are allocated as follows:

DISCRIPTION	POINTS
PRICE	80
B-BBEE LEVEL 1 OR 2	5
Entities that are at least owned by 30% Black Women	5
Entities that are at least owned 50% Black Youth	5
Entities that are owned People living with Disabilities	5
Total points for Price and Specific Goals must not exceed	100

Note: Transnet reserves the right to carry out an independent audit of the tenderers scorecard components at any stage from the date of close of the tenders until completion of the contract.

C.3.13 Tender offers will only be accepted if:

1. The tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector;

2. the tenderer does not appear on Transnet's list for restricted tenderers and National Treasury's list of Tender Defaulters;

3. the tenderer has fully and properly completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the Employer or potentially compromise the tender process and persons in the employ of the state.

4. Transnet reserves the right to award the tender to the tenderer who scores the highest number of points overall, unless there are **objective criteria** which will justify the award of the tender to another tenderer. Objective criteria include but are not limited to the outcome of a due diligence exercise to be conducted. The due diligence exercise may take the following factors into account inter alia;

   the tenderer:

   a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,
   b) is not undergoing a process of being restricted by Transnet or other state institution that Transnet may be aware of,
   c) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,
   d) has the legal capacity to enter into the contract,
   e) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,
   f) complies with the legal requirements, if any, stated in the tender data and
   g) is able, in the option of the employer to perform the contract free of conflicts of interest.

C.3.17	The number of paper copies of the signed contract to be provided by the Employer is 1 (one).

STAATSKOERANT, 8 AUGUSTUS 2019

DEPARTMENT OF PUBLIC WORKS
NOTICE 423 OF 2019

STANDARD FOR UNIFORMITY IN ENGINEERING AND CONSTRUCTION WORKS CONTRACTS
AUGUST 2019

Annex C

Standard Conditions of Tender

C.1 General

C.1.1 Actions

C.1.1.1 The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in C.2 and C.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

C.1.1.2 The employer and the tenderer and all their agents and employees involved in the tender Process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

Note: 1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.

2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.

C.1.1.3 The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

C.1.2 Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

C.1.3 Interpretation

C.1.3.1 The tender data and additional requirements contained in the tender schedules that are Included in the returnable documents are deemed to be part of these conditions of tender.

C.1.3.2 These conditions of tender, the tender data and tender schedules which are required for Tender evaluation purposes, shall form part of any contract arising from the invitation to tender.

C.1.3.3 For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation in which:

i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfill his or her duties impartially;

ii) an individual or tenderer is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or

iii) incompatibility or contradictory interests exist between an employee and the tenderer who employs that employee.

b) **comparative offer** means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;

c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process;

d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels;

C.1.4 Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

C.1.5 Cancellation and Re-Invitation of Tenders

C.1.5.1 An employer may, prior to the award of the tender, cancel a tender if

a) due to changed circumstances, there is no longer a need for the engineering and construction works specified in the invitation;

b) funds are no longer available to cover the total envisaged expenditure; or

c) no acceptable tenders are received.

d) there is a material irregularity in the tender process.

C.1.5.2 The decision to cancel a tender invitation must be published in the same manner in which the original tender invitation was advertised

C.1.5.3 An employer may only with the prior approval of the relevant treasury cancel a tender Invitation for the second time.

C.1.6 Procurement procedures

C.1.6.1 General

Unless otherwise stated in the tender data, a contract will, subject to C.3.13, be concluded with the tenderer who in terms of C.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

C.1.6.2 Competitive negotiation procedure

C.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of C.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of C.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

C.1.6.2.2 All responsive tenderers or at least a minimum of not less than three responsive tenderers that are highest ranked in terms of the evaluation criteria stated in the tender data shall be invited to enter into competitive negotiations based on the principle of equal treatment, keeping confidential the proposed solutions and associated information.

Notwithstanding the provisions of C.2.17, the employer may request that tenders be clarified, Specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

C.1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to revise their tender offer based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

C.1.6.2.4 The contract shall be awarded in accordance with the provisions of C.3.11 and C.3.13 after tenderers have been requested to submit their best and final offer.

C.1.6.3 Proposal procedure using the two stage-system

C.1.6.3.1 Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

C.1.6.3.2 Option 2

C.1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

C.1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

C.2 Tenderer's obligations

C.2.1 Eligibility

C.2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with employer.

C.2.1.2 Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

C.2.2 Cost of tendering

C.2.2.1 Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

C.2.2.2 The cost of the tender documents charged by the employer shall be limited to the actual cost incurred by the employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

C.2.3 Check documents

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

C.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

C.2.5 Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

C.2.6 Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

C.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

C.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five (5) working days before the closing time stated in the tender data.

C.2.9 Insurance

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

C.2.10 Pricing the tender offer

C.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes Except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable fourteen (14) days before the closing time stated in the tender data.

C.2.10.2 Show VAT payable by the employer separately as an addition to the tendered total of the prices.

C.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

C.2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

C.2.11 Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

C.2.12 Alternative tender offers

C.2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

C.2.12.2 Accept that an alternative tender offer must be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

C.2.12.3 An alternative tender offer must only be considered if the main tender offer is the winning tender.

C.2.13 Submitting a tender offer

C.2.13.1 Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

C.2.13.2 Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

C.2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number Of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

C.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

C.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the Packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

C.2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked “financial proposal” and place the remaining returnable documents in an envelope marked “technical proposal”. Each envelope shall state on the outside the employer’s address and identification details stated in the tender data, as well as the tenderer's name and contact address.

C.2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

C.2.13.8 Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

C.2.13.9 Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

C.2.14 Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

C.2.15 Closing time

C.2.15.1 Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

C.2.15.2 Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

C.2.16 Tender offer validity

C.2.16.1 Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

C.2.16.2 If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

C.2.16.3 Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted. If the validity period stated in C.2.16 lapses before the employer evaluating tender, the contractor reserves the right to review the price based on Consumer Price Index (CPI).

C.2.16.4 Where a tender submission is to be substituted, a tenderer must submit a substitute tender in accordance with the requirements of C.2.13 with the packages clearly marked as "SUBSTITUTE".

C.2.17 Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

Note: *Sub-clause C.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.*

C.2.18 Provide other material

C.2.18.1 Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive.

C.2.18.2 Dispose of samples of materials provided for evaluation by the employer, where required.

C.2.19 Inspections, tests and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

C.2.20 Submit securities, bonds and policies

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

C.2.21 Check final draft

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

C.2.22 Return of other tender documents

If so instructed by the employer, return all retained tender documents within twenty-eight (28) days after the expiry of the validity period stated in the tender data.

C.2.23 Certificates

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

C.3 The employer's undertakings

C.3.1 Respond to requests from the tenderer

C.3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up To five (5) working days before the tender closing time stated in the Tender Data and notify all tenderers who collected tender documents.

C.3.1.2 Consider any request to make a material change in the capabilities or formation of the Tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;
b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or
c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

C.3.2 Issue Addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three (3) working days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who collected tender documents.

C.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

C.3.4 Opening of tender submissions

C.3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

C.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

C.3.4.3 Make available the record outlined in C.3.4.2 to all interested persons upon request.

C.3.5 Two-envelope system

C.3.5.1 Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

C.3.5.2 Evaluate functionality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the functionality evaluation more than the minimum number of points for functionality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any points claimed on BBBEE status level. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality.

C.3.6 Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

C.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

C.3.8 Test for responsiveness

C.3.8.1 Determine, after opening and before detailed evaluation, whether each tender offer properly received:

a) complies with the requirements of these Conditions of Tender,

b) has been properly and fully completed and signed, and

c) is responsive to the other requirements of the tender documents.

C.3.8.2 A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer*'s* opinion, would:

a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work*,*

b) significantly change the Employer*'s* or the tenderer's risks and responsibilities under the contract, or

c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified. Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation.

C.3.9 Arithmetical errors, omissions and discrepancies

C.3.9.1 Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amount in words, the amount in words shall govern.

C.3.9.2 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with C.3.11 for:

a) the gross misplacement of the decimal point in any unit rate;

b) omissions made in completing the pricing schedule or bills of quantities; or

c) arithmetic errors in:

(i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or

(ii) the summation of the prices.

C.3.9.3 Notify the tenderer of all errors or omissions that are identified in the tender offer and either confirm the tender offer as tendered or accept the corrected total of prices.

C.3.9.4 Where the tenderer elects to confirm the tender offer as tendered, correct the errors as follows:

a) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.

b) Where there is an error in the total of the prices either as a result of other corrections Required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

C.3.10 Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

C.3.11 Evaluation of tender offers

The Standard Conditions of Tender standardize the procurement processes, methods and procedures from the time that tenders are invited to the time that a contract is awarded. They are generic in nature and are made project specific through choices that are made in developing the Tender Data associated with a specific project. Conditions of tender are by definition the document that establishes a tenderer's obligations in submitting a tender and the employer's undertakings in soliciting and evaluating tender offers. Such conditions establish the rules from the time a tender is advertised to the time that a contract is awarded and require employers to conduct the process of offer and acceptance in terms of a set of standard procedures.

The CIDB Standard Conditions of Tender are based on a procurement system that satisfies the following system requirements:

Requirement Qualitative interpretation of goal

Fair The process of offer and acceptance is conducted impartially without bias, providing simultaneous and timely access to participating parties to the same information.

Equitable Terms and conditions for performing the work do not unfairly prejudice the interests of the parties.

Transparent The only grounds for not awarding a contract to a tenderer who satisfies all requirements are restrictions from doing business with the employer, lack of capability or capacity, legal impediments and conflicts of interest.

Competitive The system provides for appropriate levels of competition to ensure cost effective and best value outcomes.

Cost effective The processes, procedures and methods are standardized with sufficient flexibility to attain best value outcomes in respect of quality, timing and price, and least resources to effectively manage and control procurement processes.

The activities associated with evaluating tender offers are as follows:

a) Open and record tender offers received
b) Determine whether or not tender offers are complete
c) Determine whether or not tender offers are responsive
d) Evaluate tender offers
e) Determine if there are any grounds for disqualification

f) Determine acceptability of preferred tenderer

g) Prepare a tender evaluation report

h) Confirm the recommendation contained in the tender evaluation report

C.3.11.1 General

The employer must appoint an evaluation panel of not less than three persons conversant with the proposed scope of works to evaluate each responsive tender offer using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

C.3.12 Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer *'s* information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

C.3.13 Acceptance of tender offer

Accept the tender offer; if in the opinion of the employer, it does not present any risk and only if the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement;

b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract;

c) has the legal capacity to enter into the contract;

d) is not; insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act No. 2008, bankrupt or being wound up, has his/her affairs administered by a court or a judicial officer, has suspended his/her business activities or is subject to legal proceedings in respect of any of the foregoing;

e) complies with the legal requirements, if any, stated in the tender data; and

f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

C.3.14 Prepare contract documents

C.3.14.1 If necessary, revise documents that shall form part of the contract and that were issued by The employer as part of the tender documents to take account of:

a) addenda issued during the tender period,

b) inclusion of some of the returnable documents and

c) other revisions agreed between the employer and the successful tenderer.

C.3.14.2 Complete the schedule of deviations attached to the form of offer and acceptance, if any.

C.3.15 Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

C.3.16 Registration of the award

An employer must, within twenty-one (21) working days from the date on which a contractor's offer to perform a construction works contract is accepted in writing by the employer, register and publish the award on the cidb Register of Projects.

C.3.17 Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the Tender Data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

C.3.18 Provide written reasons for actions taken

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

T2.1 List of Returnable Documents

2.1.1 These schedules are required for eligibility purposes:

- T2.2.1 **Eligibility Criteria Schedule -** Certificate of attendance at Compulsory Tender Clarification Meeting and Site Meeting (fully completed and signed by Transnet official.)

2.1.2 These schedules will be utilised for evaluation purposes:

- Evaluation schedule-T2.2-3 Previous experience in the transformer refurbishment between 5MVA to 20MVA transformers.
- Evaluation schedule-T2.2.4 Service Plan for 9 Days
- Evaluation schedule-T2.2.5 Availability of tools and equipment
- Evaluation schedule-T2.2.6 Management and CVs of Key Personnel

T2.2 List of Returnable Schedules

2.1.3 Returnable Schedules:

General:

- T2.2-7a - Health and Safety Requirements
- T2.2-7b Health and Safety Questionnaire
- T2.2-7c Health and Safety Cost Breakdown
- T2.2-7d: Transnet Freight Rail Safety Health and Environmental (SHE)
- T2.2-08: Environmental Management Plan
- T2.2-9 Method Statement
- T2.2-10 Authority to submit tender
- T2.2-11 Record of addenda to tender documents
- T2.2-12 Letter of Good Standing
- T2.2-13 Risk Elements
- T2.2-14 Schedule of proposed Subcontractors.
- T2.2-15 Affected property Establishment requirements

Agreement and Commitment by Tenderer:

T2.2-16 CIDB SFU ANNEX G Compulsory Enterprise Questionnaire

- Valid proof of Respondent's compliance to Specific Goals evidence (Preference Claim Form) requirements stipulated in SBD6.1.

T2.2-17 Non-Disclosure Agreement

T2.2-18 RFQ Declaration Form

T2.2-19 RFQ – Breach of Law

T2.2-20 Certificate of Acquaintance with Tender Document

T2.2-21 Service Provider Integrity Pact

T2.2-22 POPI Act form

1.3.2 Bonds/Guarantees/Financial/Insurance:

T2.2-23 Insurance provided by the *Contractor*

T2.2-24 Three (3) years audited financial statements

2.2 C1.1 Offer portion of Form of Offer & Acceptance

2.3 C1.2 Contract Data Part Two (Data by Contractor)

2.4 C2.2 Price List

T2.2-1: Eligibility Criteria Schedule:

Certificate of Attendance at Tender Clarification Meeting

This is to certify that

		(Company Name)
Represented by:		(Name and Surname)

Was represented at the compulsory tender clarification meeting

Held at:		
On (date)		Starting time:

Particulars of person(s) attending the meeting:

Name			Signature	
Capacity				

Attendance of the above company at the meeting was confirmed:

Name			Signature	
	For and on Behalf of the *Employers Agent.*		Date	

T2.2-3 Evaluation Schedule- Previous experience in the transformer refurbishment between 5MVA to 20MVA transformers.

Evaluation Schedule:

Note to tenderers:

Tenderers are required to demonstrate performance in comparable projects of similar size and nature by supplying the following:

- A list of past / current comparable projects.
- Provision of similar service as detailed in the Service Information with reference to:
    - Previous experience in the transformer refurbishment between 5MVA to 20MVA transformers.
- Sufficient references to substantiate experience indicated (Client name and contact details, project description, duration and contract value)

Index of documentation attached to this schedule.

	DOCUMENT NAME
1	
2	
3	
4	
5	
6	

Client	Client contact details	Project Description	Year of project completion	Contract Value	Subcontractors
NB: If the above information not provided, it will have a negative influence on your technical evaluation scoring					

The scoring of the previous experience in the previous experience in the transformer refurbishment between 5MVA to 20MVA transformers will be as follows:

Total Score 30 Points	**Evaluation Criteria**
Score 0	0 points =No submission or any evidence of experience.
Score 20	20 points = Relevant previous experience ≤1 Project
Score 40	40 points = Relevant previous experience > 1 Project or ≤ two projects
Score 60	60 points = Relevant previous experience > 2 Projects or ≤ 3 projects
Score 80	80 points = Relevant previous experience > 3 Projects or ≤ 4 projects
Score 100	100 points = Relevant previous experience > 5 projects
	NB: If the above information not provided, it may have a negative influence on your technical evaluation scoring

1. Index of documentation attached to this schedule:

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The table above is for information purposes only to indicate the method of scoring that will be followed to evaluate the proof of previous experience submitted by the Tenderer:
Attachment A: Electronic Copy of Programme

T2.2-4 Evaluation schedule- Service Plan

Note to tenderers:

Service Plan

The Tenderer details the plan for evaluation and attaches it to this schedule. In addition, the Tenderer is to provide an electronic copy of the programme in Ms Word or any other compatible software.

The tenderer shall provide the proposed plan**,**

(showing but not limited to the following:

- Ability to execute the works in terms of the *Employer*'s requirements and within the required timeframe indicating, in a logical sequence, the order and timing of the construction that will take place in order to Provide the Works clearly indicating the capacity & capability to achieve the dates stated in the Contract Data.

- Dates when the *Contractor* will need access to any part of the Site; submission & approval process & timing for Health & Safety Files, Environmental Files and Quality Files. In addition the Program must clearly demonstrate the procurement process for all long lead items if applicable.

- The *Contractor* indicates how he plans in achieving the following dates and clearly demonstrates them on the schedule - Start Date, Access Date, Planned Completion, Key Dates/Sectional Completion Dates & Completion Date. In addition, the Program clearly demonstrates adequate provisions for Time Risk Allowance (TRA). Time Risk Allowances are not float, are owned by the Tenderer, can be included in the activity duration and illustrated in the schedule in a code field or as an attachment.

- The Program must clearly support and demonstrate alignment to the Method Statement as contained in T2.2.8 List of Returnable.

The scoring of the service plan for 9 days will be as follows:

Total Score 20 points	**Evaluation Criteria**
	Ability to execute the works in terms of the Employer's requirements and within the required timeframe indicating, in a logical sequence, the order and timing of the construction that will take place in order to Provide the Services clearly indicating the capacity & capability to achieve the dates stated in the Contract Data. Dates when the *Contractor* will need access to site and/or persons and/or information, as well as submission approval process and timing for Health & Safety Files. The Program must be fully Resource Loaded, including, People, Equipment, Plant and Materials & Other Resources, but excluding Cost). Indication of time frame
Score 0	0 points = No detailed plan provided.
Score 20	20 points= The contractor complete 2 transformers in more than 12 days
Score 40	40 points= The contractor complete 2 transformers in 12 days including submission of oil test results
Score 60	60 points= The contractor complete 2 transformers in 11 days including submission of oil test results
Score 80	80 points= The contractor complete 2 transformers in 10 days including submission of oil test results
Score 100	100 points = The *Contractor* completes 2 transformers in 9 days including submission of oil test results
	NB: If the above information not provided, it may have a negative influence on your technical evaluation scoring

1. Index of documentation attached to this schedule:

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The table above is for information purposes only to indicate the method of scoring that will be followed to evaluate the service plan submitted by the Tenderer:

T2.2-5 Evaluation Schedule- Availability of tools and equipment

Item No	Description of plant and equipment	Number of Equipment	Please indicate: Details of Ownership / Lease or Hire	
	Description of plant and equipment	**Qty**	**Own**	**Lease or Hire**
a	Transportation for employees: Any mode of transport that is safe for transporting employees. Loading capacity (Flat bakkie or trailer that is capable of loading material and tools)			
b	Filtration System			
c	Generator			
d	Compressor			
e	Storage Vessel 15 000 Litres			
f	Spray Painting Equipment			
g	Crane truck with certified operator			
h	Stepladder			
i	Torque Wrench			
j	Sanding machine			

The scoring of the availability of plant and equipment will be as follows:

Total Score 25 points	Evaluation Criteria
Score 0	0 points = No tools and equipment stated or indicated
Score 20	20 points = ≤ 50% of tools and equipment is available as per requirements in the RFQ
Score 40	40 points = > 50% and ≤ 60% of tools and equipment is available as per requirements in the RFQ.
Score 60	60 points = 70% and ≤ 80% of tools and equipment is available as per requirements in the RFQ.
Score 80	80 points = > 80% and ≤ 95% of plant and equipment is available as per requirements in the RFQ.
Score 100	100 points = more than 100% of tools and equipment is available as per requirements in the RFQ.

1. Index of documentation attached to this schedule:

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The table above is for information purposes only to indicate the method of scoring that will be followed to evaluate the proof of availability of plant and equipment submitted by the Tenderer:

T2.2-6 Evaluation Schedule- Management of CVs of Key Personnel

Item No	Description of Qualifications	Please indicate: If attached	
		Yes	No
	1 x Safety Officer., 2 x Supervisor and 5 x Electricians. Certificates required will be as follows:		
1	Supervisor (Minimum N6 Electrical Engineering certificate)		
2	Qualified Electrician (Trade test certificate)		
3	Safety Officer (Minimum ND Safety management		

The scoring of the management of CV's will be as follows:

Total Score 25 points	Evaluation Criteria
Score 0	0 points = *Contractor* submitted no information
Score 20	20 points = 1-4 CV's and certificates of the key persons as specified above are addressed
Score 40	40 points = 5 CV's and certificates of the key persons as specified above are addressed
Score 60	60 points = 6 CV's and certificates of the key persons as specified above are addressed
Score 80	80 points = 7 CV's and certificates of the key persons as specified above are addressed
Score 100	100 points = All 8 CV's and certificates of the key persons as specified above are addressed
	NB: If the above information not provided, it may have a negative influence on your technical evaluation scoring

2. Index of documentation attached to this schedule:

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The table above is for information purposes only to indicate the method of scoring that will be followed to evaluate the proof of availability of plant and equipment submitted by the Tenderer:

T2.2-7a - Health and Safety Requirements

Submit the following documents as a minimum with your tender:

1. The Tenderers must provide their own project specific health and safety Plan.
2. Health and safety cost breakdown (Bill of Quantities)
3. Safety, Policy signed by the Chief Executive Officer, must include or cover the following five elements –
    - Commitment to Safety, prevention of pollution,
    - Continual improvement,
    - Compliance to legal requirements, appropriate to the nature of contractor's activities,
    - Hold management accountable for development of the safety systems
    - Include objectives and targets.
4. Table or outline the Roles & Responsibilities, such as S16.2 CEO, , CR8.5 Safety officer, CR8.7, CR9.1 Risk Assessor, 17.1 SHE Reps, etc. as per the Occupational health and safety Act 85 of 1993
5. List of job categories for project and competencies required per category and develop a training Matrix for all employees who will be working on the project. This matrix must include Management and highlight training planned
6. Overview of the project specific Baseline Risk Assessment (RA), indicating major activities of the project
7. **Three years** synopsis of SHE incidents, description, type and action taken to prevent re-occurrence.
8. Complete and return with tender documentation the Contractor Safety Questionnaire included as an Annexure B.

Attached submissions to this schedule:

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The scoring of the Tenderer's Health and Safety Requirements will be as follows:

MAXIMUM POINTS	**4**	**1**	**1**	**2**	**1**	**1**
10	**SHE Plan, Letter of Good standing & Safety, Health & Environmental Policy**	**Roles & Responsibilities as stipulated from above**	**List of Job Categories for project as stipulated from above**	**Overview of the project specific Baseline Risk Assessment (RA), indicating major activities of the project namely:**	**Three years synopsis of SHE incidents, descriptions, type and action taken**	**Complete and return the *Contractor* Safety Questionnaire attached hereto**
(score 0)	The Tenderer has submitted no information or inadequate information to determine a score.					
(score 20)	SHE Plan is not project specific and information supplied is totally insignificant to archieve the required standard of service. The Health and safety bill of quantities supplied is totally insignificant to achieve the required	Roles and responsibilities do not meet the Occupational health and safety Act as per construction regulations and TFR health and safety specification.	Key responsible persons are not included on training matrix as per proposed organogram structure.	Information supplied is totally insignificant /inadequate to achieve the required standard of service.	Information supplied is totally insignificant /inadequate to achieve the required standard of service.	Information supplied is totally insignificant/inadequate to achieve the required standard of service.

	standard of service. 1 of the 5 key policy components are recognized and meet the *Employer's* requirement.					
(score 40)	SHE plan is project specific, but the information lacks convincing evidence, that stated *Employer's* requirements will be met. The information provided in the Health and safety bill of quantities is poor and lacks convincing evidence.There's a medium risk that stated *Employer's* requirments will not be met.	Roles and responsibilities are unlikely to ensure compliance as per the w*orks* information and not in line with OHS Act and TFR health and safety specification.	Not all key responsible persons are included in the training matrix. Trainings matrix submitted does not cover all SHE training listed on Health and Safety specification. Training matrix not signed by responsible personnel.	Poor response/answer/solution lacks convincing evidence, medium risk that stated *Employer's* requirements will not be met.	Poor response/answer/solution lacks convincing evidence, medium risk that stated *Employer's* requirements will not be met.	Poor response/answer/solution lacks convincing evidence, medium risk that stated *Employer's* requirements will not be met.

	2 of the 5 key policy components are recognized and meet the *Employer's* requirement.					
(score 60)	SHE plan is project specific. The information is satisfactory to the particular aspect, and evidence given is sufficient that *Employers* requirements will be met. The information provided in the Health and safety bill of quantities is satisfactory and the evidence is convincing, that stated *Employer's* requirments will be met. 3 of the 5 key policy components are recognized and meet the	Satisfactory response on roles and responsibilities as per *Employer's* requirements.	Satisfactory response on the list of job categories and trainings as per proposed project organogram structure. Training matrix covers most of the trainings listed on TFR Health and safety specification.	Satisfactory response/answer/solution to the particular aspect of the requirement, evidence given that the stated *Employer's* requirements will be met.	Satisfactory response/answer/solution to the particular aspect of the requirement, evidence given that the stated *Employer's* requirements will be met.	Satisfactory response/answer/solution to the particular aspect of the requirement, evidence given that the stated *Employer's* requirements will be met.

	Employer's requirements.					
(score 80)	SHE plan is project specific. The information is good and demonstrate real understanding & ability to meet stated *Employer's* requirements. The information provided in the Health and safety bill of quantities is good and demonstrates real understanding and evidence of ability to meet stated *Employer's* requirements. 4 of the five key policy components are recognized and meets the *Employer's* requirements.	Roles and responsibilities are likely to ensure compliance as per Works Information, OHS Act and TFR health and safety specification.	Most of key persons listed on the training matrix as per proposed project organogram structure. Trainings specified on the matrix are in line with TFR health and safety specification.	Good response/answer/solution which demonstrates real understanding and evidence of ability to meet stated *Employer's* requirements.	Good response/answer/solution which demonstrates real understanding and evidence of ability to meet stated *Employer's* requirements.	Good response/answer/solution which demonstrates real understanding and evidence of ability to meet stated *Employer's* requirements.

(score 100)	She plan is project specific. The information is very good and gives real confidence that the tenderer, is most likely to ensure compliance with stated *Employer's* requirements. The information provided in the Health and safety bill of quantities is very good and gives real confidence that the tender is most likely to ensure compliance with stated stated *Employer's* requirements. All 5 key policy components are recognized and meets the *Employer's* requirements.	Roles and Responsibilities most likely to ensure compliance as per requirements of OHS Act and TFR Health and Safety Management Specification.	Training matrix include Management and all employees /personnel in the project. Training matrix had been signed by responsible personnel.	Very good response/answer/solution gives real confidence that the tenderer is most likely to ensure compliance with stated *Employer's* requirements.	Very good response/answer/solution gives real confidence that the tenderer is most likely to ensure compliance with stated *Employer's* requirements.	Very good response/answer/solution gives real confidence that the tenderer is most likely to ensure compliance with stated *Employer's* requirements.

T2.2-7b: Health and Safety Questionnaire

1.	**SAFE WORK PERFORMANCE**			
1A.	Injury Experience / Historical Performance - Alberta			
Use the previous three years injury and illness records to complete the following:				
Year				
Number of medical treatment cases				
Number of restricted workday cases				
Number of lost time injury cases				
Number of fatal injuries				
Total recordable frequency				
Lost time injury frequency				
Number of worker manhours				

1 - Medical Treatment Case	Any occupational injury or illness requiring treatment provided by a physician or treatment provided under the direction of a physician
2 – Restricted Workday Case	Any occupational injury or illness that prevents a worker from performing any of his/her craft jurisdiction duties
3 – Lost Time injury Cases	Any occupational injury that prevents the worker from performing any work for at least one day
4 – Total Recordable Frequency	Total number of Medical Treatment, Restricted Work and Lost Time Injury cases multiplied by 200,000 then divided by total manhours
5- Lost Time Injury Frequency	Total number of Lost Time Injury cases multiplied by 200,000 then divide by total manhours

1B.	Workers' Compensation Experience			
Use the previous three years injury and illness records to complete the following (if applicable):				
Industry Code:		Industry Classification:		
Year				
Industry Rate				
Contractor Rate				
% Discount or Surcharge				
Is your Workers' Compensation account in good standing? (Please provide letter of confirmation)		☐ Yes ☐ No		

2.	**CITATIONS**
2A.	Has your company been cited, charged or prosecuted under Health, Safety and/or Environmental Legislation in the last 5 years? ☐ Yes ☐ No If yes, provide details:

2B.	Has your company been cited, charged or prosecuted under the above Legislation in another Country, Region or State? ☐ Yes ☐ No If yes, provide details:

3. CERTIFICATE OF RECOGNITION

Does your company have a Certificate of Recognition?
☐ Yes ☐ No If Yes, what is the Certificate No. _____ Issue Date _____

4. SAFETY PROGRAM

Do you have a written safety program manual? ☐ Yes ☐ No
If Yes, provide a copy for review
Do you have a pocket safety booklet for field distribution? ☐ Yes ☐ No
If Yes, provide a copy for review
Does your safety program contain the following elements?

	YES	NO		YES	NO
CORPORATE SAFETY POLICY	☐	☐	EQUIPMENT MAINTENANCE	☐	☐
INCIDENT NOTIFICATION POLICY	☐	☐	EMERGENCY RESPONSE	☐	☐
RECORDKEEPING & STATISTICS	☐	☐	HAZARD ASSESSMENT	☐	☐
REFERENCE TO LEGISLATION	☐	☐	SAFE WORK PRACTICES	☐	☐
GENERAL RULES & REGULATIONS	☐	☐	SAFE WORK PROCEDURES	☐	☐
PROGRESSIVE DISCIPLINE POLICY	☐	☐	WORKPLACE INSPECTIONS	☐	☐
RESPONSIBILITIES	☐	☐	INVESTIGATION PROCESS	☐	☐
PPE STANDARDS	☐	☐	TRAINING POLICY & PROGRAM	☐	☐
ENVIRONMENTAL STANDARDS	☐	☐	COMMUNICATION PROCESSES	☐	☐
MODIFIED WORK PROGRAM	☐	☐			

5. TRAINING PROGRAM

5A. Do you have an orientation program for new hire employees? ☐ Yes ☐ No
If Yes, include a course outline. Does it include any of the following:

	YES	NO		YES	NO
GENERAL RULES & REGULATIONS	☐	☐	CONFINED SPACE ENTRY	☐	☐
EMERGENCY REPORTING	☐	☐	TRENCHING & EXCAVATION	☐	☐
INJURY REPORTING	☐	☐	SIGNS & BARRICADES	☐	☐
LEGISLATION	☐	☐	DANGEROUS HOLES & OPENINGS	☐	☐
RIGHT TO REFUSE WORK	☐	☐	RIGGING & CRANES	☐	☐
PERSONAL PROTECTIVE EQUIPMENT	☐	☐	MOBILE VEHICLES	☐	☐

EMERGENCY PROCEDURES	☐	☐	PREVENTATIVE MAINTENANCE	☐	☐
PROJECT SAFETY COMMITTEE	☐	☐	HAND & POWER TOOLS	☐	☐
HOUSEKEEPING	☐	☐	FIRE PREVENTION & PROTECTION	☐	☐
LADDERS & SCAFFOLDS	☐	☐	ELECTRICAL SAFETY	☐	☐
FALL ARREST STANDARDS	☐	☐	COMPRESSED GAS CYLINDERS	☐	☐
AERIAL WORK PLATFORMS	☐	☐	WEATHER EXTREMES	☐	☐

5B. Do you have a program for training newly hired or promoted supervisors? ☐ Yes ☐ No
(If Yes, submit an outline for evaluation. Does it include instruction on the following:

	Yes	No		Yes	No
EMPLOYER RESPONSIBILITIES	☐	☐	SAFETY COMMUNICATION	☐	☐
EMPLOYEE RESPONSIBILITIES	☐	☐	FIRST AID/MEDICAL PROCEDURES	☐	☐
DUE DILIGENCE	☐	☐	NEW WORKER TRAINING	☐	☐
SAFETY LEADERSHIP	☐	☐	ENVIRONMENTAL REQUIREMENTS	☐	☐
WORK REFUSALS	☐	☐	HAZARD ASSESSMENT	☐	☐
INSPECTION PROCESSES	☐	☐	PRE-JOB SAFETY INSTRUCTION	☐	☐
EMERGENCY PROCEDURES	☐	☐	DRUG & ALCOHOL POLICY	☐	☐
INCIDENT INVESTIGATION	☐	☐	PROGRESSIVE DISCIPLINARY POLICY	☐	☐
SAFE WORK PROCEDURES	☐	☐	SAFE WORK PRACTICES	☐	☐
SAFETY MEETINGS	☐	☐	NOTIFICATION REQUIREMENTS	☐	☐

6. SAFETY ACTIVITIES

Do you conduct safety inspections? Yes ☐ No ☐ Weekly ☐ Monthly ☐ Quarterly ☐

Describe your safety inspection process (include participation, documentation requirements, follow-up, report distribution).

Who follows up on inspection action items? _____

Do you hold site safety meetings for field employees? If Yes, how often?

Yes ☐ No ☐ Daily ☐ Weekly ☐ Biweekly ☐

Do you hold site meetings where safety is addressed with management and field supervisors?

Yes ☐ No ☐ Weekly ☐ Biweekly ☐ Monthly ☐

Is pre-job safety instruction provided before to each new task? ☐ Yes ☐ No

Is the process documented? ☐ Yes ☐ No

Who leads the discussion? _____

Do you have a hazard assessment process? ☐ Yes ☐ No

- Are hazard assessments documented? If yes, how are hazard assessments communicated and implemented on each project? Who is responsible for leading the hazard assessment process?

Does your company have policies and procedures for environmental protection, spill clean-up, reporting, waste disposal, and recycling as part of the Health & Safety Program?

☐ Yes ☐ No

How does your company measure its H&S success?

- Attach separate sheet to explain

7. SAFETY STEWARDSHIP

7A Are incident reports and report summaries sent to the following and how often?

	Yes	No	Monthly	Quarterly	Annually
Project/Site Manager	☐	☐	☐	☐	☐
Managing Director	☐	☐	☐	☐	☐
Safety Director/Manager	☐	☐	☐	☐	☐
/Chief Executive Officer	☐	☐	☐	☐	☐

7B How are incident records and summaries kept? How often are they reported internally?

	Yes	No	Monthly	Quarterly	Annually
Incidents totaled for the entire company	☐	☐	☐	☐	☐
Incidents totaled by project	☐	☐	☐	☐	☐
• Subtotaled by superintendent	☐	☐	☐	☐	☐
• Subtotaled by foreman	☐	☐	☐	☐	☐

7C How are the costs of individual incidents kept? How often are they reported internally?

	Yes	No	Monthly	Quarterly	Annually
Costs totaled for the entire company	☐	☐	☐	☐	☐
Costs totaled by project	☐	☐	☐	☐	☐
• Subtotaled by superintendent	☐	☐	☐	☐	☐
• 0Subtotaled by foreman/general foreman	☐	☐	☐	☐	☐

7D Does your company track non-injury incidents?

	Yes	No	Monthly	Quarterly	Annually
Near Miss	☐	☐	☐	☐	☐
Property Damage	☐	☐	☐	☐	☐
Fire	☐	☐	☐	☐	☐
Security	☐	☐	☐	☐	☐
Environmental	☐	☐	☐	☐	☐

8 PERSONNEL

List key health and safety officers planned for this project. Attach resume.

Name	Position/Title	Designation

Supply name, address and phone number of your company's corporate health and safety representative. Does this individual have responsibilities other than health, safety and environment?

Name	Address	Telephone Number

Other responsibilities:

9 REFERENCES

List the last three company's your form has worked for that could verify the quality and management commitment to your occupational Health & Safety program		
Name and Company	Address	Phone Number

T2.2-7c Health and Safety Cost Breakdown

Tenderer (Company)	**Responsible Person**	**Designation**	**Date**
Project/Tender Title	**Project/Tender No.**	**Project Location / Description**	
FOR THE REFURBISHMENT OF 2 X 20MVA TRACTION TRANSFORMERS AT VARIOUS SUBSTATION ON THE NORTH CORRIDOR SHUTDOWN.	SIM25002CIDB(ERAC-RCB-50234)		

#	Cost element	Unit Cost (R)	# of Units	Total Cost (R)
1.	Human Resources			
2.	Systems Documentation			
3.	Meetings & Administration			
4.	H&S Training			
5.	PPE & Safety Equipment			
6.	Signage & Barricading			
7.	Workplace Facilities			
8.	Emergency & Rescue Measures			
9.	Hygiene Surveys & Monitoring			
10.	Medical Surveillance			
11.	Safe Transport of Workers			
12.	HazMat Management (e.g. asbestos /silica)			
13.	Substance Abuse Testing (3 kits @R500 pm)			
14.	H&S Reward & Recognition			

Total Health and Safety Estimate (R)	
Total Estimate Value (R)	
H&S Cost as % of Tender value	

T2.2-7d TRANSNET FREIGHT RAIL SAFETY HEALTH AND ENVIRONMENTAL (SHE) COMPLIANCE SPECIFICATIONS FOR CONTRACTORS

CONTRACT NAME:	Refurbishment Of 2 X 20mva Traction Transformers at Various Substations
CONTRACT NUMBER:	**SIM25002CIDB(ERAC-RCB-50234)**
CONTRACT SCOPE:	repairing transformer oil leaks (132KV to 25KV) 20MVA traction transformers. Drain the transformer oil for temporary storage (supply storage). The oil should be filtered, and an oil sample should then be taken and tested in accordance with BBB0349 and BBF8190. The oil should be re-filtered if necessary. Filter Traction transformer oil, and refill or top up transformer oil if required for all transformers. Purification and refilling transformer with oil should be done according to SANS 555 and must be pumped back into the transformer under vacuum. The transformer breather including silica gel should be checked and replaced if required. Transformer oil should be sampled and tested in accordance with BBB0349, before and after filtering has taken place. The oil should be tested at a SANAS accredited laboratory. The oil should be re-filtered if necessary A hardcopy and softcopy (electronic copy) of test results should be provided to the project manager. The oil results before and after purification must be submitted to the project manager within the Shutdown Duration before the transformer is energized. The transformer bushing caps should be painted according to the colour of phases. Prepare and repaint transformer tank in Battleship Grey, plinth in red with a yellow boarder, Earth bar in green and the conservator tank in white. The total paint thickness shall be at least 125 microns Sandblast, apply rust proof painting and paint the traction transformer at RBCT substation. Replace worn out, brittle gaskets and repair transformer leaks. When storing the transformer oil after being pumped from the transformer, the transformer oil should be stored in a clean, impermeable vessel i.e., a bulk transformer oil storage bladder is required. All bolts/nuts should be re-torqued with-in 3 months after the transformer has been energised. Repair four leaking radiator fins (including pressure testing) Rehabilitate the soil around the transformer and replace the contaminated stone of 7 square meters at Nsese substation. Supply and install conservator tank with brackets at RBCT Transformer. Service drainage plugs on fins: Testing and commissioning and Preliminaries and generals
CONTRACT LOCATION:	**North corridor RBCT and Nsese substations**
CONTRACT DURATION:	**10 days.**

CONTRACT MANAGER:	Halalisani Mlondo	
TRIM TECHNICAL OFFICER:	Natasha Zuma	
SHE SPECIFICATION APPROVAL		
TITLE:	NAME:	SIGNATURE:
TRIM CONTRACT MANAGER / TECHNICAL OFFICER	**Halalisani Mlondo**	**……** **DATE:**
RISK / ENVIRONMENTAL SPECIALIST	**Elekanyani Phundulu**	**……** **DATE:**
SAFETY SPECIALIST / MANAGER	**Nomfundo Dlungele**	**……** **DATE:**

1. Introduction

1.1 This Safety, Health and Environmental (SHE) specification is Transnet Infrastructure Manager (TRIM) minimum requirements to be met by contractors when performing work for or on behalf of TRIM. They set out the requirements to be followed by the Contractor and other contractors so that the health and safety of all person's potentially at risk may receive the same priority as other facets of the contract.

1.2 The Contractor shall **develop a SHE plan and prepare a SHE file** based on these requirements, risk assessment as well as all the relevant applicable legislation. The contractor shall remain accountable for the quality and execution of his health and safety programme for his employees and sub-contractor employees. This specification in no way releases the contractors from compliance with the relevant legislation.

2 Purpose

2.1 The purpose of this specification is to ensure that the Contractor provides and maintains, as far as reasonably practicable a safe working environment for all employees and the public whilst performing work for or on behalf of TRIM.

2.2 This specification form an integral part of the contract, and the Contractor shall forward this specification to all subcontractors at the bidding stage so that they can in turn prepare health and safety plans relating to their operations

3 Scope and Application

3.1 This specification is applicable to all contractors, suppliers and all activities and processes carried out for or on behalf of Transnet Freight Rail. The Specification defines the strategies to manage Health and Safety and is a compliance document drawn up in terms of the Occupational Health and Safety Act 85 of 1993 and Electrical Installation Regulations and National Railway Safety Regulator Act (Act no 16 of 2002) requirements as applicable.

3.2 This specification shall also apply to any subcontractors as employers in their own right. The Contractor shall furnish the TRIM Contract Manager/Technical Officer with full particulars of such subcontractors and shall ensure that they comply with the OHS Act and Regulations and Transnet's safety requirements and procedures.

3.3 Every effort has been made to ensure that this specification document is accurate and adequate in all respects. Should it however, contain any errors or omissions they may not be considered as grounds for claims under the contract for additional reimbursement or extension of time, or relieve the Contractor from his responsibilities and accountability in respect of the contract to which this specification document pertains. Any such inaccuracies, inconsistencies and/or inadequacies must immediately

be brought to the attention of the TRIM Contract Manager/Technical Officer or Client Agent.

4 General

4.1 The Contractor and Transnet Freight Rail are individual employers, each in its own right, with their respective duties and obligations set out in the Occupational Health and Safety Act, Act 85 of 1993 (herein referred as the OHS Act) and applicable Regulations.

4.2 The Contractor accepts, in terms of the General Conditions of Contract and in terms of the OHS Act, his obligations as an employer in respect of all persons in his employ, other persons on the premises or the Site or place of work or on the work to be executed by him, and under his control. The Contractor shall, before commencement with the execution of the contract work, comply with the provisions set out in the OHS Act, and shall implement and maintain a SHE Plan approved by Transnet Freight Rail, on the Site and place of work for the duration of the contract.

4.3 The Contractor accepts his obligation to complying with the OHS Act and applicable Regulations notwithstanding the omission of some of the provisions of the OHS Act and the Regulations from this document.

4.4 Transnet Infrastructure Manager accepts, in terms of the OHS Act, its obligations as an employer of its own employees working on or associated with the site or place of work, and the Contractor and TRIM Contract Manager/Technical Officer or his deputy shall at all times, co-operate in respect of the health and safety management of the site, and shall agree on the practical arrangements and procedures to be implemented and maintained during execution of the works

4.5 In the event of any discrepancies between any legislation and this specification, the applicable legislation will take precedence.

5. Section 37(2) Agreements

5.1 Transnet Infrastructure Manager and the Contractor shall enter into an agreement in terms of section 37(2) of the Occupational Health and Safety Act to the arrangements and procedures between them to ensure compliance by the Contractor with the provisions of the OHS Act.

5.2 The agreement shall be completed and signed by the Contractor mandated representative as soon as possible and returned to the relevant TRIM Project Manager / TRIM Contract Manager for his/her signature on behalf of Transnet Infrastructure Manager.

5.3 The Contractor shall enter into a Section 37(2) Agreement with their respective sub-contractors. Signed copy of such agreement must be kept on the Contractor's SHE file.

6. Definitions

6.1 In this Specification the definitions as listed in the Occupational Health and Safety Act 85 of 1993 and Construction Regulations, 2014 shall apply, unless the context otherwise indicates: -

6.1.1 **"Certificate of compliance"** means –

a) a certificate with a unique number obtainable from the chief inspector, or a person appointed by the chief inspector, in the form of Annexure 1, and issued by a registered person in respect of an electrical installation or part of an electrical installation; or
b) a certificate of compliance issued under the Electrical Installation Regulations, 1992.

6.1.2 "**Competent person"** means a person who—

a) has in respect of the work or task to be performed the required knowledge, training, and experience and, where applicable, qualifications, specific to that work or task: Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training; and

b) is familiar with the Act and with the applicable regulations made under the Act.

6.1.3 "**Contractor"** means an employer (organisation) or a person who performs ANY work and has entered into a legal binding business agreement contract to supply a product or provide services to Transnet. This applies to the Suppliers, Vendors, Consultants,

Service Providers or Contractors. NB: A contractor is an employer in his/her own right (includes Principal Contractor and subcontractor).

6.1.4 **"Construction work"** means any work in connection with the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to building or any similar structure.
The construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or the moving of land, the making of excavation, piling, any similar civil engineering structure, or type of work

6.1.5 **"Electrical installation"** means any machinery, in or on any premises, used for the transmission of electricity from a point of control to a point of consumption anywhere on the premises, including any article forming part of such an electrical installation irrespective of whether or not it is part of the electrical circuit, but excluding—

a) any machinery of the supplier related to the supply of electricity on the premises.

b) any machinery which transmits electrical energy in communication, control circuits, television, or radio circuits.

c) an electrical installation on a vehicle, vessel, train, or aircraft; and

d) control circuits of 50 V or less between different parts of machinery or system components, forming a unit, that are separately installed and derived from an independent source or an isolating transformer.

6.1.6 **"Electrical Installation Regulations, 1992"** means the Electrical Installation Regulations, 1992, promulgated by Government Notice R.2920 of 23 October 1992.

6.1.7 **"Electrical tester for single phase"** means a person who has been registered as an electrical tester for single phase in terms of regulation 11(2) for the verification and certification of the construction, testing and inspection of electrical installations supplied by a single-phase electricity supply at the point of control, excluding specialised electrical installations.

6.1.8 "**Excavation work"** means the making of any man-made cavity, trench, pit, or depression formed by cutting, digging, or scooping.

6.1.9 **"Fall protection plan"** means a documented plan, which includes and provides for-

a) all risks relating to working from a fall risk position, considering the nature of work undertaken and

b) the procedures and methods to be applied in order to eliminate the risk of fall rescue plan and procedures.

6.1.10 **"Hazardous chemical agent or HCA"** means a GHS-aligned chemical agent as provided for in Annexure 1 of the occupational health and safety act 1993.

6.1.11 **"Health and safety (SHE) plan"** means a site, activity, or project specific documented plan in accordance with the client's health and safety specification.

6.1.12 **"Installation work"** means—

a) the installation, extension, modification, or repair of an electrical installation.

b) the connection of machinery at the supply terminals of such machinery; or

c) the inspection, testing and verification of electrical installations for the purpose of issuing a certificate of compliance.

6.1.13 **"Point of consumption"** means any point of outlet or the supply terminals of machinery which is not connected to a point of outlet, and which converts electrical energy to another form of energy: Provided that in the case of machinery which has been installed for any specific purpose as a complete unit, the point of consumption shall be the supply terminals which have been provided on the unit of machinery for that purpose.

6.1.14 **"Point of control"** means the point at which an electrical installation on or in any premises can be switched off by a user or lessor from the electricity supplied from the point of supply, or the point at which a particular part of an electrical installation on or in any premises can be switched off where different users occupy different portions of such premises.

6.1.15 **"Point of outlet"** means any termination of an electrical installation which has been provided for connecting any electrical machinery without the use of tools.

6.1.16 **"Point of supply"** means the point at which electricity is supplied to any premises by a supplier.

6.1.17 **"Registered person"** means a person registered in terms of—

a) regulation 11 or

b) regulation 9 of the Electrical Installation Regulations, 1992, as an electrical tester for single phase, an installation electrician, or a master installation electrician.

6.1.18 **"Specialised electrical installations"** means electrical installations in –

a) explosive atmospheres as contemplated in SANS10086-1

b) the petroleum industry as contemplated in SANS10089-2

c) hazardous locations as contemplated in SANS10108

d) medical locations as contemplated in SANS10142-1.

6.1.19 **"Respiratory protective equipment"** means a device that is worn over at least the mouth and nose to prevent the inhalation of an airborne HCA and that is of a type, or conforms to a standard, approved by the Minister.

6.1.20 **"Risk assessment"** means a programme to determine any risk associated with any hazard at a work site, in order to identify the steps needed to be taken to remove, reduce or control such hazard.

6.1.21 **"Safety data sheet" or "SDS"** means a document that is aligned to the GHS, providing information on hazard classification, properties of hazardous chemicals, procedures for handling or working with hazardous chemicals in a safe manner, and the effects of hazardous chemicals on health and safety at the workplace, and that is prepared in accordance with regulation 14A.

6.1.22 **"Safety, Health and Environmental (SHE) File"** means a file or other record in permanent form, containing the information required to be kept on site in accordance with the OHS Act and applicable Regulations.

6.1.23 **"Supply terminals"** in relation to machinery installed as a complete unit, means the terminals or connection clamps on such machinery where the external conductors supplying the machinery with electricity are terminated or connected.

6.1.24 **"TRIM"** means Transnet Infrastructure Manager, a division of Transnet SOC Ltd (Registration No. 1990/000900/30), a public company incorporated in accordance with the company laws of the Republic of South Africa.

6.1.25 **"TRIM Contract Manager"** means an employee appointed to liaise with the contractor to ensure that the specifications of the contract are met (with special emphasis on safety, technical specifications, inspection of quality and quantity of work). It includes a Technical Officer, Depot Engineering Manager, Engineering Technician, Maintenance Supervisor's, Security Inspector, Depot Security Manager, Real Estate Manager, Facilities Manager etc.

7. Notification of Construction Work

7.1 The Contractor who intends to carry out any construction work other than work where a Construction Work Permit is required, must at least 7 days before carrying out such work, notify the Provincial Director of the Department of Labour in writing if the construction work: -

(a) includes excavation work

(b) includes working at a height where there is a risk of a person falling.

(c) includes the demolition of a structure; or

(d) includes the use of explosives to perform construction work,

7.2 The notification to the Provincial Director shall be on a form similar to Annexure 2 of the Construction Regulations, 2014. The Contractor shall ensure that a copy of the completed notification form is kept on site for inspection by an inspector, TRIM Contract Manager/Technical Officer or employee.

8. Letter of Good standing

8.1 The Contractor shall submit proof of registration and Letter of Good Standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Diseases Act,1993 (Act No. 130 of 1993) for his company and each of his sub-contractors'.

8.2 No contractor may do any work for TRIM without a valid letter of good standing. The Contractor must ensure that the Letter of Good Standing remains valid for the duration of the contract period.

8.3 The letter of good standing must reflect the name of the Contractor and/or Sub-contractor, registration number and expiry date.

9. Management and Supervision

9.1 The Contractor and all subcontractors shall submit a SHE organogram outlining the site SHE management structure including the relevant appointments/competent persons or the intended appointments where such appointments have not been made.

9.2 The Contractor shall, in accordance with the OHS Act and applicable Regulations, make all the necessary appointments of competent persons in writing. Copies should also be retained on the SHE file.

10. SHE Committee Meetings and SHE Representatives

10.1 Where applicable, The Contractor and subcontractors shall appoint SHE Representative/s in writing after consultation with employees and ensure that they are trained in performing their duties.

10.2 SHE Representatives duties shall include inspections of the workplace, taking part in incident investigations, risk assessments, attending SHE Committee meetings etc. Records of monthly inspections of SHE Representatives must be kept on the SHE file.

10.3 The number of SHE Representatives appointed shall be in accordance with the requirements of the Occupational health and Safety Act 85 of 1993.

10.4 When required by legislation, the Contractor must ensure that a SHE Committee meeting is held monthly, and minutes of such meeting shall be recorded and records kept on the SHE file. The Contractor representative and appointed SHE representatives shall attend the monthly SHE Committee meeting.

10.5 The TRIM Contract Manager/Technical Officer or his deputy shall be allowed to attend meetings of the Contractor's health and safety committee as an observer.

10.6 Subcontractors appointed by the Contractor shall have their own internal monthly SHE Committee meeting.

11. SHE Audits and Contractor Monthly Reports

11.1 The TRIM Contract Manager/Technical Officer or his deputy shall ensure that the Contractor's SHE Plan is audited at intervals mutually agreed to between them, but at least once every month to ensure that the SHE Plan is implemented and maintained on site.

11.2 TRIM Safety Officers / Specialists shall at all reasonable times be allowed access to the work sites, the Contractor site offices and tool-sheds to inspect the Contractor's and its subcontractor's tools, equipment, registers and workplace.

11.3 Should any non-compliances or contraventions to the TRIM safety requirements, legal requirements, this specification or the Contractor's SHE Plan be identified, such non-compliances or contraventions shall be rectified by the contractor at its cost immediately or within a period specified by the TRIM Contract Manager/Technical Officer, his deputy, or TRIM Safety Officers / Specialists.

11.4 Should the Contractor refuse or fail to rectify such non-compliances or contraventions, TRIM may take remedial action at the Contractor's cost as it may deem necessary to ensure safety at the TRIM sites at all times.

11.5 TRIM reserves the right to conduct safety audits without prior warning.

11.6 The Contractor on all contracts of more than 1 month shall provide a monthly safety performance report as required by TRIM.

11.7 The Monthly safety performance report shall be compiled in terms of Annexure 1 or in any format that the Contractor has as long as it includes all items listed in Annexure 1.

12. Training, Competence and Awareness

12.1 Induction Training

12.1.1 The Contractor shall ensure that all his employees and subcontractors employees undergo a TRIM SHE Induction with regard to the general hazards prevalent on the site, rules and regulations, and other related aspects before commencing work. It is the responsibility of the contractor to inform TRIM whenever new employees are appointed after the initial induction was conducted.

12.1.2 In addition to the TRIM SHE induction, it is the responsibility of the Contractor to develop and implement a site specific SHE Induction programme, a job specific induction programme and a general employee SHE awareness programme, to develop awareness amongst employees on the generic SHE issues associated with the scope of work and the specific environmental issues in question.

12.1.3 The Contractor shall ensure that all visitors and suppliers to the site undergo and comply with Contractors' site-specific safety induction requirement prior to being allowed access to site. All visitors and suppliers shall sign the attendance register.

12.1.4 All visitors and suppliers shall wear the necessary personal protective equipment whilst on site and shall remain in the care of the host who understand the scope of work and associated risks.

12.1.5 The Contractor shall maintain comprehensive attendance records of SHE induction training on the SHE file.

12.2 Competency / Training

12.2.1 The Contractor must ensure that all his employees are adequately trained to perform the tasks allocated to them and that there is the requisite amount of supervision at all times to maintain safe work practices and standards.

12.2.2 The Contractor shall identify training requirements of employees whose work may have a significant impact on their health and safety or that might create a significant impact upon the environment and ensure that these employees will receive appropriate training. A Training matrix shall be used as a mechanism to manage and control the training of employees.

12.2.3 The Contractor shall identify all training needs and incorporate the site-specific training into the SHE plan.

12.2.4 Each Contractor shall be required to ensure that before an employee commences work on the contract that the supervisor in control with responsibility for the employee has informed the employee of his scope of authority and any hazards associated with the work performed. This will include man-job specifications, the discussion of any standard task procedures or hazardous operational procedures to be performed by the employee

12.2.5 The Contractor is to ensure that the supervisor has satisfied himself that the employee is conversant with all hazards associated with any work to be performed by conducting task observations.

12.2.6 The Contractor must ensure that certificate/s of competence where applicable is/are provided in the SHE File.

12.3 Awareness Training

12.3.1 Awareness training required shall be identified for all employees on the contract using the SHE Policy, the SHE Plan, the SHE programmes and procedures.

12.3.2 The Contractor shall have a daily safety talk. This talk shall include subcontractor employees.

12.3.3 The talk must be brief and concise. Subject topics should be applicable to the job at hand, incidents, accidents and up-and-coming work will be discussed along with suggestions and comments. These meetings can be used as a training meeting with the central idea of educating employees.

12.4 Information, instruction and training

12.4.1 The contractor who undertakes work which is liable to expose an employee to an HCA must, before any employee is exposed or may be exposed, after consultation with the health and safety committee established for that section of the workplace, provide that employee with suitable and sufficient information, instruction and training, as well as thereafter inform, instruct and train that employee at intervals as may be recommended by that health and safety committee.

12.4.2 The information, instruction and training must include

(a) in regard to the Hazardous Chemical Agent's

(i) the chemical substance regulations that are in place that govern all aspects of HCA use at the workplace.

(ii) the legislated OELs that are in place; and

(iii) the duties of persons who are likely to be exposed to an HCA,

(b) details of the HCAs to which the employee is likely to be exposed at the workplace, including

(i) the names of the HCAs and where they may be found in the workplace.

(ii) information on the potential harmfulness of the HCAs at the workplace; and

(iii) significant findings of the HCA exposure assessment,

(c) information on how to access the relevant SDSs.

(d) the information that each part of an SDS provides.

(e) the information that each part of the label on containers provides and why the information is being provided.

(f) the work practices and procedures that must be followed for the use, handling, storage, transportation, spillage and disposal of an HCA, in emergency situations, as well as for good housekeeping and personal hygiene.

(g) the necessity of personal air sampling, biological monitoring and medical surveillance

(h) the need for engineering controls and how to use and maintain them; (i) the need for personal protective equipment, including respiratory protective equipment, and its use and maintenance.

(j) the precautions that must be taken by an employee to protect themselves against health risks associated with exposure, including wearing and using protective clothing and respiratory protective equipment; and

(k) the necessity, correct use, maintenance and potential of safety equipment, facilities and engineering control measures provided.

12.4.3 The contractor must give written instructions of the procedures to be followed in the event of spillages, leakages or any similar emergency situations to the drivers of vehicles transporting an HCA.

12.4.4 In terms of section 37(2) of the Act, the contractor and mandatary must agree in writing to the arrangements and procedures between them to ensure compliance by the mandatary with information, instruction and training requirements.

13. Health and Safety Plan (SHE Plan)

13.1 Potential Contractor submitting tenders shall submit with their tender, a Health and Safety Plan setting out the practical arrangements and procedures to be implemented by him to ensure compliance by him with the OHS Act and Regulations, this SHE specification and particularly in respect of: -

(a) The provision, as far as is reasonably practical, of a working environment that is safe and without risk to the health of his employees and subcontractors in terms of section 8 of the OHS Act.

(b) the execution of the contract work in such a manner as to ensure in terms of section 9 of the OHS Act that persons other than those in the Contractor's employment, who may be directly affected by the contract work are not thereby exposed to hazards to their health and safety.

(c) ensuring, as far as is reasonably practical, in terms of section 37 of the OHS Act that no employee or subcontractor of the Contractor does or omits to do any act which would be an offence for the Contractor to do or omit to do.

13.2 The Contractor's Health and Safety Plan shall be based on a risk assessment in respect of the hazards to health and safety of his employees and other persons under his control that are associated with or directly affected by the Contractor's activities in performing the contract work and shall establish precautionary measures as are reasonable and practical in protecting the safety and health of such employees and persons.

13.3 The SHE Plan shall include full particulars in respect of: -

(a) Safety Management Structure arrangements i.e., Appointments to be done and how.

(b) SHE Organisation arrangements i.e., SHE Committees, SHE Audits, Findings and Corrective Actions

(c) Risk Management i.e., Risk Assessment frequencies, methodology

(d) Education and Training i.e., safety induction, site / job specific training arrangements

(e) Emergency Planning

(f) Health and Safety Communication i.e., Toolbox talks, incident recall

(g) Safe working methods and procedures to be implemented i.e., safe work procedures, task observation

(h) Fall Protection Plan i.e., documented plan, training/competency, medical surveillance, rescue plan

(i) Personal protective Equipment and Clothing

(j) Contract Security i.e., site access control and security

(k) SHE Costs

(l) Occupational Health i.e. Medical Surveillance, First Aid, Welfare Facilities, Substance Abuse testing, Noise, Vibration, Manual Handling etc

(m) Environmental management

(n) Incident Management i.e. reporting and investigation

(o) Operational Control and

(p) Review plan of the SHE Plan

13.5 The Contractor shall submit a final SHE Plan after awarding of the contract which shall be subject to the TRIM Contract Manager/Technical Officer's approval and he may, in consultation with the Contractor, order that additional and/or supplementary practical arrangements and procedures be implemented and maintained by the Contractor or that different working methods or safety equipment be used or safety clothes be issued which, in the TRIM Contract Manager/Technical Officer's opinion, are necessary to ensure full compliance by the Contractor with his obligations as an employer in terms of the OHS Act and Regulations.

13.6 The Contractor shall approve the SHE Plan of the subcontractor and further take reasonable steps to ensure that each subcontractor's SHE Plan is implemented and maintained on the site: Provided that the steps taken, shall include periodic audits at intervals mutually agreed to between them, but at least once every month.

13.7 The Contractor shall stop any subcontractor from executing any construction work, which is not in accordance with the Contractor's, and/or subcontractor's SHE Plan for the site or which poses a threat to the health and safety of persons.

13.8 The Contractor shall ensure that a copy of the SHE Plan is available on site for inspection by an inspector, TRIM Contract Manager/Technical Officer, agent, subcontractor, employee, registered employee organisation, health and safety representative or any member of the health and safety committee.

14. Hazards Identification and Potential Hazardous Situations

14.1 The Contractor shall ensure a risk assessment is carried out by a competent person, appointed in writing, before commencement of any work and reviewed during the duration of the contract period. The Risk Assessments shall form part of the Health and Safety Plan to be applied on the site and shall include at least the following:

(a) The identification of the risks and hazards (including ergonomic risks) that persons may be exposed to.

(b) The analysis and evaluation of the hazards identified.

(c) A documented plan, including safe work procedures to mitigate, reduce or control the; risks identified; and

(d) A monitoring and review plan.

14.2 Risk assessments shall be conducted by a competent person and such person shall use a documented method to analyse and evaluate identified risk and hazards.

14.3 The Contractor shall consult with the health and safety committee or, if no health and safety committee exist, with a representative group of employees, on the development, monitoring and review of the risk assessment

14.4 The risk assessment shall be reviewed when there are changes that affect the design of the structure that may affect the health, safety and environment on site or after an incident.

14.5 The Contractor shall ensure that all employees are to be informed, instructed and trained regarding any risks, hazard and related SHE procedures by a competent person as outlined in the risk assessment prior to commencement of work and thereafter at predetermined intervals as outlined in the monitoring plan.

14.6 The Contractor shall ensure that all subcontractors are informed regarding any hazard as stipulated in the risk assessment before any work commences, and thereafter at such intervals as may be determined in the risk assessment.

14.7 The risk assessment shall be available on site for review. Where a risk assessment is not readily available or not communicated to contractor employees, the construction activities shall be stopped until such time the contractor complies.

14.8 The Contractor and the TRIM Contract Manager/Technical Officer shall immediately notify one another of any hazardous or potentially hazardous situations which may arise during performance of the contract or any subcontractor and, in particular, of such hazards as may be caused by the design, execution and/or location and any other aspect pertaining to the contract work.

14.9 The Contractor shall be required to analyse his scope of work and define these critical activities. For each activity, a risk assessment shall be required which defines systems and safe work procedures that will be used in order to complete the activity safely.

14.10 Copies of all safe work procedures and proof that employees have been trained on those safe work procedures shall be kept on the SHE file.

14.11 Preliminary risk and hazard identification shall be conducted by the Contractor prior to work commencement on site. Should the Client's Agent, Project Manager, TRIM Contract Manager/Technical Officer or his duly nominated alternative identify hazardous activities performed by the Contractor on the site for which the Contractor has not submitted a risk assessment, the Contractor shall be required to do so before continuing with work.

15. Safety, Health and Environmental (SHE) File

15.1 The Contractor shall prepare a SHE file and submit to TRIM Contract Manager for approval prior to commencement of work on site. The file shall include all documentation required as per the OHS Act and applicable regulations.

15.2 The approval time of the SHE file is at least 5 working days

15.3 The Contractor shall ensure that a copy of both his or her SHE File as well as any subcontractor's SHE File is kept on site and made available to an inspector of the Department of Labour, the TRIM Contract Manager/Technical Officer, or subcontractor upon request.

15.4 The Contractor shall hand over a consolidated SHE file to the TRIM Contract Manager/Technical Officer upon completion of the Construction Work and shall in addition to documentation mentioned in the OHS Act and applicable Regulations include a record of all drawings, designs, materials used and other similar information concerning the completed structure.

16. Occupational Health

16.1 Medical Surveillance Programme

16.1.1 The Contractor shall ensure that all his and subcontractor employees have a valid medical certificate of fitness issued by an Occupational Health Practitioner.

16.1.2 Medical certificate of fitness must be available and be kept in the SHE file.

16.2 Substance Abuse

16.2.1 All Contractors must comply with the Transnet Substance Abuse Policy and Regulation 2A of the General Safety Regulations of the OHS Act.

16.2.2 No Contractor may possess, sell, offer to other person, use, store, manufacture, transport, distribute, or transfer drugs or alcohol during work hours, on or off TRIM premises.

16.2.3 TRIM will not tolerate substance abuse or use which put at risk the health and safety of its employees or threatens its services to our stakeholders. It is on this basis that a contractor employee will be considered unfit for work if:

(a) He/she is subjected to alcohol screening and/or alcohol testing and is found to have alcohol in his/her breathe and/or blood.

(b) Refuses to undergo substance screening and/or testing.

(c) He /she produces a positive confirmatory test for any other substances, measured by sample analysis at a registered pathological laboratory and authorised by a medical practitioner; and/or

(d) Through observation by security personnel or TRIM Contract Manager, it is evident that the contractor's physical, emotional, mental or behavioural state reflects that they are intoxicated or under the influence.

16.2.4 Any transgression of this policy will constitute a breach of the relevant contract and may result in the termination of services/contract.

16.2.5 Any contractor employee using medication that has a narcotic effect must declare before work to his / her supervisor.

16.3 Occupational Hygiene

16.3.1 The Contractor shall conduct Health Risk Assessments of all the Occupational Hygiene / Environmental stressors (e.g. noise, dust, illumination, HCS, heat & cold stressors, ergonomics, etc.) present in the area where they operate to determine if there is any possible worker exposure. Records of all these assessments should be documented and kept up to date.

16.3.2 The Contractor shall monitor the extent to which their employees are exposed to the occupational hygiene stressors. These assessments shall be conducted by an Approved Inspection Authority as listed on the Department of Labour database. The findings from these assessments should be kept on the SHE file, communicated to all affected parties and be reported to relevant authorities.

16.4 First Aid requirements

16.4.1 All Contractors shall ensure that their employees receive prompt first aid treatment in case of injury or emergency. The Contractor must have the necessary equipment and/or facility on site for treatment of injured persons.

16.4.2 Contractor shall ensure that the first aid box / boxes are available and accessible. More first aid boxes shall be provided if the risks, distance between work teams, or the working environment requires it.

16.4.3 Taking into account the type of injuries that are likely to occur on site, the nature of activities performed and the number of employees on site, the Contractor shall ensure that the first aid box contain suitable first aid equipment which includes at least the minimum contents as listed on Annexure 1 of General Safety Regulation (GSR).

16.4.4 The Contractor must ensure that trained / certificated first-aid personnel are appointed and be available on site at all times. The ratio of first aiders to employees shall be 1:50.

16.5 Asbestos Control

16.5.1 The Contractor shall inform the TRIM Project Manager or TRIM Contract Manager if during construction work asbestos or suspected asbestos containing material is found. Only Asbestos Approved Contractor can work on asbestos containing material.

16.6 Noise

16.6.1 The Contractor shall ensure that the requirements of the Noise Induced Hearing Loss Regulations are complied with.

16.6.2 Contractor shall ensure that machinery and equipment are operated at noise levels not exceeding an equivalent level of 85-dB (A) during normal working conditions.

16.6.3 Where the noise levels at the Operator position or to employees working in the vicinity exceed an equivalent level of 85-dB (A) during normal working conditions, the Contractor shall take appropriate measures to reduce such levels to an equivalent level of 85-dB (A). The use of Personal Protective Equipment (PPE) should be the last resort.

16.6.4 All employees exposed to noise must be trained on the effects of exposure, precautionary measures to be taken to prevent exposure and the correct use of PPE.

16.6.5 Noise zones must be demarcated as such.

16.7 Vibration

16.7.1 Contractors must put measures to reduce the risks associated with hand–arm vibrations, avoid, whenever possible, the need for vibration equipment.

16.7.2 Contractor shall develop a good maintenance regime for tools and machinery. This may involve ensuring that tools are regularly sharpened, worn components are replaced or engines are regularly tuned and adjusted.

16.7.3 The Contractor must introduce a work pattern that reduces the time exposure to vibrations.

16.7.4 The Contractor shall issue employees with gloves and warm clothing. There is a debate as to whether anti-vibration gloves are really effective, but it is agreed that warm clothing helps with blood circulation which reduces the risk of vibration white finger. Care must be taken so that the tool does not cool the hand of the operator.

16.8 Manual Handling

16.8.1 Contractor must reduce risk of injury due to manual handling by using mechanical assistance involving the use of mechanical aids to assist the manual handling operation. Mechanical aids such as hand-powered hydraulic hoists, especially adapted trolleys, hoist for lifting patients and roller conveyors can be used.

16.8.2 Contractor shall ensure all employees involved in manual handling are trained in good lifting techniques.

16.9 Dust

16.9.1 The Contractor shall monitor dust caused by their activities, mobile equipment, generators and other equipment during construction. Factors such as wind can often affect the intensity to which the impact is experienced.

16.9.2 Dust suppression measures must be in place to reduce the dust caused by the activities on site.

16.9.3 Appropriate PPE should be provided to exposed employees.

16.10 Weather precautions

16.10.1 In the event of adverse weather (high winds, flooding, storm surge, lightning etc) or other conditions, the Contractor must institute precautionary measures to protect employees on site.

16.10.2 The Contractor shall take steps to prevent heat stroke, dehydration and exhaustion of employees as a result of exposure to excessive heat on site. Such steps may include employees taking regular breaks, consuming enough water, provision of sun brims for their hard hats and sunscreen to protect them against sun burn.

16.10.3 The Contractor shall take steps to prevent hypothermia or dangerous overcooling of the body as a result of exposure to cold temperatures.

16.11. Welfare Facilities

16.11.1 The Contractor must ensure that all workplace facilities meet health, safety and welfare needs of all employees, including disabled persons where applicable.

16.11.2 The Contractor must in addition to Facilities Regulations 2004, provide at or within reasonable access of every construction site, the following clean, hygienic and maintained facilities:

a) Shower facilities, at least one shower facility per 15 persons
b) At least one sanitary facility for each sex and for every 30 workers
c) Changing facilities for each sex; and
d) Sheltered eating areas

16.11.3 The Contractor must provide reasonable and suitable living accommodation for the workers at construction sites who are far removed from their homes and where adequate transportation between the site and their homes or other suitable living accommodation, is not available

16.12 Work in Confined Space

16.12.1 The Contractor shall ensure that a confined space is only entered by an employee or any other person only after the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof, and who has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

16.12.2 The Contractor shall take steps to ensure that any confined space in which there exist or is likely to exist a hazardous gas, vapour, dust or fumes, or which has or likely to have, an oxygen content of less than 20 percent by volume, is entered by an employee or other person only when:

(a) the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken.

(b) the confined space is isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a value or a cock, or, if this is not practicable, only when all valves and cocks

which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.

16.12.3 The Contractor shall ensure that the provisions of General Safety Regulation 5 are complied with regard to work on confined space

16.12.4 The Contractor must take into consideration that a tunnel is defined as a confined space in terms of the General Safety Regulations and must ensure compliance to the above when working in tunnels.

16.13 Disposal of hazardous chemical agents

16.13.1 The Contractor must, as far as is reasonably practicable

(a) recycle all HCA waste.

(b) ensure that all HCA waste is classified and disposed of as waste in terms of the following legislation:

(i) The Waste Classification and Management Regulations, 2013, published as Government Notice No. R. 634 of 23 August 2013; and

(ii) the National Norms and Standards for the Assessment of Waste for Landfill Disposal, published as Government Notice No. R. 635 of 23 August 2013; and

(c) ensure that all collectable HCA waste is placed in containers that prevent the likelihood of exposure during handling.

(d) ensure that all vehicles, reusable containers and covers, which have been in contact with HCA waste, are cleaned and decontaminated after use in such a way that the vehicles, containers or covers do not cause a hazard inside or outside the premises concerned.

(e) ensure that all employees occupied in the collection, transport and disposal of HCA waste, who may be exposed to that waste, are provided with suitable personal protective equipment; and

(f) ensure that if the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor must also comply with the provisions of these regulations.

17 Incidents/Occurrences

17.1 All incidents referred to in Regulation 9 of General Administration Regulations of the OHS Act involving the contractor and his subcontractor on TRIM premises, shall be reported to the TRIM Contract Manager and Department of Labour as prescribed by the OHS Act.

17.2 TRIM must be forwarded with a copy of a report of any investigation, formal inquiry conducted in terms of Section 31 and 32 of the Act into any incident involving the contractor, his subcontractor, any person or machinery under his control on TRIM premises.

17.3 TRIM Contract Manager must be informed of the above incidents/occurrences before the end of shift when the incident/occurrence occurred.

17.4 The Contractor shall make available its employees to attend as witnesses when required so by TRIM during an investigation into any incident where TRIM believes the said contractor employees were witnesses or may assist in the investigation.

17.5 The contractor shall make available to TRIM any documents required to assist in their investigation.

18. SHE Cost

18.1 The Contractor shall ensure that it has made adequate provision for the cost of health and safety measures in the tender offer.

18.2 The Contractor shall ensure that its subcontractors have made adequate provision for the cost of health and safety measures in the tender offer.

19. Personal Protective Equipment (PPE)

19.1 The Contractor shall ensure that all employees are provided with appropriate prescribed Personal Protective Equipment (PPE) free of charge (according to General Safety Regulations (2), suitable for the type of activities that the employees will perform.

19.2 Such PPE shall be approved by credible institution such as SABS, EN, or AN.

19.3 The Contractor shall manage the issuing of PPE and ensure that PPE is used at all times. Employees shall be trained in the proper use of PPE.

20. Emergency Evacuation Plan and Procedure

20.1 The Contractor must establish and implement an emergency evacuation plan to ensure that in the event of fire, explosion structural collapse etc. all staff is able to evacuate the area to a demarcated area for the purpose.

20.2 The area so selected must be demarcated and the relevant "Assembly Point" sign displayed where applicable or use TRIM nearest assembly point.

20.3 An Emergency Evacuation Procedure must be drawn up; all staff members and contractors shall be given awareness training and participate in regular evacuation drills.

20.4 The Contractor and its employees shall collaborate and adhere to TRIM evacuation drills and requirements.

21. Access Control and Security

21.1 The Contractor shall, before commencing any work, obtain from the TRIM Contract Manager/Technical Officer a Site Access Certificate signed by him, permitting and limiting access to the designated site or place of work by the Contractor and any subcontractors under his control.

21.2 No Site Access Certificate will be granted to the Contractor who fails to comply with TRIM minimum SHE requirements, with the SHE File not approved and without the SHE induction been concluded.

21.3 The Contractor must assess the security risks and implement appropriate measures. All contractors are to strictly adhere to all security requirements on the premises.

21.4 The Contractor in collaboration with the TRIM representative will ensure that proper access control is in place and functional at all times onto and out of the site. A form of access control will be issued to contractor employees who have been inducted and submitted copies of ID documents or work permits (where required).

21.5 Access Permits should be carried by a contract employee at all time when on site. Access Permits shall be produced at the point of entry / gate.

21.6 Contractors shall ascertain from TRIM Contract Manager/Technical Officer the correct route along with their employees may proceed when coming on or going off shift and direct their employees accordingly.

22. Management of Subcontractors

22.1 The Contractor is directly responsible for the actions of his contractors/sub-contractors.

22.2 The Contractor will also be responsible for initiating any remedial action (recovery plan) that may be necessary to ensure that the contractor complies with all requirements.

22.3 The Contractor shall provide any contractor who is making a bid or appointed to perform construction work, with the relevant sections of the documented SHE specification, who would in turn provide a SHE plan for approval.

22.4 The Contractor shall carry out inspection/audits on the contractor/subcontractor to ensure that their SHE plan is being implemented and maintained and submit audit report to TRIM Representative.

22.5 The Contractor shall stop any contractor/subcontractor from executing construction work which poses a threat to the safety and health of persons or the environment.

22.6 The Contractor shall ensure that the sub-contractors appointed have the necessary competencies and resources to perform the work safely.

22.7 The Contractor will be required to submit 37(2) mandatory agreement between the Contractor and subcontractor to the TRIM Contract Manager

23. Environmental Management

23.1 The Contractor shall identify, document and comply with all pertinent Environmental laws and associated Regulations, approvals, licenses and permits which are applicable to the Services and activities undertaken.

23.2 Before commencement with any of the services to be rendered to TRIM, the Contractor shall make available all personnel who will be working on the specified contract to be given environmental induction training. All Contractor employees arriving on the site shall attend such induction.

23.3 The Contractor shall adhere to all instructions issued by Contract Manager or his /her delegated person in promotion of environmental management and legal compliance.

23.4 The Contractor shall determine the correct positioning of topsoil stockpiling to avoid massive disturbance and prepare the topsoil for reuse during landscaping.

23.5 Concrete shall not be mixed directly on the ground or any other permeable surface. Should concrete batching activities occur, these should be located in the designated area on site with low environmental sensitivity levels.

23.6 All excess concrete shall be removed from site on completion of plastering or concrete pouring and disposed of in an environmentally acceptable manner.

23.7 The Contractor shall ensure that his or her employees are aware of the procedures to be followed when dealing with spills and leaks, which shall include notifying the relevant authorities and TRIM as required in terms of National Environmental Management Act (NEMA), 1998 and National Water Act (NWA), 1998. The Contractor shall ensure that all necessary material and equipment required for use during clean – up/rehabilitation of spills and leaks are available on site at all times. Treatment, remediation and/or rehabilitation of contaminated areas shall be undertaken to the reasonable satisfaction of the TRIM Environmental Control Officer or relevant Environmental Specialist.

23.8 Contractor shall be solely responsible for the control of dust generated from his or her activities. Excavation, handling and transport of erodible material shall be avoided under aggressive wind conditions or when a visible dust plume is present. If dust

damping measures are deemed inadequate, working must cease until the wind speed drops to an acceptable level.

23.9 Construction activities generating output levels of 85 db (A) or more shall be confined to the hours 08h00 to 17h00 Mondays to Fridays (close to residential areas).

23.10 No on-site burying or dumping of waste material shall occur. Waste must be collected by a licensed waste transporting contractor and disposed of at a licensed disposal site. Disposal certificate must be made available to TRIM on request.

23.11 Waste bins must be provided in sufficient number and capacity to store solid waste produced on a daily basis. These bins must be kept closed and emptied regularly.

23.12 A designated re-fuelling area (s) must be provided. The re-fuelling area must be protected from hydrocarbon spillage to the reasonable satisfaction of the TRIM Environmental Control Officer or Relevant Environmental Specialist. As a minimum requirement, re-fuelling and workshop areas shall have a bunded floor surface and storm water collection mechanism. Refuelling shall always be accompanied by the use of drip trays.

23.13 The Contractor must notify the Contract Manager immediately of any pollution incident. An incident record system shall be maintained on site for inspection by TRIM and relevant authorities.

23.14 All vehicles and equipment's shall be kept in good working condition. All leaking equipment's shall be repaired immediately or removed from site. All vehicles and equipment shall be maintained and not emit excessive noise.

23.15 In case of major hydrocarbon spill or leakage as a result of equipment failure, Contract Manager must be made aware of such event and the affected area must be fenced off and be cleaned immediately to the reasonable satisfaction of the TRIM Environmental Control Officer to prevent contamination of soil and both surface and groundwater.

23.16 The Contractor shall ensure that no spillage occurs when toilets are being cleaned or emptied and that the contents are removed from site by a licensed service provider.

23.17 The use of borrow pits for the construction of access roads must comply with the provisions of Minerals and Petroleum Resources Development Act of 2004 as amended and should not be located inside the border of any protected area (e.g. Nature Reserve).

23.18 All disturbed areas must be rehabilitated to the reasonable satisfaction of TRIM Environmental Control Officer or Relevant Environmental Specialist.

23.19 Transportation, handling and storage of all substances classified as hazardous must comply with the provisions of the Hazardous Substances Act, 15 of 1973, relevant Regulations and SANS Codes.

23.20 Archaeological remains, artificial features and structures older than 60 years are protected by the Natural Heritage Resources Act, 25 of 1999. Should any archaeological artefact be exposed during construction or any contract work, such work must be stopped immediately. The TRIM Environmental Control Officer must be called in for inspection and to recommend the way-forward. Under no circumstances may any artefacts be destroyed or removed from site.

23.21 The extraction of water for construction purposes must at all times comply with licensing requirements of Department of Water Affairs, where applicable. Extraction of water from a stream or a river requires approval.

23.22 Blasting work that may be required on site shall be carried out entirely within the provisions of the Explosives Act, 26 of 1956 and other relevant engineering and safety standards.

23.23 Office and camp sites shall be established, as far as is practicable, outside the flood plain, above the 1:50 flood level mark within the boundaries of the construction area.

23.24 No camp or office site shall be located closer than 100 metres from a stream, river, spring, dam or pan.

23.25 The area chosen for these purposes shall be the minimum reasonably required and which will involve the least disturbance to vegetation.

23.26 Camps and site offices shall be fenced (where necessary) in consultation with the landowner.

23.27 The Project Manager or TRIM Contract Manager may, at his or her discretion stop any work, activity or process not in accordance with Environmental laws and associated Regulations, approvals, licenses and permits.

23.28 The contractor shall preserve wildlife in terms of the NEMA.

24 Operational Safety

24.1 National Safety Regulator requirements

24.1.1 The Contractor shall ensure that its equipment, machinery and employees when on TRIM premises complies fully with all applicable railway safety requirements and/or regulations of the National Safety Regulator Act 16 of 2002 and the relevant SANS Codes of Practice.

24.1.2 Permission for the engagement of a subcontractor by the Principal both initially and during a contract shall be subject to a review by TRIM of the capability of the proposed subcontractor to comply with railway safety requirements and user specifications.

24.1.3 The Contractor and/or his subcontractors must grant TRIM access, during the term of the contract, to review any railway safety related activities, including the coordination of such activities across all parts of the organisation.

24.1.4 The Contractor shall ensure that where applicable, such work is performed by person who has the necessary competencies as required in terms of any applicable railway safety standard or code of practice.

24.1.5 The Contractor shall ensure that all his employees are protected from the risk of being hit by moving trains.

24.1.6 The Contractor must ensure that it complies to the requirements of RSR 00-4-1.2016 Edition 1, Part 4-1 Human Factors Management-Fatigue Management standard.

24.2 Special Permits

24.2.1 Where special work permits are required before work may be carried out such as for e.g. hot work (welding, cutting etc.), isolation, and occupations, the Contractor shall apply to the TRIM Contract Manager/Technical Officer or the relevant authority for such permits to be issued. The Contractor shall strictly comply with the conditions and requirements pertaining to the issue of such work permits.

24.3 Vehicle Safety

With respect to vehicles, vehicles and mobile plants the Contractor must ensure that:

24.3.1 They are of an acceptable design and maintained in a good working order and are used in accordance with their design and the intention for which they were designed

24.3.2 Are operated by a person who-has received appropriate training, is certified competent and in possession of proof of competency and is authorised in writing to operate such vehicle and mobile plant;

24.3.3 Are operated by a person who has a medical certificate of fitness to operate those vehicle and mobile plant, issued by an occupational health practitioner;

24.3.4 Vehicles used to transport employees have seats firmly secured and adequate for the number of employees to be carried. No employees will be allowed to be transported at the back of LDV's / bakkies unless it is provided with a seat and safety belt and further that the risk assessment has indicated it to be a low risk.

24.3.5 Vehicles are fitted with structures designed to protect the operator from falling material or from being crushed should the vehicle or mobile plant overturn.

24.3.6 Vehicle must be equipped with an acoustic warning device which can be activated by the operator and an automatic acoustic reversing alarm

24.3.7 Vehicles must be inspected by the authorised operator or driver on a daily basis using a relevant checklist prior to use and that the findings of such inspection are recorded in a register kept in the construction vehicle or mobile plant.

24.3.8 No person rides or is required or permitted to ride on a construction vehicle or mobile plant otherwise than in a safe place provided thereon for that purpose.

24.3.9 All vehicles or mobile plant when not in use, have buckets, booms or similar appendages, fully lowered or blocked, controls in a neutral position, motors stopped, wheels chocked, brakes set and ignition secured.

24.3.10 Whenever visibility conditions warrant additional lighting, all mobile plant are equipped with at least two headlights and two taillights when in operation

24.3.11 Tools, material and equipment are secured and separated by means of a physical barrier in order to prevent movement when transported in the same compartment with employees.

24.3.12 Where applicable, also in collaboration with the TRIM representative and other appropriate personnel develop a traffic management plan for the site to ensure the safe movement of all construction related mobile plant where applicable

24.3.13 This plan is to be reviewed as and when required to ensure its applicability where applicable.

24.3.14 Those working or operating on public roads comply with the requirements of the National Road Traffic Act, 1996.

24.4 Housekeeping and general safeguarding on sites

24.4.1 Contractor must ensure that suitable housekeeping is continuously implemented on each work site

24.4.2 The Contractor must ensure proper storage of materials and equipment and the removal of scrap, waste and debris at appropriate intervals.

24.4.3 The Contractor must ensure that materials required for use, are not placed on the site so as to obstruct means of access to and egress from workplaces and passageways

24.4.4 The Contractor must ensure that materials which are no longer required for use, do not accumulate on and are removed from the site at appropriate intervals.

24.5 Electrical Equipment

The Contractor must ensure that:

24.5.1 Implementation and compliance with Electrical Installation Regulations, Electrical Machinery Regulations and regulation 24 of the Construction Regulations and OH&S Act.

24.5.2 All electrical installations, machinery and electrical work is performed in compliance with TRIM Electrical Safety Instructions.

24.5.3 Connections are not made to any power supply without the prior written approval of the TRIM Contract Manager.

24.5.4 All electrical machines and appliances provided by the Contractor for his own use on the Site are in a serviceable condition

24.5.5 Power tools used on the Site are protected by residual current devices approved by TRIM Contract Manager and are double insulated.

24.5.6 All extension cords, portable tools and electrical plant supplied at a voltage above 32 volts are inspected, tested and tagged by a Licensed Electrician at regular monthly intervals. Details of inspections and tests are kept in Logbooks available for inspection by the TRIM Contract Manager or any other authorised Officer of TRIM.

24.5.7 All electrical installations are inspected by the TRIM Contract Manager (or his nominee) to ensure that the installation complies with the Statutory Regulations applicable to the site and TRIM Electrical Safety Instructions. Any installations

deemed unsatisfactory by the TRIM Contract Manager should be removed by the Contractor at his expense.

24.5.8 Portable lights have adequate stability and are fitted with a mechanical guard to protect the lamp. Temporary festoon lighting is of the 'double insulated' type and is supported at least 2.5m above the floor, if possible. Hand lamps are of the 'all insulated' type.

24.5.9 All temporary light fittings are supplied from more than one final sub-circuit, with the supply from a residual current device, extra low voltage source or an isolating transformer.

24.5.10 The Contractor must obtain approval from the TRIM Contract Manager before any of his employees or Sub-contractors commence work within three (3) metres of conductor rails or high-tension wires, or where there is a possibility of equipment coming close to and/or touching a power source and must provide suitable protective insulating barriers. For the erection of scaffolding, the distance is five (5) metres.

24.5.11 Only authorised persons may enter Electrical Contactor Houses, Motor Rooms, Switch Rooms, Control Rooms or Cable Ducts. Should the Contractor require entering such places to carry out work, he must first obtain permission from the TRIM Contract Manager and obtain a valid Permit to Work.

24.5.12 The Contractor's employees required to enter such electrical spaces "authorised persons", with the names entered in the TRIM Authorised Persons Register, after receiving approval from the TRIM Electrical Officer, or they are accompanied by an authorised person who must supervise the placement of Danger Tags and Out-of-Service Tags, as well as Electrical Isolation Permit.

24.5.13 Electrical equipment supply cabling distribution boards, fixed lighting and portable appliances, extension leads, welding machines, compressors, pumps and hand portable tools are inspected on a monthly basis and also by the user daily before use.

24.5.14 Such monthly inspection(s) are to be performed by an appropriately qualified Electrician.

24.5.15 Contractors working on, over, under, or adjacent to railway lines and near high voltage equipment shall comply with the Transnet E7/1 Specification for Works On, Over, Under or Adjacent to Railway Lines and Near High Voltage Equipment.

24.5.16 No person may do electrical installation work as an electrical contractor unless that person has been registered as an electrical contractor in terms of the Electrical Installation Regulations.

24.5.17 No person shall authorize, design, install or permit or require the installation of an electrical installation, other than in accordance with a health and safety standard provided that the components within an electrical installation shall comply with the standards and proof of compliance shall be identifiable on the components or certification shall be available from the supplier or manufacturer of the components.

24.5.18 Contractor shall provide further that items of an electrical installation not covered by such incorporated safety standard, and the conductors between the point of supply and the point of control, shall be installed in accordance with the by-laws or regulations of the supplier concerned.

24.5.19 A registered person shall exercise general control over all electrical installation work being carried out, and no person shall allow such work without such control: Provided that where the voltage exceeds 1kV, the installation shall be designed and supervised by a person deemed competent

24.5.20 No supplier shall restrict the application of a health and safety standard when an electrical installation is installed, except where the distribution system of the supplier may be adversely affected by the application thereof.

24.6 Stacking and Storage

24.6.1 The Contractor shall ensure that a competent person is appointed in writing with the duty of supervising all stacking and storage.

24.6.2 Adequate storage areas are provided, demarcated as storage areas and are kept neat and under control.

24.7 Fire Precautions and Fire Safety

24.7.1 The Contractor must ensure that all appropriate measures are taken to avoid the risk of fire. The Contractor shall comply to the fire precautions as stipulated in the Environmental Regulations for Workplaces, 1987 and regulation 29 of the Construction Regulations, 2014

24.7.2 Sufficient and suitable storage is provided for flammable liquids, solids and gases.

24.7.3 Smoking is prohibited and notices in this regard are prominently displayed in all places containing readily combustible or flammable materials

24.7.4 The Contractor shall ensure that the work areas are clear, at all times, of any material, which could fuel a fire and that ccombustible materials do not accumulate, oily rags, waste and other substances liable to ignite are without delay removed to a safe place.

24.7.5 A thorough inspection is made of the work site at the end of any working period to ensure that no material is left at the work site or any situation left in such a manner that a fire or accident could result (all machines to be turned off at main switches, and cylinders to be closed and hoses deflated).

24.7.6 Suitable and sufficient fire-extinguishing equipment is placed at strategic locations or as may be recommended by the Fire Chief or local authority concerned and that such equipment is maintained in a good working order.

24.7.7 The fire equipment is inspected by a competent person, who has been appointed in writing for that purpose, in the manner indicated by the manufacturer thereof

24.7.8 Sufficient number of employees are trained in the use of fire extinguishing equipment and familiarise themselves with locations of fire fighting equipment in the work site.

24.7.9 There is an effective evacuation plan providing for all persons to be evacuated speedily without panic, accounted for and a siren is installed and sounded in the event of a fire.

24.7.10 Where appropriate, suitable visual signs are provided to clearly indicate the escape routes in the case of a fire and the means of escape is kept clear at all times.

24.7.11 The Contractor must ensure that fire fighting equipment are not to be used for any purpose other than their intended use.

24.8 Demarcation of the site

24.8.1 The Contractor shall ensure that its activities are conducted within a limited area to facilitate control and to minimize the impact on the existing natural environment and other TRIM activities.

24.8.2 The Contractor shall demarcate the boundaries of the site in order to restrict activities to the site.

24.8.3 The method of demarcation and the location of the demarcated area shall be determined by the Contractor and approved by the TRIM Contract Manager prior to any work being undertaken. The Contractor shall ensure that all his plant, labour and materials remain within the boundaries of the site.

24.8.4 Failure to do so may result in the Contractor being required to fence off the boundaries of the site at his own expense to the satisfaction of the TRIM. The contractor is responsible for the safeguarding of his/her own equipment and material while on site.

24.9 Fall Protection Plan

24.9.1 In the event of the risk and hazard identification, as required in terms of clause 14 of this Specification, revealing risks relating to working from a fall risk position the contractor shall cause the designation of a competent person, responsible for the preparation of a fall protection plan.

24.9.2 The Contractor shall implement, maintain and monitor the fall protection plan for the duration of the contract. The Contractor shall also take such steps to ensure the continued adherence to the fall protection plan.

24.9.3 The fall protection plan shall include: -

(a) a risk assessment of all work carried out from a fall risk position.

(b) the procedures and methods to address all the identified risks per location.

(c) the evaluation of the employees physical and psychological fitness necessary to work at fall risk positions.

(d) the training of employees working from fall risk positions.

(e) rescue plan; and

(f) the procedure addressing the inspection, testing and maintenance of all fall protection equipment

24.10 SHE Signage (Symbolic Safety Signs) on plant and in buildings

24.10.1 The Contractor's employees shall comply with all SHE signage posted at various locations of TRIM sites.

24.10.2 The Contractor shall after occupation of the construction site ensure that appropriate, SHE signs (Symbolic Safety Signs) are displayed on site

24.11 General Machinery, Tools and Equipment

24.11.1 The Contractor shall ensure that all machinery, tools and equipment are identified, numbered or tagged, listed on an inventory list.

24.11.2 The Contractor shall ensure that all machinery, tools and equipment are safe to be used and is maintained in a good condition.

24.11.3 The Contractor shall ensure that all machines driven by means of belts, gear wheels, chains and couplings shall be adequately guarded in such a manner that persons cannot gain inadvertent access to the moving parts.

24.11.4 All machinery, tools and equipment to be regularly inspected at least monthly or as required by legislation and risk assessments. Records of such inspections shall be kept on the SHE file.

24.11.5 Where applicable machinery, tools and equipment must have the necessary approved test or calibration documentation.

24.11.6 The Contractor shall ensure that all machinery, tools and equipment are operated by persons who have been trained to operate such machinery, tools or equipment.

24.12 Portable Electrical Tools and Explosive Power Tools

24.12.1The Contractor shall ensure that use and storage of all explosive power tools and portable electrical tools comply with all applicable legislation.

24.12.2The Contractor shall ensure that only trained employees are authorised to use portable electrical tools and explosive power tools

24.12.3 The Contractor shall ensure that all portable electrical tools and explosive power tools are kept in a safe working condition.

24.12.4 All portable electrical tools and explosive power tools are inspected monthly by a competent person and daily before use by the operator of such tool. Records of such inspections must be kept in the safety file.

24.12.5 Users / Operators of electrical power tools and explosive power tools should be issued with suitable protective equipment

24.13 Lifting Machine, Lifting Tackle and Suspended Loads

24.13.1The Contractor shall ensure that lifting machine and tackle comply with Driven Machinery Regulation 18 and all other applicable legislative requirements and standards.

24.13.2The Contractor shall ensure that lifting machine operators shall be competent to operate a lifting machine. They must be in possession of a valid permit. The training should have been done according to the Code of Practice by a provider registered by the Department of Labour.

24.13.3 A lock out system should be implemented to ensure that only an operator that is competent can draw lifting machines and forklifts.

24.13.4 The Contractor shall ensure that before using any lifting machines or tackle the operator inspect it. Records of such inspections and examinations shall be kept on the safety file.

24.13.5 All lifting machines shall be examined and subjected to a performance test by an accredited person/company at intervals not exceeding 12 months.

24.13.6 All lifting tackle should be recorded on a register and should be examined by an accredited person/company at intervals not exceeding 3 months.

24.13.7 All hooks shall be fitted with a safety latch/catch.

24.13.8 All lifting tackle should be conspicuously and clearly marked with identification particulars and the maximum mass load which it is designed for.

24.13.9 No person shall be moved or supported by means of a lifting machine unless such a machine is fitted with a cradle approved by an inspector.

24.13.10 Rigging of loads to be done in accordance with acceptable safe work practices

24.13.11 Contractors and their employees shall keep out from under suspended loads, including excavators, and between a load and a solid object where they might be crushed if the load should swing or fall. They shall not pass or work under the boom or any crane or excavator.

24.13.12 Contractors and their employees shall ensure that crane loads are not carried over the heads of any workmen.

24.13.13 The Contractor shall ensure proper supervision in terms of guiding the load including the use of guide ropes to prevent loads from swinging and a trained person to direct lifting operations and checking the lifting tackle and attachments daily.

24.14 Hand Tools and Pneumatic Tools

24.14.1 All hand tools (hammers, chisels, spanners, etc) must be recorded on a register and inspected by a competent person on a monthly basis as well as by users prior to use.

24.14.2 All pneumatic tools should be numbered, recorded and inspected at least monthly as well as by users prior to use. And the revolutions per minutes measured in accordance with the manufacturer specifications

24.14.3 Tools with sharp points in toolboxes must be protected with a cover.

24.14.4 All files and similar tools must be fitted with handles.

24.14.5 The Contractor must have a policy on private and makeshift tools on site.

24.14.6 No pneumatic tool shall be operated by using a compressed gas cylinder. Pneumatic equipment shall only draw supply from mobile air compressors or from compressed air lines installed within the premises.

24.15 Electrical Installations

24.15.1 Each electrical installation (temporary or permanent) installed or worked on by contractor must be inspected by a nominated project management representative to

ensure that the installation complies with all statutory requirements, codes, design criteria and safety standards applicable to the project

24.15.2 A nominated project management representative must approve all electrical work before the installation is energised.

24.15.3 Any installation deemed unsatisfactory by a nominated project management representative must be removed, repaired, or modified by the contractor at his expense.

24.15.4 For every permanent or temporary electrical installation, a certificate of compliance must be issued by a competent and appropriately qualified electrician.

24.15.5 These certificates must be available for inspection. Single line diagrams (with supporting documentation) must be produced and maintained for all electrical installations.

24.15.6 This information must include system fault calculations, equipment details, electrical protection discrimination curves, and cable ratings. Work on electrical installations (new installations, and modifications or repairs to existing installations) may only be carried out by qualified and authorised personnel (i.e., electricians).

24.15.7 Electrical safety devices (specifically, earth leakage protection and overcurrent protection) must be installed on all distribution circuits and the settings must be established by suitably qualified personnel.

24.15.8 A suitable numbering and / or labelling system must be used so that each circuit breaker or earth leakage device can be clearly and readily matched with the outlet or equipment that it protects.

24.15.9 To ensure the safety of the user, each distribution panel must be completely enclosed, must be of the dead-front type, and must be properly constructed and earthed.

24.15.10 All electrical cabling must be covered (e.g., in cable trenches) or elevated (in cable trays) to protect it from damage and to eliminate tripping hazards.

24.15.11 All permanent and temporary electrical installations (cabling, sockets, distribution panels, transformers, switchgear, etc.) must be inspected and tested by a competent and suitably qualified electrician on a monthly basis.

24.15.12 The testing must include a grounding (earthing) continuity test and testing of the electrical safety devices. Details of these inspections and tests must be recorded in a

register which must be made available to the nominated project management representative for inspection.

24.15.13 A rigorous Isolation, Lockout and Permit to Work system must be applied to all electrical work (i.e., work on electrical installations, machinery, or equipment). All personnel must comply with the system and procedures applicable to the project. Before any work on an electrical installation or equipment is carried out, the installation or equipment must be de-energised.

24.15.14 No electrical work may be performed live, regardless of the voltage, unless written approval is obtained from the nominated project management representative (a TRN-IMS-GRP-GDL-014.3 Version 2.0 Page 95 of 157 Contractor Management Procedure ©Transnet SOC Ltd justification as to why it is necessary for the work to be carried out with the equipment in an energised state must be provided).

24.15.15 For all energised electrical work, a Safe Work Procedure must be in place and, with the exception of voltage testing and where no tools are used, a Permit to Work (specifically authorising energised electrical work) must be issued. When carrying out any energised electrical work, approved electrically insulated gloves, blankets, mats and other protective equipment must be used.

24.15.16 Control centres, switchgear rooms, substations, generators, transformers, capacitor banks, and other similar electrical plant and equipment must be appropriately guarded and labelled and, except for emergency shut-off mechanisms, must be made inaccessible to unauthorised personnel (i.e., plant or equipment of this nature must be positioned within rooms or fenced enclosures which must be kept locked).

24.15.17 Appropriate warning signage must be prominently displayed within, and at all entrances to, these rooms or enclosures. The signage must indicate that unauthorised persons are prohibited from entering, that unauthorised persons are prohibited from handling or interfering with any electrical plant or equipment, the procedure to be followed in the event of a fire, and the first aid procedure to be followed should a person suffer electric shock. Suitable fire-fighting equipment must be provided in all such rooms or enclosures.

24.15.18 All electrical panels must be kept locked (using keyed-alike padlocks). Keys may only be issued to authorised personnel. All un-insulated (bare) or partially insulated conductors must be enclosed and protected to prevent accidental contact therewith. Measures must be taken to prevent unauthorised access and appropriate warning signage must be conspicuously displayed.

24.15.19 Only authorised persons may enter rooms or enclosures housing electrical plant or equipment, and only authorised persons may access electrical panels or cabinets, and cable ducts or trenches. If any work must be carried out in such an area or on such equipment, a Permit to Work must first be obtained from the nominated project management representative.

24.15.20 No connection to any electrical system may be made without prior approval and a valid Permit to Work from the nominated project management representative. No electrical equipment or apparatus may be modified without written authorisation from the nominated project management representative. Conductive ladders may not be used in proximity to non-insulated electrically energised lines or equipment.

24.15.21 All permanent and temporary electrical cables, whether energised or not, must at all times be handled as if they are energised. Only appropriately certified intrinsically safe electrical equipment may be used in flammable or potentially explosive atmospheres such as in confined spaces. Any equipment or structure on which electric charges may accumulate (such as storage tanks) must be grounded (earthed).

24.15.22 Lightning protection must be provided on all tall structures and buildings. TRN-IMS-GRP-GDL-014.3 Version 2.0 Page 96 of 157 Contractor Management Procedure ©Transnet SOC Ltd Grounding (earthing) and lightning protection systems and devices must be designed, engineered, selected, and installed based on site-specific requirements.

24.15.23 Before carrying out any excavation work, a Permit to Work (specifically authorising the excavation activities) must be obtained from the nominated project management representative. Such a permit must not be issued until it has been verified that no buried hazards or services exist where the excavation work is to be carried out (refer to the Excavation Standard).

24.16 Ladders

24.16.1 A contractor shall ensure that all ladders are numbered, inspected before use and weekly inspections are recorded in a register. A contractor shall ensure that a competent person who carries the above inspections is appointed in writing.

25. Scaffolding

25.1 The Contractor must ensure that all scaffolding operations are carried out under the supervision of a competent person and that all erectors, team leaders and inspectors are competent to carry out their work.

25.2 The Contractor must ensure that scaffolding when used and erected, complies with the safety standards as per SANS 10085-1:2004 Please note that Scaffold also need to comply with CR 12 Temporary Works.

25.3 All scaffolding equipment to be inspected and proclaimed safe to use or rectified as to be safe to use after any inclement weather. Signage must be posted to indicate the status of the scaffolding.

26. Excavations, Floor Openings and Trenches

The Contractor must ensure that:

26.1 All excavation work is carried out under the supervision of a competent person who has been appointed in writing for that purpose.

26.2 Evaluation of the stability of the ground, as far as is reasonably practicable, before excavation work begins.

26.3 Sufficient steps in order to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation.

26.4 No person is permitted to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where the sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or such an excavation is in stable material: Provided that permission has been given in writing by the appointed competent person upon evaluation by him or her of the site conditions.

26.5 Where any uncertainty pertaining to the stability of the soil still exists the decision from a professional engineer or a professional technologist competent in excavations is decisive and such a decision must be noted in writing and signed by both the competent person and the professional engineer or technologist, as the case may be.

26.6 The shoring or bracing used is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question.

26.7 No load, material, plant or equipment is placed or moved near the edge of any excavation where it may cause its collapse and consequently endangers the safety of any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing;

26.8 Where the stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons.

26.9 Convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six meters from the point where any worker within the excavation is working.

26.10 The location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed and must before the commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all persons involved.

26.11 Every excavation, including all bracing and shoring, is inspected by the competent person, daily, prior to the commencement of each shift; after every blasting operation; after an unexpected fall of ground; after damage to supports; and after rain in order to ensure the safety of the excavation and of persons.

26.12 The results of such inspections must be recorded in a register kept on site and made available on request to an inspector, the client, the client's agent, any other contractor or any employee.

26.13 Every excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, to be adequately protected by a barrier or fence of at least one metre in height and as close to the excavation as is practicable; and provided with warning illuminates or any other clearly visible boundary indicators at night or when visibility is poor.

26.14 All precautionary measures stipulated for confined spaces as determined in the General Safety Regulations, 2003, are complied with by any person entering any excavation.

26.15. Where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and must ensure that a method statement is developed by that person in accordance with the applicable explosive's legislation.

26.16 Warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections or tests.

27. Confidentiality

27.1 The Contractor must, at all times, consider all data or information given to him or that is required in connection with the work of the Company, as confidential and not makes unauthorized use of it.

27.2 He/she must ensure that such data or information is not given to any non-employee of the contractor without written consent of the TRIM Contract Manager.

27.3 The Contractor shall be aware of the confidentiality of the mentioned information and is compelled to treat it accordingly.

27.4 The Contractor must provide adequate physical protection for any confidential documents, etc, which were obtained from Transnet in connection with the contract work as well as any copies made thereof. If any documents or sketches are lost, the TRIM Contract Manager must be notified immediately.

ANNEXURE 1

CONTRACTOR MONTHLY SHE REPORT

For Month/Year		Name of Contractor	
Name of Contract			
Contract Number	Date of Commencement	Date of Completion	

Number of employees	Man-hours worked this Month	Cumulative (Contract duration man-hours)	Man-hours Since last Lost Time Incident (LTI)	DIFR

1. Details of SHE Incidents

Incident	This Month	Cumulative (Contract duration)	Short description of major/ significant incidents and preventative action taken
Number of fatalities			
Number of disabling incidents			
Number of Medical Treatment Cases			
Number of first aid Cases			
Number of near miss incidents			

Motor vehicle incidents			
Number of environmental incidents			
Positive substance abuse incidents			
Substandard Act/ Conditions observed			
Legal violations observed			

2. Details of SHE Meetings

Date	No of participants	Major SHE Concerns	Action taken

3. Details of Audits/Inspections

Date	Area / Facility	Findings/Recommendations	Action taken

5. Details of any SHE Promotional activities for the month

Date	Activity	Remarks

6. Safety Communication

Month	Number of Safety talks held	Remarks

Attach separate sheets for further or other details

…… ……
……

Name of Contractor Representative Signature Date

Contractor Signature…… . Date……

T2.2-08: Environmental Management Plan

The tenderer must provide an environmental management plan describing:-

- Key environmental aspects and impacts that need to be avoided, managed and mitigated (impact management actions).
- The method and frequency of monitoring the implementation of the impact management actions
- An indication of the roles and responsibilities in the implementation of the impact management actions
- A description of how the environmental incidents will be managed on site.
- Monitoring techniques and reporting (types of records) of both accidents and incidents.
- Details of induction and other forms of awareness or training (if any).
- How non-conformance/non-compliance will be dealt with

The following documents are key -

1.0 Transnet SOC Limited – Integrated Management Systems (IMS) Policy,

1.1 By signing this Tender Schedule, the tenderer confirms that they will comply with the above policy statement and environmental commitments therein.

1.2 Tender to provide a signed declaration of understanding as part of the returnable acknowledging understanding thereof and the budget provision for the implementation of environmental management requirements.

By signing this Tender Schedule, the tenderer confirms that they will **comply** with the above requirements and in particular Transnet Freight Rail IMS policy statement and environmental commitments therein.

The scoring of the Tenderer's Environmental Management Plan will be as follows:

Key Environmental Impacts and Possible Mitigation Measures (60%) *(Potential effects that project activities may have on the environment and measures to reduce the impact)*	
	Assessment Feedback
The EMP is **not submitted** by the bidder.	
EMP with **zero/no key** impacts and mitigation measures specific to the project	
EMP contains **1-3** key impacts and mitigation measures specific to the project.	

EMP contains **4-6** key impacts and mitigation measures specific to the project.	
EMP contains **7-9** key reasonable and relevant impacts and mitigation measures specific to the project.	
EMP contains **10 and more** key reasonable and relevant impacts and mitigation measures specific to the project, which meet and exceed tender requirements.	
Key Roles and Responsibilities (20%) *(Assignment of impact management actions within the organisation)*	
	Assessment Feedback
The EMP is **not submitted** by the bidder.	
EMP with **zero/no key** roles and responsibilities specific to the project.	
EMP **contains 1-3 key** reasonable and relevant roles and responsibilities specific to the project.	
EMP contains **4-6 key** reasonable and relevant roles and responsibilities specific to the project.	
EMP contains **7-9 key** reasonable and relevant roles and responsibilities specific to the project.	
EMP contains **10 and more key** reasonable and relevant roles and responsibilities specific to the project, which meet and exceed tender expectations.	

Environmental Monitoring, Training and Reporting (20%) *(communication methods, monitoring methods and types of reports to be produced for monitoring)*	
	Assessment Feedback
The EMP is **not submitted** by the bidder.	
EMP with **zero/no** monitoring techniques, no training and no form of reporting.	
Tenderer did not demonstrate understanding of the project scope and **provided irrelevant information** on monitoring techniques, training methods and types of reports.	
Tenderer understood the project scope but provided relevant but **less detailed information** on monitoring techniques, training methods and types of reports.	

Tenderer understood the project scope and identified **relevant** monitoring techniques, relevant training methods and relevant reports.	
Tenderer understood the project scope and addresses critical aspects with regards to monitoring, training and reporting which meets **and exceeds tender requirements**.	

Attached submissions to this schedule:

.....

.....

.....

.....

.....

.....

.....

.....

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

T2.2-9: Method Statement

Note to tenderers:

Method statement - The tenderers must sufficiently demonstrate the approach/methodology that will be employed to cover the scope of the project.

- A detailed method statement is required …….

In addition to general methodology for the project, the tenderer must demonstrate the following aspects but not limited to:

- Order and timing of the audits, inspection and design milestones that will take place in order to provide the *Service*.
- Indication of how the above will be achieved in terms of the associated policies and procedures, and relevant specification described in the tender.

or

In addition to general methodology for the project please provide specific information for the following points:

1. REFURBISHMENT OF 2 X 20MVA TRACTION TRANSFORMERS AT VARIOUS SUBSTATIONS ON THE RICHARDS BAY DEPOT

T2.2-10: Authority to submit a Tender.

Indicate the status of the tenderer by ticking the appropriate box hereunder. The tenderer must complete the certificate set out below for his category of organisation or alternatively attach a certified copy of a company / organisation document which provides the same information for the relevant category as requested here.

A - COMPANY	B - PARTNERSHIP	C - JOINT VENTURE	D - SOLE PROPRIETOR

A. Certificate for Company

I, _____ chairperson of the board of directors _____ _____, hereby confirm that by resolution of the board taken on _____ (date), Mr/Ms _____, acting in the capacity of _____, was authorised to sign all documents in connection with this tender offer and any contract resulting from it on behalf of the company.

Signed	.....	Date	.....
Name	.....	Position	Chairman of the Board of Directors .....

B. Certificate for Partnership

We, the undersigned, being the **key partners** in the business trading as _____

_____ hereby authorise Mr/Ms _____

acting in the capacity of _____, to sign all documents in connection with the tender offer for Contract _____ and any contract resulting from it on our behalf.

Name	Address	Signature	Date

NOTE: This certificate is to be completed and signed by the full number of Partners necessary to commit the Partnership. Attach additional pages if more space is required.

C. Certificate for Joint Venture

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms _____, an authorised signatory of the company_____ _____, acting in the capacity of lead partner, to sign all documents in connection with the tender offer for Contract _____ and any contract resulting from it on our behalf.

This authorisation is evidenced by the attached power of attorney signed by legally authorised signatories of all the partners to the Joint Venture.

Furthermore, we attach to this Schedule a copy of the joint venture agreement which incorporates a statement that all partners are liable jointly and severally for the execution of the contract and that the lead partner is authorised to incur liabilities, receive instructions and payments and be responsible for the entire execution of the contract for and on behalf of any and all the partners.

Name of firm	**Address**	**Authorising signature, name (in caps) and capacity**

D. Certificate for Sole Proprietor

I, _____, hereby confirm that I am the sole owner of the business trading as _____.

Signed		Date	
Name		Position	Sole Proprietor

T2.2-11: Record of Addenda to Tender Documents

This schedule as submitted confirms that the following communications received from the *Employer* before the submission of this tender offer, amending the tender documents, have been taken into account in this specific tender offer:

	Date	Title or Details
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Attach additional pages if more space is required.

T2.2-12 Letter/s of Good Standing with the Workmen's Compensation Fund

Attached to this schedule is the Letter/s of Good Standing.

1.

2.

3.

4.

Name of Company/Members of Joint Venture:

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

T2.2-13: Risk Elements

Tenderers to identify and evaluate the potential risk elements associated with the Works and possible mitigation thereof. The risk elements and the mitigation as identified thereof by the Tenderer are to be submitted.

If No Risks are identified "No Risks" must be stated on this schedule.

Tenderers are also to evaluate any risk/s stated by the *Employer* in Contract Data Part C1, and provide possible mitigation thereof.

Tenders to note: Notwithstanding this information, all costs related to risk elements which are at the Contractor's risk are deemed to be included in the tenderer's offered total of the Prices.

T2.2-14: Schedule of Proposed Subcontractors

Tenderer to note that if successful, any deviations from the list of proposed sub-contractors in the contract phase will be subject to acceptance by the *Service Manager* in terms of the Conditions of Contract. Please also note the applicable Z clauses in Contract Data by *Employer*.

Provide **detailed information** of the proposed Sub-contractors below:

	Name of proposed Sub-contractor	**Proposed Sub-contractor National Treasury Central Supplier Database Registration Number Address and Region**	**Nature and extent of work**	**B-BBEEE Certificates or Sworn Affidavit attached behind this schedule? Yes/No**	**Percentage (%) of the sub-contracted works in terms of the tendered total of the prices.**
1.					
2.					
3.					
4.					
5.					
6.					

T2.2-15: Affected Property Establishment Requirements

Tenderers to indicate their Affected Property establishment area requirements:

T2.2-16 : CIDB SFU ANNEX G Compulsory Enterprise Questionnaire

The following particulars hereunder must be furnished.

In the case of a Joint Venture, separate enterprise questionnaires in respect of each partner/member must be completed and submitted.

1. **Section 1: Name of enterprise:** _____

2. **Section 2: VAT registration number, if any:** _____

3. **Section 3: CIDB registration number, if any:** _____

4. **Section 4: CSD number:** _____

5. **Section 5: Particulars of sole proprietors and partners in partnerships**

Name	Identity number	Personal income tax number

* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

6. **Section 6: Particulars of companies and close corporations**

Company registration number _____

Close corporation number _____

Tax reference number: _____

Section 7: The attached SBD 6 must be completed for each tender and be attached as a tender requirement.

Section 8: The attached SBD 4 must be completed for each tender and be attached as a requirement.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;

ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;

iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;

iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed _____ Date _____

Name _____ Position _____

Enterprise name .....

SBD 6.1

SPECIFIC GOALS POINTS CLAIM FORM

This preference form must form part of all bids invited. It contains general information and serves as a claim for preference points for Specific Goals contribution. Transnet will award preference points to companies who provide valid proof of evidence as per the table of evidence in paragraph 4.1 below.

---

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and

1.2 The value of this bid is estimated to not exceed R50 000 000 (all applicable taxes included) and therefore the 80/20 preference point system shall be applicable. Despite the stipulated preference point system, Transnet shall use the lowest acceptable bid to determine the applicable preference point system in a situation where all received acceptable bids are received outside the stated preference point system.

1.3 Preference points for this bid shall be awarded for:

(a) Price;

(b) B-BBEE Status Level of Contribution; and

(c) Any other specific goal determined in the Transnet preferential procurement policy

1.4 The maximum points for this bid are allocated as follows:

PRICE AND SPECIFIC GOALS	POINTS
PRICE	**80**
SPECIFIC GOALS	
B-BBEE status level of contribution level 1 or 2	**5**
Entities that are at least owned by 30% Black Women	**5**
Entities that are at least owned 50% Black Youth	**5**
Entities that are owned People living with Disabilities	**5**
Non-Compliant and/or B-BBEE Level 3-8 contributors	**0**
Total points for Price and Specific Goals must not exceed	**100**

1.5 Failure on the part of a bidder to submit proof of evidence required for any of the specific goals together with the bid will be interpreted to mean that preference points for that specific goal are not claimed.

1.6 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

2. DEFINITIONS

(a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

(b) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

(c) "**B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

(d) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the supply/provision of services, works or goods, through price quotations, advertised competitive bidding processes or proposals;

(e) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(f) **"EME"** means an Exempted Micro Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(g) **"functionality"** means the ability of a bidder to provide goods or services in accordance with specification as set out in the bid documents

(h) **"Price"** includes all applicable taxes less all unconditional discounts.

(i) **"Proof of B-BBEE Status Level of Contributor"**

i) the B-BBBEE status level certificate issued by an authorised body or person;

ii) a sworn affidavit as prescribed by the B-BBEE Codes of Good Practice; or

iii) any other requirement prescribed in terms of the B-BBEE Act.

(j) **"QSE"** means a Qualifying Small Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(k) **"rand value"** means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties.

(l) **Specific goals"** means targeted advancement areas or categories of persons or groups either previously disadvantaged or falling within the scope of the Reconstruction and Development Programme identified by Transnet to be given preference in allocation of procurement contracts in line with section 2(1) of the PPPFA.

3. POINTS AWARDED FOR PRICE

3.1 THE 80/20 PREFERENCE POINT SYSTEMS

A maximum of 80 points is allocated for price on the following basis:

80/20

$$Ps = 80\left(1 - \frac{Pt - P\min}{P\min}\right)$$

Where

Ps = Points scored for comparative price of bid under consideration

Pt = Comparative price of bid under consideration

Pmin = Comparative price of lowest acceptable bid

3.2

Selected Specific Goals	Number of points allocated (20)
B-BBEE status level of contribution level 1 or 2	5
Entities that are at least owned by 30% Black Women	5
Entities that are at least owned 50% Black Youth	5
Entities that are owned People living with Disabilities	6
Non-Compliant and/or B-BBEE Level 3-8 contributors	0

4. EVIDENCE REQUIRED FOR CLAIMING SPECIFIC GOALS

4.1 In terms of Transnet Preferential Procurement Policy (TPPP) and Procurement Manuals, preference points must be awarded to a bidder for providing evidence in accordance with the table below:

Specific Goals	Acceptable Evidence
B-BBEE	B-BBEE Certificate / Sworn- Affidavit / B-BBEE CIPC Certificate (in case of JV, a consolidated scorecard will be accepted) as per DTIC guideline
Entities that are at least owned by 30% Black Women	Certified copy of ID Documents of the Owners and B-BBEE Certificate / Sworn- Affidavit / B-BBEE CIPC Certificate (in case of JV, a consolidated scorecard will be accepted) as per DTIC guideline
Entities that are at least owned 50% Black Youth	Certified copy of ID Documents of the Owners and B-BBEE Certificate / Sworn- Affidavit / B-BBEE CIPC Certificate (in case of JV, a consolidated scorecard will be accepted) as per DTIC guideline
Entities that are owned People living	Certified copy of ID Documents of the Owners / Doctor's note

with Disabilities	and /or EEA1 form confirming the disability

4.2 The table below indicates the required proof of B-BBEE status depending on the category of enterprises:

Enterprise	B-BBEE Certificate & Sworn Affidavit
Large	Certificate issued by SANAS accredited verification agency
QSE	Certificate issued by SANAS accredited verification agency Sworn Affidavit signed by the authorised QSE representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership (only black-owned QSEs - 51% to 100% Black owned) [Sworn affidavits must substantially comply with the format that can be obtained on the DTI's website at www.dti.gov.za/economic_empowerment/bee_codes.jsp.]
EME	Sworn Affidavit signed by the authorised EME representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership Certificate issued by CIPC (formerly CIPRO) confirming annual turnover and black ownership Certificate issued by SANAS accredited verification agency only if the EME is being measured on the QSE scorecard

4.3 A trust, consortium or joint venture (including unincorporated consortia and joint ventures) must submit a consolidated B-BBEE Status Level verification certificate for every separate bid.

4.4 Tertiary Institutions and Public Entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.

4.5 A person will not be awarded points for B-BBEE status level if it is indicated in the bid documents that such a bidder intends sub-contracting more than 25% of the value of the contract to any other enterprise that does not qualify for at least the points that such a bidder qualifies for, unless the intended sub-contractor is an EME that has the capability and ability to execute the sub-contract.

4.6 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.

4.7 Bidders are to note that the rules pertaining to B-BBEE verification and other B-BBEE requirements may be changed from time to time by regulatory bodies such as National Treasury or the DTI. It is the Bidder's responsibility to ensure that his/her bid complies fully with all B-BBEE requirements at the time of the submission of the bid.

5. BID DECLARATION

5.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

6. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 6.1

6.1 B-BBEE Status Level of Contribution: . = ……(maximum of 20 points)

(Points claimed in respect of paragraph 6.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

7. SUB-CONTRACTING

7.1 Will any portion of the contract be sub-contracted?

(***Tick applicable box***)

YES		NO	

7.1.1 If yes, indicate:

i) What percentage of the contract will be subcontracted.....%
ii) The name of the sub-contractor.....
iii) The B-BBEE status level of the sub-contractor.....
iv) Whether the sub-contractor is an EME or QSE.
(Tick applicable box)

YES		NO	

8. DECLARATION WITH REGARD TO COMPANY/FIRM

8.1 Name of company/firm:.....

8.2 VAT registration number:.....

8.3 Company registration number:.....

8.4 TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One person business/sole propriety
- ☐ Close corporation
- ☐ Company
- ☐ (Pty) Limited

[TICK APPLICABLE BOX]

8.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

.....
.....
.....

8.6 COMPANY CLASSIFICATION

- ☐ Manufacturer
- ☐ Supplier
- ☐ Professional Service provider
- ☐ Other Service providers, e.g. transporter, etc.

[*TICK APPLICABLE BOX*]

8.7 Total number of years the company/firm has been in business:.....

8.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contribution indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

i) The information furnished is true and correct;

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraph 1.4 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;

iv) If a bidder submitted false information regarding its B-BBEE status level of contributor,, which will affect or has affected the evaluation of a bid, or where a bidder has failed to declare any subcontracting arrangements or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have

(a) disqualify the person from the bidding process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) if the successful bidder subcontracted a portion of the bid to another person without disclosing it, Transnet reserves the right to penalise the bidder up to 10 percent of the value of the contract;

(e) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the audi alteram partem (hear the other side) rule has been applied; and

(f) forward the matter for criminal prosecution.

WITNESSES 1. …… 2	…… SIGNATURE(S) OF BIDDERS(S) DATE: ……

BIDDER'S DISCLOSURE

1. PURPOSE OF THE FORM

Any person (natural or juristic) may make an offer or offers in terms of this invitation to bid. In line with the principles of transparency, accountability, impartiality, and ethics as enshrined in the Constitution of the Republic of South Africa and further expressed in various pieces of legislation, it is required for the bidder to make this declaration in respect of the details required hereunder.

Where a person/s are listed in the Register for Tender Defaulters and / or the List of Restricted Suppliers, that person will automatically be disqualified from the bid process.

2. Bidder's declaration

2.1 Is the bidder, or any of its directors / trustees / shareholders / members / partners or any

person having a controlling interest1 in the enterprise,

employed by the state? **YES/NO**

2.1.1 If so, furnish particulars of the names, individual identity numbers, and, if applicable, state employee numbers of sole proprietor/ directors / trustees / shareholders / members/ partners or any person having a controlling interest in the enterprise, in table below.

Full Name	**Identity Number**	**Name of State institution**

2.2 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution? **YES/NO**

2.2.1 If so, furnish particulars:

.....

.....

2.3 Does the bidder or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest in the enterprise have any interest in any other related enterprise whether or not they are bidding for this contract?
YES/NO

2.3.1 If so, furnish particulars:
.....

1 the power, by one person or a group of persons holding the majority of the equity of an enterprise, alternatively, the person/s having the deciding vote or power to influence or to direct the course and decisions of the enterprise.

3 DECLARATION

I, the undersigned, (name)……. in submitting the accompanying bid, do hereby make the following statements that I certify to be true and complete in every respect:

3.1 I have read and I understand the contents of this disclosure;

3.2 I understand that the accompanying bid will be disqualified if this disclosure is found not to be true and complete in every respect;

3.3 The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium2 will not be construed as collusive bidding.

3.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications, prices, including methods, factors or formulas used to calculate prices, market allocation, the intention or decision to submit or not to submit the bid, bidding with the intention not to win the bid and conditions or delivery particulars of the products or services to which this bid invitation relates.

3.4 The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

3.5 There have been no consultations, communications, agreements or arrangements made by the bidder with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification on the bid submitted where so required by the institution; and the bidder was not involved in the drafting of the specifications or terms of reference for this bid.

3.6 I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

I CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 1, 2 and 3 ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF

2 Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

PARAGRAPH 6 OF PFMA SCM INSTRUCTION 03 OF 2021/22 ON PREVENTING AND COMBATING ABUSE IN THE SUPPLY CHAIN MANAGEMENT SYSTEM SHOULD THIS DECLARATION PROVE TO BE FALSE.

…… ……

Signature Date

…… ……

Position Name of bidder

T2.2-17 NON-DISCLOSURE AGREEMENT

Note to tenderers: This Non-Disclosure Agreement is to be completed and signed by an authorised signatory:

THIS AGREEMENT is made effective as of ..... day of ..... 20..... by and between:

TRANSNET SOC LTD

(Registration No. 1990/000900/30), a company incorporated and existing under the laws of South Africa, having its principal place of business at Transnet Corporate Centre 138 Eloff Street , Braamfontein , Johannesburg 2000

and

.....

(Registration No. .....),a private company incorporated and existing under the laws of South Africa having its principal place of business at

.....

.....

WHEREAS

Transnet and the Company wish to exchange Information [as defined below] and it is envisaged that each party may from time to time receive Information relating to the other in respect thereof. In consideration of each party making available to the other such Information, the parties jointly agree

that any dealings between them shall be subject to the terms and conditions of this Agreement which themselves will be subject to the parameters of the Tender Document.

IT IS HEREBY AGREED

IT IS HEREBY AGREED

1. INTERPRETATION

In this Agreement:

1.1 **Agents** mean directors, officers, employees, agents, professional advisers, contractors or sub-contractors, or any Group member;

1.2 **Bid** or **Bid Document** (hereinafter Tender) means Transnet's Request for Information [**RFI**] Request for Proposal [**RFP**] or Request for Quotation [**RFQ**], as the case may be;

1.3 **Confidential Information** means any information or other data relating to one party [the **Disclosing Party**] and/or the business carried on or proposed or intended to be carried on by that party and which is made available for the purposes of the Bid to the other party [the **Receiving Party**] or its Agents by the Disclosing Party or its Agents or recorded in agreed minutes following oral disclosure and any other information otherwise made available by the Disclosing Party or its Agents to the Receiving Party or its Agents, whether before, on or after the date of this Agreement, and whether in writing or otherwise, including any information, analysis or specifications derived from, containing or reflecting such information but excluding information which:

1.3.1 *is publicly available at the time of its disclosure or becomes publicly available [other than as a result of disclosure by the Receiving Party or any of its Agents contrary to the terms of this Agreement]; or*

1.3.2 *was lawfully in the possession of the Receiving Party or its Agents [as can be demonstrated by its written records or other reasonable evidence] free of any restriction as to its use or disclosure prior to its being so disclosed; or*

1.3.3 *following such disclosure, becomes available to the Receiving Party or its Agents [as can be demonstrated by its written records or other reasonable evidence] from a source other than the Disclosing Party or its Agents, which source is not bound by any duty of confidentiality owed, directly or indirectly, to the Disclosing Party in relation to such information;*

1.4 **Group** means any subsidiary, any holding company and any subsidiary of any holding company of either party; and

1.5 **Information** means all information in whatever form including, without limitation, any information relating to systems, operations, plans, intentions, market opportunities, know-how, trade secrets and business affairs whether in writing, conveyed orally or by machine-readable medium.

2. CONFIDENTIAL INFORMATION

2.1 All Confidential Information given by one party to this Agreement [the **Disclosing Party**] to the other party [the **Receiving Party**] will be treated by the Receiving Party as secret and confidential and will not, without the Disclosing Party's written consent, directly or indirectly communicate or disclose [whether in writing or orally or in any other manner] Confidential Information to any other person other than in accordance with the terms of this Agreement.

2.2 The Receiving Party will only use the Confidential Information for the sole purpose of technical and commercial discussions between the parties in relation to the Tender or for the subsequent performance of any contract between the parties in relation to the Tender.

2.3 Notwithstanding clause above, the Receiving Party may disclose Confidential Information:

2.3.1 *to those of its Agents who strictly need to know the Confidential Information for the sole purpose set out in clause above, provided that the Receiving Party shall ensure that such Agents are made aware prior to the disclosure of any part of the Confidential Information that the same is confidential and that they owe a duty of confidence to the Disclosing Party. The Receiving Party shall at all times remain liable for any actions of such Agents that would constitute a breach of this Agreement; or*

2.3.2 *to the extent required by law or the rules of any applicable regulatory authority, subject to clause, below.*

2.4 In the event that the Receiving Party is required to disclose any Confidential Information in accordance with clause, above, it shall promptly notify the Disclosing Party and cooperate with the Disclosing Party regarding the form, nature, content and purpose of such disclosure or any action which the Disclosing Party may reasonably take to challenge the validity of such requirement.

2.5 In the event that any Confidential Information shall be copied, disclosed or used otherwise than as permitted under this Agreement then, upon becoming aware of the same, without prejudice to any rights or remedies of the Disclosing Party, the Receiving Party shall as soon as practicable notify the Disclosing Party of such event and if requested take such steps [including the institution of legal proceedings] as shall be necessary to remedy [if capable of remedy] the default and/or to prevent further unauthorised copying, disclosure or use.

2.6 All Confidential Information shall remain the property of the Disclosing Party and its disclosure shall not confer on the Receiving Party any rights, including intellectual property rights over the Confidential Information whatsoever, beyond those contained in this Agreement.

3. RECORDS AND RETURN OF INFORMATION

3.1 The Receiving Party agrees to ensure proper and secure storage of all Information and any copies thereof.

3.2 The Receiving Party shall keep a written record, to be supplied to the Disclosing Party upon request, of the Confidential Information provided and any copies made thereof and, so far as is reasonably practicable, of the location of such Confidential Information and any copies thereof.

3.3 The Company shall, within 7 [seven] days of receipt of a written demand from Transnet:

3.3.1 *return all written Confidential Information [including all copies]; and*

3.3.2 *expunge or destroy any Confidential Information from any computer, word processor or other device whatsoever into which it was copied, read or programmed by the Company or on its behalf.*

3.4 The Company shall on request supply a certificate signed by a director as to its full compliance with the requirements of clause 3.3.2 above.

4. ANNOUNCEMENTS

4.1 Neither party will make or permit to be made any announcement or disclosure of its prospective interest in the Tender without the prior written consent of the other party.

4.2 Neither party shall make use of the other party's name or any information acquired through its dealings with the other party for publicity or marketing purposes without the prior written consent of the other party.

5. DURATION

The obligations of each party and its Agents under this Agreement shall survive the termination of any discussions or negotiations between the parties regarding the Tender and continue thereafter for a period of 5 [five] years.

6. PRINCIPAL

Each party confirms that it is acting as principal and not as nominee, agent or broker for any other person and that it will be responsible for any costs incurred by it or its advisers in considering or pursuing the Tender and in complying with the terms of this Agreement.

7. ADEQUACY OF DAMAGES

Nothing contained in this Agreement shall be construed as prohibiting the Disclosing Party from pursuing any other remedies available to it, either at law or in equity, for any such threatened or actual breach of this Agreement, including specific performance, recovery of damages or otherwise.

8. PRIVACY AND DATA PROTECTION

8.1 The Receiving Party undertakes to comply with South Africa's general privacy protection in terms Section 14 of the Bill of Rights in connection with this Tender and shall procure that its personnel shall observe the provisions of such Act [as applicable] or any amendments and re-enactments thereof and any regulations made pursuant thereto.

8.2 The Receiving Party warrants that it and its Agents have the appropriate technical and organisational measures in place against unauthorised or unlawful processing of data relating to the Tender and against accidental loss or destruction of, or damage to such data held or processed by them.

9. GENERAL

9.1 Neither party may assign the benefit of this Agreement, or any interest hereunder, except with the prior written consent of the other, save that Transnet may assign this Agreement at any time to any member of the Transnet Group.

9.2 No failure or delay in exercising any right, power or privilege under this Agreement will operate as a waiver of it, nor will any single or partial exercise of it preclude any further exercise or the exercise of any right, power or privilege under this Agreement or otherwise.

9.3 The provisions of this Agreement shall be severable in the event that any of its provisions are held by a court of competent jurisdiction or other applicable authority to be invalid, void or otherwise unenforceable, and the remaining provisions shall remain enforceable to the fullest extent permitted by law.

9.4 This Agreement may only be modified by a written agreement duly signed by persons authorised on behalf of each party.

9.5 Nothing in this Agreement shall constitute the creation of a partnership, joint venture or agency between the parties.

9.6 This Agreement will be governed by and construed in accordance with South African law and the parties irrevocably submit to the exclusive jurisdiction of the South African courts.

Signed		Date	
Name		Position	
Tenderer			

T2.2-18: RFQ DECLARATION FORM

NAME OF COMPANY: _____

We _____ do hereby certify that:

1. Transnet has supplied and we have received appropriate tender offers to any/all questions (as applicable) which were submitted by ourselves for tender clarification purposes;
2. we have received all information we deemed necessary for the completion of this Tender;
3. at no stage have we received additional information relating to the subject matter of this tender from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the tender documents;
4. we are satisfied, insofar as our company is concerned, that the processes and procedures adopted by Transnet in issuing this tender and the requirements requested from tenderers in responding to this tender have been conducted in a fair and transparent manner; and
5. furthermore, we acknowledge that a direct relationship exists between a family member and/or an owner / member / director / partner / shareholder (unlisted companies) of our company and an employee or board member of the Transnet Group as indicated below: *[Respondent to indicate if this section is not applicable]*

   FULL NAME OF OWNER/MEMBER/DIRECTOR/

   PARTNER/SHAREHOLDER: ADDRESS:

   _____

   _____

   _____

Indicate nature of relationship with Transnet:

_____

_____

_____

_____

[Failure to furnish complete and accurate information in this regard may lead to the disqualification of your response and may preclude a Respondent from doing future business with Transnet]

We declare, to the extent that we are aware or become aware of any relationship between ourselves and Transnet (other than any existing and appropriate business relationship with Transnet) which could unfairly advantage our company in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

6. We accept that any dispute pertaining to this tender will be resolved through the Ombudsman process and will be subject to the Terms of Reference of the Ombudsman. The Ombudsman process must first be exhausted before judicial review of a decision is sought. (Refer "Important Notice to respondents" below).

7. We further accept that Transnet reserves the right to reverse a tender award or decision based on the recommendations of the Ombudsman without having to follow a formal court process to have such award or decision set aside.

8. We have acquainted ourselves and agree with the content of T2.2-20 "Service Provider Integrity Pact".

For and on behalf of …… duly authorised thereto
Name:
Signature:
Date:

IMPORTANT NOTICE TO TENDERERS

- Transnet has appointed a Procurement Ombudsman to investigate any material complaint in respect of tenders exceeding R5,000,000.00 (five million S.A. Rand) in value. Should a Tenderer

have any material concern regarding an tender process which meets this value threshold, a complaint may be lodged with Transnet's Procurement Ombudsman for further investigation.

- It is incumbent on the Tenderer to familiarise himself/herself with the Terms of Reference for the Transnet Procurement Ombudsman, details of which are available for review at Transnet's website www.transnet.net.
- An official complaint form may be downloaded from this website and submitted, together with any supporting documentation, within the prescribed period, to procurement.ombud@transnet.net
- For transactions below the R5,000,000.00 (five million S.A. Rand) threshold, a complaint may be lodged with the Chief Procurement Officer of the relevant Transnet Operating Division.

All Tenderers should note that a complaint must be made in good faith. If a complaint is made in bad faith, Transnet reserves the right to place such a tenderer on its List of Excluded Bidder

T2.2-19: REQUEST FOR QUOTATION – BREACH OF LAW

NAME OF COMPANY: _____

We _____ do hereby certify that:

1. Transnet has supplied and we have received appropriate tender offers to any/all questions (as applicable) which were submitted by ourselves for tender clarification purposes;
2. we have received all information we deemed necessary for the completion of this Tender;
3. at no stage have we received additional information relating to the subject matter of this tender from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the tender documents;
4. we are satisfied, insofar as our company is concerned, that the processes and procedures adopted by Transnet in issuing this tender and the requirements requested from tenderers in responding to this tender have been conducted in a fair and transparent manner; and
5. furthermore, we acknowledge that a direct relationship exists between a family member and/or an owner / member / director / partner / shareholder (unlisted companies) of our company and an employee or board member of the Transnet Group as indicated below: *[Respondent to indicate if this section is not applicable]*

   FULL NAME OF OWNER/MEMBER/DIRECTOR/

PARTNER/SHAREHOLDER: ADDRESS:

_____

_____

_____

Indicate nature of relationship with Transnet:

_____

_____

_____

_____

[Failure to furnish complete and accurate information in this regard may lead to the disqualification of your response and may preclude a Respondent from doing future business with Transnet]

We declare, to the extent that we are aware or become aware of any relationship between ourselves and Transnet (other than any existing and appropriate business relationship withTransnet) which could unfairly advantage our company in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

ii. We accept that any dispute pertaining to this tender will be resolved through the Ombudsman process and will be subject to the Terms of Reference of the Ombudsman. The Ombudsman process must first be exhausted before judicial review of a decision is sought. (Refer "Important Notice to respondents" below).

iii. We further accept that Transnet reserves the right to reverse a tender award or decision based on the recommendations of the Ombudsman without having to follow a formal court process to have such award or decision set aside.

iv. We have acquainted ourselves and agree with the content of T2.2-20 "Service Provider Integrity Pact".

For and on behalf of …… duly authorised thereto
Name:
Signature:
Date:

IMPORTANT NOTICE TO TENDERERS

- Transnet has appointed a Procurement Ombudsman to investigate any material complaint in respect of tenders exceeding R5,000,000.00 (five million S.A. Rand) in value. Should a Tenderer have any material concern regarding an tender process which meets this value threshold, a complaint may be lodged with Transnet's Procurement Ombudsman for further investigation.
- It is incumbent on the Tenderer to familiarise himself/herself with the Terms of Reference for the Transnet Procurement Ombudsman, details of which are available for review at Transnet's website www.transnet.net.
- An official complaint form may be downloaded from this website and submitted, together with any supporting documentation, within the prescribed period, to procurement.ombud@transnet.net
- For transactions below the R5,000,000.00 (five million S.A. Rand) threshold, a complaint may be lodged with the Chief Procurement Officer of the relevant Transnet Operating Division.

All Tenderers should note that a complaint must be made in good faith. If a complaint is made in bad faith, Transnet reserves the right to place such a tenderer on its List of Excluded Bidder

T2.2-20 Certificate of Acquaintance with Tender Documents

NAME OF TENDERING ENTITY:

_____

1. By signing this certificate I/we acknowledge that I/we have made myself/ourselves thoroughly familiar with, and agree with all the conditions governing this RFQ. This includes those terms and conditions of the Contract, the Supplier Integrity Pact, Non-Disclosure Agreement etc. contained in any printed form stated to form part of the documents thereof, but not limited to those listed in this clause.
2. I/we furthermore agree that Transnet SOC Ltd shall recognise no claim from me/us for relief based on an allegation that I/we overlooked any tender/contract condition or failed to take it into account for the purpose of calculating my/our offered prices or otherwise.
3. I/we understand that the accompanying Tender will be disqualified if this Certificate is found not to be true and complete in every respect.
4. For the purposes of this Certificate and the accompanying Tender, I/we understand that the word "competitor" shall include any individual or organisation, other than the Tenderer, whether or not affiliated with the Tenderer, who:

a) has been requested to submit a Tender in response to this Tender invitation;

b) could potentially submit a Tender in response to this Tender invitation, based on their qualifications, abilities or experience; and

c) provides the same Services as the Tenderer and/or is in the same line of business as the Tenderer

5. The Tenderer has arrived at the accompanying Tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium will not be construed as collusive Tendering.

6. In particular, without limiting the generality of paragraph 5 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

a) prices;

b) geographical area where Services will be rendered [market allocation]

c) methods, factors or formulas used to calculate prices;

d) the intention or decision to submit or not to submit, a Tender;

e) the submission of a tender which does not meet the specifications and conditions of the tender; or

f) Tendering with the intention not winning the tender.

7. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the Services to which this tender relates.

8. The terms of the accompanying tender have not been, and will not be, disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official tender opening or of the awarding of the contract.

9. I/We am/are aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to tenders and contracts, tenders that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and/or may be reported to the National Prosecuting Authority [NPA] for criminal investigation. In addition, Tenderers that submit suspicious tenders may be restricted from conducting business with the public sector for a period not exceeding 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

Signed on this _____ day of _____20___

_____

SIGNATURE OF TENDERER

T2.2-21 Service Provider Integrity Pact

Important Note: All potential tenderers must read this document and certify in the RFQ Declaration Form that that have acquainted themselves with and agree with the content.

The contract with the successful tenderer will automatically incorporate this Integrity Pact and shall be deemed as part of the final concluded contract.

INTEGRITY PACT

Between

TRANSNET SOC LTD

Registration Number: 1990/000900/30

("Transnet")

and

The Contractor (hereinafter referred to as the "Tenderer/Service Providers/Contractor")

PREAMBLE

Transnet values full compliance with all relevant laws and regulations, ethical standards and the principles of economical use of resources, fairness and transparency in its relations with its Tenderers / Service Providers/Contractors.

In order to achieve these goals, Transnet and the Tenderer / Service Provider hereby enter into this agreement hereinafter referred to as the "Integrity Pact" which will form part of the Tenderer's / Service Provider's / Contractor's application for registration with Transnet as a vendor.

The general purpose of this Integrity Pact is to agree on avoiding all forms of dishonesty, fraud and corruption by following a system that is fair, transparent and free from any undue influence prior to, during and subsequent to the currency of any procurement and / or reverse logistics event and any further contract to be entered into between the Parties, relating to such event.

All Tenderers / Service Providers / Contractor's will be required to sign and comply with undertakings contained in this Integrity Pact, should they want to be registered as a Transnet vendor.

1 OBJECTIVES

1.1 Transnet and the Tenderer / Service Provider / Contractor agree to enter into this Integrity Pact, to avoid all forms of dishonesty, fraud and corruption including practices that are anti-competitive in nature, negotiations made in bad faith and under-pricing by following a system that is fair, transparent and free from any influence / unprejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:

a) Enable Transnet to obtain the desired contract at a reasonable and competitive price in conformity to the defined specifications of the works, goods and services; and

b) Enable Tenderers / Service Providers / Contractors to abstain from bribing or participating in any corrupt practice in order to secure the contract.

2 COMMITMENTS OF TRANSNET

Transnet commits to take all measures necessary to prevent dishonesty, fraud and corruption and to observe the following principles:

2.1 Transnet hereby undertakes that no employee of Transnet connected directly or indirectly with the sourcing event and ensuing contract, will demand, take a promise for or accept directly or through intermediaries any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Tenderer, either for themselves or for any person, organisation or third party related to the contract in exchange for an advantage in the tendering process, Tender evaluation, contracting or implementation process related to any contract.

2.2 Transnet will, during the registration and tendering process treat all Tenderers / Service Providers with equity, transparency and fairness. Transnet will in particular, before and during the registration process, provide to all Tenderers / Service Providers the same information and will not provide to any Tenderers / Service Providers / Contractors confidential / additional information through which the Tenderers / Service Providers / Contractors could obtain an advantage in relation to any tendering process.

2.3 Transnet further confirms that its employees will not favour any prospective Tenderer in any form that could afford an undue advantage to a particular Tenderer during the tendering stage, and will further treat all Tenderers / Service Providers / Contractors participating in the tendering process.

2.4 Transnet will exclude from the tender process such employees who have any personal interest in the Tenderers / Service Providers / Contractors participating in the tendering process.

3 OBLIGATIONS OF THE TENDERER / SERVICE PROVIDER

3.1 Transnet has a '**Zero Gifts'** Policy. No employee is allowed to accept gifts, favours or benefits.

a) Transnet officials and employees **shall not** solicit, give or accept, or from agreeing to solicit, give, accept or receive directly or indirectly, any gift, gratuity, favour, entertainment, loan, or anything of monetary value, from any person or juridical entities in the course of official duties or in connection with any operation being managed by, or any transaction which may be affected by the functions of their office.

b) Transnet officials and employees **shall not** solicit or accept gifts of any kind, from vendors, suppliers, customers, potential employees, potential vendors, and suppliers, or any other individual or organisation irrespective of the value.

c) Under **no circumstances** should gifts, business courtesies or hospitality packages be accepted from or given to prospective suppliers participating in a tender process at the respective employee's Operating Division, regardless of retail value.

d) Gratuities, bribes or kickbacks of any kind must never be solicited, accepted or offered, either directly or indirectly. This includes money, loans, equity, special privileges, personal favours, benefit or services. Such favours will be considered to constitute corruption.

3.2 The Tenderer / Service Provider / Contractor commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its

Tender or during any ensuing contract stage in order to secure the contract or in furtherance to secure it and in particular the Tenderer / Service Provider / Contractor commits to the following:

a) The Tenderer / Service Provider / Contractor will not, directly or through any other person or firm, offer, promise or give to Transnet or to any of Transnet's employees involved in the tendering process or to any third person any material or other benefit or payment, in order to obtain in exchange an advantage during the tendering process; and

b) The Tenderer / Service Provider / Contractor will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any employee of Transnet, connected directly or indirectly with the tendering process, or to any person, organisation or third party related to the contract in exchange for any advantage in the tendering, evaluation, contracting and implementation of the contract.

3.3 The Tenderer/Service Provider/Contractor will not collude with other parties interested in the contract to preclude a competitive Tender price, impair the transparency, fairness and progress of the tendering process, Tender evaluation, contracting and implementation of the contract. The Tenderer / Service Provider further commits itself to delivering against all agreed upon conditions as stipulated within the contract.

3.4 The Tenderer/Service Provider/Contractor will not enter into any illegal or dishonest agreement or understanding, whether formal or informal with other Tenderers/Service Providers/Contractors. This applies in particular to certifications, submissions or non-submission of documents or actions that are restrictive or to introduce cartels into the tendering process.

3.5 The Tenderer/Service Provider/Contractor will not commit any criminal offence under the relevant anti-corruption laws of South Africa or any other country. Furthermore, the Tenderer/Service Provider/Contractor will not use for illegitimate purposes or for restrictive purposes or personal gain, or pass on to others, any information provided by Transnet as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

3.6 A Tenderer/Service Provider/Contractor of foreign origin shall disclose the name and address of its agents or representatives in South Africa, if any, involved directly or indirectly in the registration or tendering process. Similarly, the Tenderer / Service

Provider / Contractor of South African nationality shall furnish the name and address of the foreign principals, if any, involved directly or indirectly in the registration or tendering process.

3.7 The Tenderer/Service Provider/Contractor will not misrepresent facts or furnish false or forged documents or information in order to influence the tendering process to the advantage of the Tenderer/Service Provider/Contractor or detriment of Transnet or other competitors.

3.8 Transnet may require the Tenderer/Service Provider/Contractor to furnish Transnet with a copy of its code of conduct. Such code of conduct must address the compliance programme for the implementation of the code of conduct and reject the use of bribes and other dishonest and unethical conduct.

3.9 The Tenderer/Service Provider/Contractor will not instigate third persons to commit offences outlined above or be an accessory to such offences.

3.10 The Tenderer/Service Provider/Contractor confirms that they will uphold the ten principles of the United Nations Global Compact (UNGC) in the fields of Human Rights, Labour, Anti-Corruption and the Environment when undertaking business with Transnet as follows:

a) Human Rights

- Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights; and
- Principle 2: make sure that they are not complicit in human rights abuses.

b) Labour

- Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- Principle 4: the elimination of all forms of forced and compulsory labour;
- Principle 5: the effective abolition of child labour; and
- Principle 6: the elimination of discrimination in respect of employment and occupation.

c) Environment

- Principle 7: Businesses should support a precautionary approach to environmental challenges;
- Principle 8: undertake initiatives to promote greater environmental responsibility; and

• Principle 9: encourage the development and diffusion of environmentally friendly technologies.

d) Anti-Corruption

• Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

4 INDEPENDENT TENDERING

4.1 For the purposes of that Certificate in relation to any submitted Tender, the Tenderer declares to fully understand that the word "competitor" shall include any individual or organisation, other than the Tenderer, whether or not affiliated with the Tenderer, who:

a) has been requested to submit a Tender in response to this Tender invitation;
b) could potentially submit a Tender in response to this Tender invitation, based on their qualifications, abilities or experience; and
c) provides the same Goods and Services as the Tenderer and/or is in the same line of business as the Tenderer.

4.2 The Tenderer has arrived at his submitted Tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium will not be construed as collusive tendering.

4.3 In particular, without limiting the generality of paragraph 5 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

a) prices;
b) geographical area where Goods or Services will be rendered [market allocation];
c) methods, factors or formulas used to calculate prices;
d) the intention or decision to submit or not to submit, a Tender;
e) the submission of a Tender which does not meet the specifications and conditions of the RFP; or
f) tendering with the intention of not winning the Tender.

4.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the Goods or Services to which his/her tender relates.

4.5 The terms of the Tender as submitted have not been, and will not be, disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official Tender opening or of the awarding of the contract.

4.6 Tenderers are aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to Tenders and contracts, Tenders that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and/or may be reported to the National Prosecuting Authority [**NPA**] for criminal

investigation and/or may be restricted from conducting business with the public sector for a period not exceeding 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

4.7 Should the Tenderer find any terms or conditions stipulated in any of the relevant documents quoted in the Tender unacceptable, it should indicate which conditions are unacceptable and offer alternatives by written submission on its company letterhead, attached to its submitted Tender. Any such submission shall be subject to review by Transnet's Legal Counsel who shall determine whether the proposed alternative(s) are acceptable or otherwise, as the case may be.

5 DISQUALIFICATIONS FROM TENDERING PROCESS

5.1 If the Tenderer / Service Provider / Contractor has committed a transgression through a violation of section 3 of this Integrity Pact or in any other form such as to put its reliability or credibility as a Tenderer / Service Provider into question, Transnet may reject the Tenderer's / Service Provider's / Contractor's application from the registration or tendering process and remove the Tenderer / Service Provider from its database, if already registered.

5.2 If the Tenderer / Service Provider / Contractor has committed a transgression through a violation of section 3, or any material violation, such as to put its reliability or credibility into question. Transnet may after following due procedures and at its own discretion also exclude the Tenderer / Service Provider / Contractor from future tendering processes. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be determined by the circumstances of the case, which will include amongst others the number of transgressions, the position of the transgressors within the company hierarchy of the Tenderer / Service Provider /Contractor and the amount of the damage. The exclusion will be imposed for up to a maximum of 10 (ten) years. However, Transnet reserves the right to impose a longer period of exclusion, depending on the gravity of the misconduct.

5.3 If the Tenderer / Service Provider / Contractor can prove that it has restored the damage caused by it and has installed a suitable corruption prevention system, or taken other remedial measures as the circumstances of the case may require, Transnet may at its own discretion revoke the exclusion or suspend the imposed penalty.

6 TRANSNET'S LIST OF EXCLUDED TENDERERS (BLACKLIST)

6.1 The process of restriction is used to exclude a company/person from conducting future business with Transnet and other organs of state for a specified period. No Tender shall be awarded to a Tenderer whose name (or any of its members, directors, partners or trustees) appear on the Register of Tender Defaulters kept by National Treasury, or who have been placed on National Treasury's List of Restricted Suppliers. Transnet reserves the right to withdraw an award, or cancel a contract concluded with a Tenderer should it be established, at any time, that a tenderer has been restricted with National Treasury by another government institution.

6.2 All the stipulations around Transnet's blacklisting process as laid down in Transnet's Supply Chain Policy and Procurement Procedures Manual (CPM included) are included herein by way of reference. Below follows a condensed summary of this blacklisting procedure.

6.3 On completion of the restriction procedure, Transnet will submit the restricted entity's details (including the identity number of the individuals and registration number of the entity) to National Treasury for placement on National Treasury's Database of Restricted Suppliers for the specified period of exclusion. National Treasury will make the final decision on whether to restrict an entity from doing business with any organ of state for a period not exceeding 10 years and place the entity concerned on the Database of Restricted Suppliers published on its official website.

6.4 The decision to restrict is based on one of the grounds for restriction. The standard of proof to commence the restriction process is whether a "*prima facie*" (i.e. on the face of it) case has been established.

6.5 Depending on the seriousness of the misconduct and the strategic importance of the Goods/Services, in addition to restricting a company/person from future business, Transnet may decide to terminate some or all existing contracts with the company/person as well.

6.6 A Service Provider or Contractor to Transnet may not subcontract any portion of the contract to a blacklisted company.

6.7 Grounds for blacklisting include: If any person/Enterprise which has submitted a Tender, concluded a contract, or, in the capacity of agent or subcontractor, has been associated with such Tender or contract:

a) Has, in bad faith, withdrawn such Tender after the advertised closing date and time for the receipt of Tenders;
b) has, after being notified of the acceptance of his Tender, failed or refused to sign a contract when called upon to do so in terms of any condition forming part of the Tender documents;
c) has carried out any contract resulting from such Tender in an unsatisfactory manner or has breached any condition of the contract;
d) has offered, promised or given a bribe in relation to the obtaining or execution of the contract;
e) has acted in a fraudulent or improper manner or in bad faith towards Transnet or any Government Department or towards any public body, Enterprise or person;
f) has made any incorrect statement in a certificate or other communication with regard to the Local Content of his Goods or his B-BBEE status and is unable to prove to the satisfaction of Transnet that:

(i) he made the statement in good faith honestly believing it to be correct; and

(ii) before making such statement he took all reasonable steps to satisfy himself of its correctness;

g) caused Transnet damage, or to incur costs in order to meet the contractor's requirements and which could not be recovered from the contractor;

h) has litigated against Transnet in bad faith.

6.8 Grounds for blacklisting include a company/person recorded as being a company or person prohibited from doing business with the public sector on National Treasury's database of Restricted Service Providers or Register of Tender Defaulters.

6.9 Companies associated with the person/s guilty of misconduct (i.e. entities owned, controlled or managed by such persons), any companies subsequently formed by the person(s) guilty of the misconduct and/or an existing company where such person(s) acquires a controlling stake may be considered for blacklisting. The decision to extend the blacklist to associated companies will be at the sole discretion of Transnet.

7 PREVIOUS TRANSGRESSIONS

7.1 The Tenderer / Service Provider /Contractor hereby declares that no previous transgressions resulting in a serious breach of any law, including but not limited to, corruption, fraud, theft, extortion and contraventions of the Competition Act 89 of 1998, which occurred in the last 5 (five) years with any other public sector undertaking, government department or private sector company that could justify its exclusion from its registration on the Tenderer's / Service Provider's / Contractor's database or any tendering process.

7.2 If it is found to be that the Tenderer / Service Provider /Contractor made an incorrect statement on this subject, the Tenderer / Service Provider / Contractor can be rejected from the registration process or removed from the Tenderer / Service Provider / Contractor database, if already registered, for such reason (refer to the Breach of Law Form contained in the applicable RFX document.)

8 SANCTIONS FOR VIOLATIONS

8.1 Transnet shall also take all or any one of the following actions, wherever required to:

a) Immediately exclude the Tenderer / Service Provider / Contractor from the tendering process or call off the pre-contract negotiations without giving any compensation the Tenderer / Service Provider / Contractor. However, the proceedings with the other Tenderer / Service Provider / Contractor may continue;

b) Immediately cancel the contract, if already awarded or signed, without giving any compensation to the Tenderer / Service Provider / Contractor;
c) Recover all sums already paid by Transnet;
d) Encash the advance bank guarantee and performance bond or warranty bond, if furnished by the Tenderer / Service Provider / Contractor, in order to recover the payments, already made by Transnet, along with interest;
e) Cancel all or any other contracts with the Tenderer / Service Provider; and
f) Exclude the Tenderer / Service Provider / Contractor from entering into any Tender with Transnet in future.

9 CONFLICTS OF INTEREST

9.1 A conflict of interest includes, inter alia, a situation in which:
a) A Transnet employee has a personal financial interest in a tendering / supplying entity; and
b) A Transnet employee has private interests or personal considerations or has an affiliation or a relationship which affects, or may affect, or may be perceived to affect his / her judgment in action in the best interest of Transnet, or could affect the employee's motivations for acting in a particular manner, or which could result in, or be perceived as favouritism or nepotism.

9.2 A Transnet employee uses his / her position, or privileges or information obtained while acting in the capacity as an employee for:
a) Private gain or advancement; or
b) The expectation of private gain, or advancement, or any other advantage accruing to the employee must be declared in a prescribed form.

Thus, conflicts of interest of any Tender committee member or any person involved in the sourcing process must be declared in a prescribed form.

9.3 If a Tenderer / Service Provider / Contractor has or becomes aware of a conflict of interest i.e. a family, business and / or social relationship between its owner(s) / member(s) / director(s) / partner(s) / shareholder(s) and a Transnet employee / member of Transnet's Board of Directors in respect of a Tender which will be considered for the Tender process, the Tenderer / Service Provider / Contractor:
a) must disclose the interest and its general nature, in the Request for Proposal ("RFX") declaration form; or
b) must notify Transnet immediately in writing once the circumstances has arisen.

9.4 The Tenderer / Service Provider / Contractor shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any committee member or any person involved in the sourcing process, where this is done, Transnet shall be entitled forthwith to rescind the contract and all other contracts with the Tenderer / Service Provider / Contractor.

10 DISPUTE RESOLUTION

10.1 Transnet recognises that trust and good faith are pivotal to its relationship with its Tenderer / Service Provider / Contractor. When a dispute arises between Transnet and its Tenderer / Service Provider / Contractor, the parties should use their best endeavours to resolve the dispute in an amicable manner, whenever possible. Litigation in bad faith negates the principles of trust and good faith on which commercial relationships are based. Accordingly, following a blacklisting process as mentioned in paragraph 0 above, Transnet will not do business with a company that litigates against it in bad faith or is involved in any action that reflects bad faith on its part. Litigation in bad faith includes, but is not limited to the following instances:

a) **Vexatious proceedings**: these are frivolous proceedings which have been instituted without proper grounds;
b) **Perjury:** where a Tenderer / Service Provider / Contractor make a false statement either in giving evidence or on an affidavit;
c) **Scurrilous allegations:** where a Tenderer / Service Provider / Contractor makes allegations regarding a senior Transnet employee which are without proper foundation, scandalous, abusive or defamatory; and
d) **Abuse of court process:** when a Tenderer / Service Provider / Contractor abuses the court process in order to gain a competitive advantage during a Tender process.

11 GENERAL

11.1 This Integrity Pact is governed by and interpreted in accordance with the laws of the Republic of South Africa.

11.2 The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the law relating to any civil or criminal proceedings.

11.3 The validity of this Integrity Pact shall cover all the tendering processes and will be valid for an indefinite period unless cancelled by either Party.

11.4 Should one or several provisions of this Integrity Pact turn out to be invalid the remainder of this Integrity Pact remains valid.

11.5 Should a Tenderer / Service Provider / Contractor be confronted with dishonest, fraudulent or corruptive behaviour of one or more Transnet employees, Transnet expects its Tenderer / Service Provider / Contractor to report this behaviour directly to a senior Transnet official / employee or alternatively by using Transnet's "Tip-Off Anonymous" hotline number 0800 003 056, whereby your confidentiality is guaranteed.

The Parties hereby declare that each of them has read and understood the clauses of this Integrity Pact and shall a Tenderer by it. To the best of the Parties' knowledge and belief, the information provided in this Integrity Pact is true and correct.

I …….. duly authorised by the tendering entity, hereby certify that the tendering entity are **fully acquainted** with the contents of the Integrity Pact and further **agree to abide by it** in full.

Signature ……

Date ……..

T2.2.22 PROTECTION OF PERSONAL INFORMATION (For normal contract)

1. The following terms shall bear the same meaning as contemplated in Section 1 of the Protection of Person information act, No.4 of 2013. ("POPIA"):

   consent; data subject; electronic communication; information officer; operator; person; personal information; processing; record; Regulator; responsible party; special information; as well as any terms derived from these terms.

2. Transnet will process all information by the Respondent in terms of the requirements contemplated in Section 4(1) of the POPIA:

Accountability; Processing limitation; Purpose specification; Further processing limitation; Information quality; Openness; Security safeguards and Data subject participation.

3. The Parties acknowledge and agree that, in relation to personal information that will be processed pursuant to this RFQ, the Responsible party is "Transnet" and the Data subject is the "Respondent". Transnet will process personal information only with the knowledge and authorisation of the Respondent and will treat personal information which comes to its knowledge as confidential and will not disclose it, unless so required by law or subject to the exceptions contained in the POPIA.
4. Transnet reserves all the rights afforded to it by the POPIA in the processing of any of its information as contained in this RFQ and the Respondent is required to comply with all prescripts as detailed in the POPIA relating to all information concerning Transnet.
5. In responding to this bid, Transnet acknowledges that it will obtain and have access to personal information of the Respondent. Transnet agrees that it shall only process the information disclosed by Respondent in their response to this bid for the purpose of evaluating and subsequent award of business and in accordance with any applicable law.
6. Transnet further agrees that in submitting any information or documentation requested in this RFQ, the Respondent is consenting to the further processing of their personal information for the purpose of, but not limited to, risk assessment, assurances, contract award, contract management, auditing, legal opinions/litigations, investigations (if applicable), document storage for the legislatively required period, destruction, de-identification and publishing of personal information by Transnet and/or its authorised appointed third parties.
7. Furthermore, Transnet will not otherwise modify, amend or alter any personal data submitted by the Respondent or disclose or permit the disclosure of any personal data to any third party without the prior written consent from the Respondent. Similarly, Transnet requires the Respondent to process any personal information disclosed by Transnet in the bidding process in the same manner.
8. Transnet shall, at all times, ensure compliance with any applicable laws put in place and maintain sufficient measures, policies and systems to manage and secure against all forms of risks to any information that may be shared or accessed pursuant to this RFQ (physically, through a computer or any other form of electronic communication).
9. Transnet shall notify the Respondent in writing of any unauthorised access to information, cybercrimes or suspected cybercrimes, in its knowledge and report such crimes or suspected crimes to the relevant authorities in accordance with applicable laws, after becoming aware of such crimes or suspected crime. The Respondent must take all necessary remedial steps to mitigate the extent of the loss or compromise of personal information and to restore the integrity of the affected personal information as quickly as is possible.

10. The Respondent may, in writing, request Transnet to confirm and/or make available any personal information in its possession in relation to the Respondent and if such personal information has been accessed by third parties and the identity thereof in terms of the POPIA. The Respondent may further request that Transnet correct (excluding critical/mandatory or evaluation information), delete, destroy, withdraw consent or object to the processing of any personal information relating to the Respondent in Transnet's possession in terms of the provision of the POPIA and utilizing Form 2 of the POPIA Regulations.
11. In submitting any information or documentation requested in this RFQ, the Respondent is hereby consenting to the processing of their personal information for the purpose of this RFQ and further confirming that they are aware of their rights in terms of Section 5 of POPIA.

Respondents are required to provide consent below:

YES		**NO**	

12. Further, the Respondent declares that they have obtained all consents pertaining to other data subject's personal information included in its submission and thereby indemnifying Transnet against any civil or criminal action, administrative fines or other penalty or loss that may arise as a result of the processing of any personal information that the Respondent submitted.
13. The Respondent declares that the personal information submitted for the purpose of this RFQ is complete, accurate, not misleading, is up to date and may be updated where applicable.

Signature of Respondent's authorised representative: _____

Should a Respondent have any complaints or objections to processing of its personal information, by Transnet, the Respondent can submit a complaint to the Information Regulator on https://www.justice.gov.za/inforeg/, click on contact us, click on complaints.IR@justice.gov.za

T2.2-23: Insurance provided by the *Contractor*

Clause 83.1 in NEC3 Term Service Contract (June 2005) (amended June 2006 and April 2013) requires that the *Contractor* provides the insurance stated in the insurance table except any insurance which the *Employer* is to provide as stated in the Contract Data.

Please provide the following details for insurance which the *Contractor* is still to provide. Notwithstanding this information all costs related to insurance are deemed included in the tenderer's rates and prices.

Insurance against (See clause 83.1 of the TSC)	**Name of Insurance Company**	**Cover**	**Premium**
Liability for death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract			
Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of R5 000 000			
Insurance in respect of loss of or damage to own property and equipment.			

T2.2-24: Three (3) years audited financial statements.

Attached to this schedule is the last three (3) years audited financial statements of the single tenderer/members of the Joint Venture.

NAME OF COMPANY/IES and INDEX OF ATTACHMENTS:

……

……

……

……

……

C1.1 Form of Offer & Acceptance

Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

FOR THE REFURBISHMENT OF 2 X 20MVA TRACTION TRANSFORMERS AT VARIOUS SUBSTATION ON THE NORTH CORRIDOR SHUTDOWN.

The tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Returnable Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Contractor* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

The *currency of this contract* is the South African Rand.

The offered total of the Prices exclusive of VAT is	**R**
Value Added Tax @ 15% is	**R**
The offered total of the Prices inclusive of VAT is	**R**
(in words)	

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Contractor* in the *conditions of contract* identified in the Contract Data.

Signature(s) .....

Name(s) .....

Capacity .....

For the tenderer: .....

Name & signature of witness .....

(Insert name and address of organisation)

Date .....

Tenderer's CIDB registration number: .....

Acceptance

By signing this part of this Form of Offer and Acceptance, the *Employer* identified below accepts the tenderer's Offer. In consideration thereof, the *Employer* shall pay the *Contractor* the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the *Employer* and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Scope of Work: Service Information
Part C4	Site Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any).

Unless the tenderer (now *Contractor*) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s)	.....	.....
Name(s)	.....	.....
Capacity	.....	.....
for the Employer	Transnet SOC Ltd	
	.....	.....
Name & signature of witness	*(Insert name and address of organisation)*	Date .....

Schedule of Deviations

Note:

1. To be completed by the Employer prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		
4		
5		
6		
7		

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

	For the tenderer:	**For the Employer**
Signature	.....	.....
Name	.....	.....
Capacity	.....	.....
On behalf of	*(Insert name and address of organisation)*	Transnet SOC Ltd
Name & signature of witness	.....	.....
Date	.....	.....

C1.2 Contract Data

Part one - Data provided by the *Employer*

Clause	Statement	Data
1	**General**	
	The *conditions of contract* are the core clauses and the clauses for main Option:	
		A: **Priced contract with price list**
	dispute resolution Option	**W1:** **Dispute resolution procedure**
		X2 **Changes in the law**
		Z: ***Additional conditions of contract***
	of the NEC3 Term Service Contract (June 2005) (and amended June 2006 and April 2013)	
10.1	**Transnet SOC Ltd**	**Transnet SOC Ltd** **Transnet Corporate Centre** **138 Eloff Street** **Braamfontein** **Johannesburg** **2000** **Transnet Freight Rail** **Supply Chain Services- Pretoria** **Nzasm Building** **Corner Minaar and Paul Kruger Street** **Pretoria** **0001** **012 315 2059** **012 315 2125**
	Transnet SOC Ltd	**Transnet SOC Ltd**
10.1	The *Service Manager* is (name):	**Natasha Zuma**
	Address	**Transnet Freight Rail** **Malahle House** **4 Kiewiet Street** **Empangeni** **3880**

	Tel	**035 906 7196/ 083 385 1940**
	e-mail	**natasha.zuma@transnet.net**
11.2(2)	The Affected Property is	**RBCT and Insese Substations**
11.2(13)	The *service* is	**Refurbishment of 2 x 20MVA traction transformers at various substation locations**
11.2(14)	The following matters will be included in the Risk Register	**Live high voltage equipment-Electrocution. Live high voltage cables-Electric shock. Oil spillage, Driving, transporting material, equipment and people on same vehicle, Loading and offloading of material, Use of Portable electrical tools & Strike action by residents of informal settlement**
11.2(15)	The Service Information is in	**The Scope of Services**
12.2	The *law of the contract* is the law of	**the Republic of South Africa subject to the jurisdiction of the Courts of South Africa.**
13.1	The *language of this contract* is	**English**
13.3	The *period for reply* is	**2 weeks**
2	**The *Contractor*'s main responsibilities**	(If the optional statement for this section is not used, no data will be required for this section)
21.1	The *Contractor* submits a first plan for acceptance within	**2 weeks of the Contract Date**
3	**Time**	
30.1	The *starting date* is.	**TBA**
30.1	The *service period* is	**Four weeks**
4	**Testing and defects**	**No additional data is required for this section of the *conditions of contract*.**
5	**Payment**	
50.1	The *assessment interval* is	**25th (twenty fifth) day of each successive month.**
51.1	The *currency of this contract* is the	**South African Rand.**
51.2	The period within which payments are made is	**Payment will be affected on or before the last day of the month following the month during which a valid Tax Invoice and Statement were received.**
51.4	The *interest rate* is	**The prime lending rate of the Standard Bank South Africa.**
6	**Compensation events**	**Not applicable**

7	**Use of Equipment Plant and Materials**	**No additional data is required for this section of the *conditions of contract*.**
8	**Risks and insurance**	
80.1	**These are additional *Employers* risks**	
83.1	The minimum limit of indemnity for insurance in respect of loss and damage to property (except goods, plant and materials and equipment) and liability for bodily injury or death of a person (not an employee of the *Service Provider)* caused by activity in connection with this contract for any one event is:	**Whatever *Contractor* deems necessary as the *Employer* is not carrying this indemnity.**
83.1	The minimum limit of indemnity for insurance in respect of death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract for any one event is:	**As prescribed by the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 and the *Contractor's* common law liability for people falling outside the scope of the Act.**
83.1	Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of R 5 000 000	
83.1	The *Contractor* liability to the *Employer* for indirect or consequential loss including loss of profit, revenue and goodwill, is limited to:	**The Total of the Prices.**
83.1	For any one event, the *Contractor* liability to the *Employer* for loss of or damage to the *Employers* property is limited to:	**The Total of the Prices.**
83.1	The *Contractor* total liability to the *Employer* for all matters arising under or in connection with this contract, other than the excluded matters, is limited to:	**The Total of the Prices.**
9	**Termination**	**There is no Contract Data required for this section of the *conditions of contract*.**
10	**Data for main Option clause**	
A	**Priced contract with price list**	
20.5	The *Contractor* prepares forecasts of the final total of the Prices for the whole of the *service* at intervals no longer than	**4 weeks.**

20.4	The *Contractor* prepares forecasts of the total Defined Cost for the whole of the *service* at intervals no longer than	**4 weeks.**
11	**Data for Option W1**	
W1.1	The *Adjudicator* is (Name)	**Both parties will agree as and when a dispute arises. If the parties cannot reach an agreement on the *Adjudicator*, the chairman of the Association of Arbitrators will appoint an *Adjudicator.***
W1.2(3)	The *Adjudicator nominating body* is: If no *Adjudicator nominating body* is entered, it is	**The Association of Arbitrators (Southern Africa)**
W1.4(2)	The *tribunal* is:	**Arbitration**
W1.4(5)	The *arbitration procedure* is	**The Rules for the Conduct of Arbitrations of the Association of Arbitrators (Southern Africa)**
	The place where arbitration is to be held is	**Gauteng, South Africa**
	The person or organisation who will choose an arbitrator - if the Parties cannot agree a choice or - if the arbitration procedure does not state who selects an arbitrator, is	**The Chairman of the Association of Arbitrators (Southern Africa)**
12	**Data for secondary Option clauses**	
X2	**Changes in the law**	**No additional data is required for this Option**
X18	**Limitation of liability**	
X18.1	The *Contractor*'s liability to the *Employer* for indirect or consequential loss is limited to	**Nil.**
X18.2	For any one event, the *Contractor*'s liability to the *Employer* for loss of or damage to the *Employer*'s property is limited to	**The deductible of the relevant insurance policy**
X18.3	The *Contractor*'s liability for Defects due to his design of an item of Equipment is limited to	**The cost of correcting the defect.**

X18.4	The *Contractor*'s total liability to the *Employer*, for all matters arising under or in connection with this contract, other than the excluded matters, is limited to	**Total of the Prices.**
X18.5	The *end of liability date* is	**1 year after the end of the service period.**

Z *Additional conditions of contract*

Z1 Obligations in respect of Termination

Z1.1		The following will be included under core clause 91.1: In the second main bullet, after the word 'partnership' add 'joint venture whether incorporated or otherwise (including any constituent of the joint venture)'; and Under the second main bullet, insert the following additional bullets after the last sub-bullet: • commenced business rescue proceedings (R22) • repudiated this Contract (R23)
Z1.2	Termination Table	The following will be included under core clause 90.2 Termination Table as follows: Amend "A reason other than R1 – R21" to "A reason other than R1 – R23"
Z1.3		Amend "R1 – R15 or R18" to "R1 – R15, R18, R22 or R23."

Z2 Right Reserved by Transnet to Conduct Vetting through SSA

Z2.1		Transnet reserves the right to conduct vetting through State Security Agency (SSA) for security clearances of any Contractor who has access to National Key Points for the following without limitations: 1. Confidential – this clearance is based on any information which may be used by malicious, opposing or hostile elements to harm the objectives and functions of an organ of state. 2. Secret – clearance is based on any information which may be used by malicious, opposing or hostile elements to disrupt the objectives and functions of an organ of state. 3. Top Secret – this clearance is based on information which may be used by malicious, opposing or hostile elements to neutralise the objectives and functions of an organ of state.
Z3	**Additional clause relating to Collusion in the Construction Industry**	
Z3.1		The contract award is made without prejudice to any rights Transnet may have to take appropriate action later with regard to any declared bid rigging including blacklisting.
Z4	**Protection of Personal Information Act**	
Z4.1		The *Employer* and the *Contractor* are required to process information obtained for the duration of the Agreement in a manner that is aligned to the Protection of Personal Information Act

C1.2 Contract Data

Part two - Data provided by the *Contractor*

The tendering contractor is advised to read both the NEC3 Term Service Contract (June 2005) and the relevant parts of its Guidance Notes (TSC3-GN) in order to understand the implications of this Data which the tenderer is required to complete.

Completion of the data in full, according to Options chosen, is essential to create a complete contract.

Clause	Statement	Data
10.1	The *Contractor* is (Name):	
	Address	
	Tel No.	
	Fax No.	
11.2(8)	The *direct fee percentage* is	**.....%**
	The *subcontracted fee percentage* is	**.....%**
11.2(14)	The following matters will be included in the Risk Register	**.....**
11.2(15)	The Service Information for the *Contractor*'s plan is in:	**.....**
21.1	The plan identified in the Contract Data is contained in:	**.....**
24.1	The key persons are:	
	1 Name:	**.....**
	Job:	**.....**
	Responsibilities:	**.....**
	Qualifications:	**.....**
	Experience:	**.....**
	2 Name:	**.....**
	Job	**.....**
	Responsibilities:	**.....**
	Qualifications:	**.....**
	Experience:	**.....**
		.....
		CV's (and further key person's data including CVs) are in .....

A	**Priced contract with price list**	
11.2(12)	The *price list* is in	**.....**
11.2(19)	The tendered total of the Prices is	**R.....**

PART C2: PRICING DATA

Document reference	Title	No of pages
C2.1	Pricing instructions: Option A	2
C2.2	Price List	3

C2.1 Pricing instructions: Option A

1.1 The *conditions of contract*

1.2 How the contract prices work and assesses it for progress payments

Clause 11 in NEC3 Term Services Contract (TSC), June 2005 (with amendments June 2006 and April 2013) Option A states:

Identified and defined terms 11

11.2 (17) The Price for Services Provided to Date is the total of

- the Price for each lump sum item in the Price List which the *Contractor* has completed and
- where a quantity is stated for an item in the Price List, an amount calculated by multiplying the quantity which the *Contractor* has completed by the rate.

(19) The Prices are the amounts stated in the Price column of the Price List, where a quantity is stated for an item in the Price List, the Price is calculated by multiplying the quantity by the rate.

1.3 Measurement and Payment

1.3.1 The Price List provides the basis of all valuations of the Price for Services Provided to Date, payments in multiple currencies and general progress monitoring.

1.3.2 The amount due at each assessment date is based on activities and/or milestones completed as indicated on the Price List.

1.3.3 The Price List work breakdown structure provided by the *Contractor* is based on the activity/milestone provided by the Employer. The activities listed by the *Employer* are the minimum activities acceptable and identify the specific activities which are required to achieve Completion. T**he Price List work breakdown structure is compiled to the satisfaction of the *Employer* with any additions and/or amendments deemed necessary.**

1.3.4 The *Contractor's* detailed Price List summates back to the activity/milestone provided by the *Employer* and is sufficient detail to monitor completion of activities related to the operations on the Accepted Plan in order that payment of completed activities may be assessed.

1.3.5 The Prices are obtained from the Price List. The Prices includes for all direct and indirect costs, overheads, profits, risks, liabilities, obligations, etc. relative to the contract.

C2.2 Price List

A. Unit 1 Traction transformer at Nsese Traction Substation

Item no.	Description	Quantity	Rate	Price
1.	Drain and store the 16000L transformer oil	1 sum		
2.	Sample and test the Insulation oil before and after the commencement of work. The oil results before and after purification must be submitted to the project manager within the Shutdown Duration, before the transformer is energized	1 sum		
3.	Repair leak on the core earth	1 sum		
4.	Repair the leaking radiator fins (including pressure testing)	4 each		
5.	Service drainage plugs on fins both top and bottom	3 each		
6.	Regaskets and service two bottom radiator fin valves from the LV side	2 each		
7.	Repair leak on the sample pipe	1 sum		
8.	Top up transformer with virgin oil about 210L drum	1 sum		
9.	Pumped back the 16000L of oil into the transformer under vacuum	1 sum		
10.	Sandblast and apply anti corrosive paint to the oil and winding temp structure.	1 sum		
11.	Paint Plinth in red with a yellow boarder	1 sum		
12.	Rehabilitate the soil around the transformer and replace the contaminated crusher stones of an area of 7m^2	1 sum		
	The total of the Prices:			

B. Unit 1 Traction Transformer at RBCT Substation				
Item no.	**Description**	**Quantity**	**Rate**	**Price**
1	Remove, store, purify and vacuum oil to specification	1 sum		
2	Replace gaskets on top cover, sample and drainage valve, tap changer and Buchholz relay	1 sum		
3	Supply and install breather complete with silica gel	1 sum		
4	Sample and test the Insulation oil before and after the commencement of work. The oil results before and after purification must be submitted to the project manager within the Shutdown Duration, before the transformer is energized	1 sum		
5	Clean, sandblast, rust proof with anti-corrosive paint and paint main transformer tank in Battleship Grey, Paint Bushing cap to the colour of the phasing, Paint Plinth in red with a yellow boarder, drain taps in red, Paint the Earth bar green and conservator tank in white.	1 sum		
6.	Top up transformer with virgin oil about 210L drum	1 sum		
7.	Supply and install conservator tank with brackets.	1 sum		
8.	Service drainage plug on fin from the HV side (Top and Bottom plug)	1 each		
9.	Service Buchholz Relay	1 sum		
10.	Service valve by the Buchholz relay	1 sum		
	The total of the Prices:			

PART 4: AFFECTED PROPERTY

Core clause 11.2(2) states

"Affected Property is property which

- Is affected by the work of the *Contractor* or used by the *Contractor* in Providing the Service
- is in the documents which the Contract Data states it is in."

In Contract Data, reference has been made to this Part 4 of the contract for the location of the Affected Property.

1. Description of the Affected Property and its surroundings

1.1. General description

The work shall be performed at Transnet Freight Rail, on one (132KV to 25KV) 20MVA traction transformer at RBCT Traction Substation and one (132KV to 25KV) 20MVA traction transformer at Nsese Traction Substation.

The sites are along the COAL line in Richards Bay. The road to sites is mostly tarred. Contractors will be provided a site access certificate only after their Safety File has been approved by a Transnet Safety Specialist. The contractor will only be allowed to work under work permit conditions which will be taken by a Transnet Electrician and is the responsible person in charge of the site. Access will only be granted to workers that have had Transnet approved induction.
Working hours: Shutdown 06H00 to 18H00.

Work to be done at the following sites in accordance with the scope of work C3:

- **Nsezi Substation**

The Site is situated in Richards Bay. The site location is at these GPS Coordinates: Lat: 28°46'7.90"S & Long: 31°58'13.43"E

- **RBCT Substation**

The Site is situated in Richards Bay. The site location is at these GPS Coordinates: Lat: 28°48'14.19"S & Long: 32° 0'59.47"E

1.2. Existing buildings, structures, and plant & machinery on the Affected Property

- Adjacent Unit (traction transformer) will be on load/live.
- Vehicles must be parked outside the substation to avoid outdoor yard equipment being damaged.

1.3. Subsoil information.

If the contractor spills the oil during the transformer refurbishment project, he/she is responsible for soil rehabilitation and replacement of crusher stones for the area affected.

1.4. Hidden services

- Electrical cable and sewer network line

1.5. Other reports and publicly available information

A site inspection will be arranged, which must be attended by tenderers. Further details regarding date and time will appear in the appointment letter.

PART C3: SCOPE OF WORK

Document reference	Title	No of page
	This cover page	1
C3.1	*Employer's* Works Information	3
	Total number of pages	**12**

C3.1 EMPLOYER'S WORKS INFORMATION

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SECTION 1

1 Description of the *works*

1.1 Executive overview

The works that the Contractor is to perform involve repairing transformer oil leaks on one (132KV to 25KV) 20MVA traction transformer at RBCT substation and one (132KV to 25KV) 20MVA traction transformer at Nsese substation. The oil should be filtered, and an oil sample should then be taken and tested in accordance with BBB0349 and BBF8190. The oil should be re-filtered if necessary.

2 Scope of Work

2.1 Description of Work

The Contractor's design for the works shall be in accordance with the scope of work and shall take every clause into consideration. The Scope of Works should be followed for the transformer repairs/refurbishment for all 2 transformers, unless specified:

2.1.1 Replace worn out, brittle gaskets and repair transformer leaks.

2.1.2 Filter Traction transformer oil, and refill or top up transformer oil if required for all transformers. Purification and refilling transformer with oil should be done according to SANS 555 and must be pumped back into the transformer under vacuum.

2.1.3 Prepare and repaint transformer tank in Battleship Grey, plinth in red with a yellow boarder, Earth bar in green and the conservator tank in white. The total paint thickness shall be at least 125 microns.

2.1.4 The transformer breather including silica gel should be checked and replaced if required.

2.1.5 The transformer bushing caps should be painted according to the colour of phases.

2.1.6 Transformer oil should be sampled and tested in accordance with BBB0349, before and after filtering has taken place. The oil should be tested at a SANAS accredited laboratory. The oil should be re-filtered if necessary.

2.1.7 A hardcopy and softcopy (electronic copy) of test results should be provided to the project manager. The oil results before and after purification must be submitted to the project manager within the Shutdown Duration before the transformer is energized.

2.1.8 When storing the transformer oil after being pumped from the transformer, the transformer oil should be stored in a clean, impermeable vessel i.e., a bulk transformer oil storage bladder is required.

2.1.9 All bolts/nuts should be re-torqued with-in 3 months after the transformer has been energised.

2.1.10 Sandblast, apply rust proof painting and paint the traction transformer at RBCT substation.

2.1.11 Repair four leaking radiator fins (including pressure testing)

2.1.12 Rehabilitate the soil around the transformer and replace the contaminated stone of 7 square meters at Nsese substation.

2.1.13 Supply and install conservator tank with brackets at RBCT Transformer.

2.1.14 Service drainage plugs on fins:

- HV side – first fin from left, top and bottom at Nsese
- LV side – 4th and 5th fin from left, top and bottom at Nsese
- HV side – First fin from right, top and bottom at RBCT

Applicable Standards

South African National Standards
SANS 1091 National colour standard.
SANS 763 Hot dip galvanised zinc coating.
SANS 121 Hot Dip Galvanised Coating for Fabricated iron or Steel Article
SANS 0555 2007 Unused and reclaimed mineral insulating oil for transformer and switchgear.
SANS 8528 Reciprocating internal combustion engine driven alternating current generating set.
SANS 10064. 2005 Code of Practice for the preparation of steel surfaces for coating.
BSS 171. 1987 Power Transformers.
SANS 10142 Wiring Code.
SANS 60137 Insulated bushings for alternating voltages above 1 000 V.
CEE. 0229.95 Dry-out and Regeneration of insulating oil and reclaiming and desludging of transformers
CEE.0045.2002/1 Painting of steel Components of Electrical
CEE.0224.2002 Drawings, catalogues, instruction manuals and spares list for electrical supplied under contract

2.2 Equipment required to be included in the works.

2.2.1 As stipulated in the scope of works indicated in 2.1. Employer's design or Scope of Works.

A minimum of Two of each equipment required to execute the work, is as follows:

- Generator
- Filtration System
- Storage Vessel 15 000 Litres
- Compressor
- Spray Painting Equipment
- Torque Wrench
- Crane Truck

3 Site access

3.1.1 Site access certificate will only be provided to the Contractor once the safety file of the Contractor has been accepted by Transnet's Safety department. The Contractor and his employees (sub-contractors) who are required to work at Nsese and RBCT Substations must undergo a one day's safety induction.

3.1.2 Restrictions to access on Site, roads, walkways, and barricades

3.1.3 Only People who have attended the safety induction and have conformed to the requirements on the safety file are allowed on site. The working hours during the Shutdown (July 2025) is from 06H00 to 18H00.

3.1.4 The Contractor keeps daily records of his people engaged on the Site and Working Areas (including Subcontractors) with access to such daily records available for inspection by the Project Manager at all reasonable times.

3.1.5 Transnet Freight Railway will not be held responsible for any losses, damage or injury to workmen while working on Transnet Freight Rail property.

The Contractor shall comply with the provision of the Occupational Health and Safety Act (Act 85 of 1993). For this Act, the site/s occupied by the Contractor is transferred, for the duration of the Contract, to the control of the Contractor, as if it is his/her property. As employer, he/she is in every respect responsible for compliance with the provisions of this Act.

The Contractor shall comply with the Compensation for Occupational Injuries and Diseases Act (Act 130 of 1993). The Service Provider shall produce proof of his/her registration and good standing with the Compensation Commissioner of the act. This proof shall be submitted with the return of these documents during the tender stage.

The Contractor is to ensure that the area where work is in progress is cordoned off, with hazard tape to prevent all persons not required from entering the area.

The Contractor must always ensure that his/her staff working next to the railway track wears reflective clothing and does not enter nor interfere with the railway track.

3.1.6 No making of fires for whatever reason will be permitted on site. Any claims arising from the making or burning of farmer's property from such fires will be for the account of the Contractor.

3.1.7 Restrictions to access on Site, roads, walkways, and barricades.

3.1.8 The Contractor does not advertise the contract or the project to any third party, nor communicate directly with the media (in any jurisdiction) whatsoever without the express written notification and consent of the Project Manager.

3.1.9 The Contractor keeps daily records of his Equipment used on Site and the Working Areas (distinguishing between owned and hired Equipment) with access to such daily records available for inspection by the Project Manager at all reasonable times.

3.1.10 Site services and facilities:

The Contractor to provide his own Power source, Security services and ablution facility. The Contractor shall provide everything necessary for providing the Works.

3.1.11 Any cable damaged during trenching, etc. will be for the cost of the contractor. No cable joins are acceptable. A new cable is to be installed. Damage to any Transnet asset on site will be for the cost of the contractor.

3.2 Completion, testing and correction of Defects.

3.2.1 The *work* to be done by the Completion Date: July 2025

On or before the Completion Date the Contractor shall have done everything required to Provide the Works including the work listed on the bill of quantities which is to be done before the Completion Date and in any case before the dates stated. The Project Manager cannot certify Completion until all the work listed on the BOQ has been done and is also free of Defects, which would have, in his opinion, prevented the Employer from using the works and others from doing their work.

3.2.2 The *Contractor* is permitted to carry out the following *works* after Completion:

Minor defects that do not prevent the energising of the Substation on the July 2025.

3.2.3 Commissioning to take place in accordance with Transnet specification BBF8128.

3.2.4 Take over procedures will entail completing a hand-over document (GI.018) indicating all the faults identified. These faults are faults that will not interrupt cancellation of the work permit and return the substation to service.

3.2.5 The Contractor ensures that the documentation as described under paragraph 3.8 of the Works Information is presented to the Project Manager before Completion.

3.2.6 The Contractor ensures that the Project Manager has a full and accurate dossier of As-built documents that represent the state combination of Mechanical, Electrical and General Layout status of the completed works.

3.2.7 The Contractor ensures that the Project Manager has a full and accurate dossier of Maintenance and Operating Manuals at the earlier of take-over or Completion.

3.2.8 Where the Contractor has presented Maintenance and Operating Manuals as appropriate to the Project Manager at take-over, the Contractor modifies and updates As-built documents as necessary prior to Completion.

3.2.9 Access given by the Employer for correction of Defects will be during the Coal line Double line occupation date. (1 day in a month).

SECTION *2*

4 Management and start up.

4.1 Management meetings

Regular meetings of a general nature may be convened and chaired by the *Project Manager* as follows:

Title and purpose	Approximate time & interval	Location	Attendance by:
Risk register and compensation events	Weekly – everyday Friday at 11H00.	Teleconference/ Microsoft Team	Employer, Project Manager Contractor, and as necessary and appropriate delegates.
Overall contract progress and feedback	Weekly – everyday Friday at 11H00.	Teleconference/ Microsoft Team	Employer, Project Manager Contractor, and as necessary and appropriate delegates.

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *works*. Records of these meetings are to be submitted to the *Project Manager* by the person convening the meeting within five days of the meeting.
All meetings are to be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register are not to be used for the purpose of confirming actions or instructions under the contract as these are to be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

4.2 Documentation Control

In undertaking the '*Works*' (including all incidental services required), the *Contractor* shall conform and adhere to the requirements of the 'Contractor Documentation Submittal Requirements'

During the execution of the works the Contractor is to keep a daily site diary with two carbon copy pages. This diary will be signed by the Contractor and Project Manager daily.

4.3 Safety risk management

4.3.1 The *Contractor* complies with the following SMP: Site Cardinal Rules, Project Site Induction, and Hazard Management on Site, Risk Assessments, and Daily Safe Task Instructions.

Occupational Health and Hygiene, Safe System of Work, Incident Management, Site management (as minimum).

4.3.2 The *Contractor* must ensure that its Subcontractors comply with the requirements of the SMP.

4.3.3 The Contractor makes the SMP available to its employees and Subcontractors in the language of this contract and other local languages as required.

4.4 Environmental constraints and management

4.4.1 The Contractor performs the works and all construction activities within the Site and Working Areas having due regard to the environment and to environmental management practices as more particularly described within the SES and PES.

The SES describes the minimal acceptable standard for environmental management for a range of environmental aspects commonly encountered on construction projects and sets environmental objectives and targets, which the Contractor observes and complies.

Where relevant, method statements, as detailed in the SES and PES, shall be provided by the Contractor. These include, but are not limited to, the following where applicable:

- Establishment of construction lay down area.

- Hazardous and non-hazardous solid waste management
- Storm water management
- Hydrocarbon spills
- Diesel tanks and refuelling procedures
- Dust control
- Sourcing, excavating, transporting and dumping of fill material.
- Noise and vibration control
- Environmental awareness training
- Site division
- Emergency procedures for environmental incidents
- *Contractor's* SHE Officer
- Closure of construction laydown area

The Contractor shall ensure that his management, foremen and the general workforce, as well as all suppliers and visitors to Site have attended the Induction Programme prior to commencing any work on Site. If new personnel commence work on the Site during construction, the Contractor shall ensure that these personnel undergo the Induction Programme and are made aware of the environmental specifications on Site.

The Contractor must appoint enough named assistants to the CSHEO to monitor environmental issues e.g., litter, spills, illegal activities, fence patrol, dust etc. These appointments, along with details of the individuals being appointed and job descriptions, must be part of the safety file.

During the construction period, the Contractor complies with the following:

A copy of the SES, and the relevant PES shall be available on Site, and the Contractor shall ensure that all the personnel on Site (including Subcontractors and their staff) as well as suppliers are familiar with and understand the specifications contained in the SES (as amended by the PES).

Method statements that are required during construction must be submitted to the Project Manager for approval at least 20 days prior to the proposed commencement of the activity. Emergency construction activity method statements may also be required. The activities requiring method statements cannot commence if they have not been approved by the Project Manager.

Where applicable, the Contractor shall provide job-specific training on an ad hoc basis when workers are engaged in activities, which require method statements.

The Contractor shall ensure that any Materials delivery drivers are informed of all procedures and restrictions (e.g., which access roads to use, no go areas, speed limits, noise, etc) required by the CEMP before they arrive at Site and off load any Materials.

The Contractor shall be responsible for rehabilitating and re-vegetating all areas to the satisfaction of the Project Manager as detailed in the SES and PES.

The Contractor shall clear and clean the Site and Working Areas and ensure that everything not forming part of the works is removed from the Site and Working Areas and that all rehabilitation has taken place in accordance with the PES

The Contractor makes copies of the CEMP, SES and PES available at the offices of the Contractor on Site. The Contractor ensures that all personnel on Site (including Subcontractors) are familiar with and understand the requirements of the CEMP.

4.4.2 The *Contractor* complies with the following SES:

The *Contractor* shall identify the kinds of environmental impacts that will occur because of his activities and then prepare separate method statements describing how each of those impacts

will be prevented or managed so that the standards set out in this document are achieved. These method statements will be prepared in accordance with the requirements set out in the CEMP.

To ensure that environmental issues are considered in the establishment of the Site offices and all other facilities on Site.

4.4.3 The Contractor complies with the CEMP, SES and PES. The Contractor abides by the instructions of the Project Manager regarding the implementation of the CEMP.

4.5 Quality assurance requirements

4.5.1 The *Contractor* submits his Quality Management System documents to the Project Manager as part of his programme which include details of:

- Quality Plan for the contract.
- Quality Policy
- Index of Procedures to be used; and
- A schedule of internal and external audits during the contract

4.5.2 The Contractor develops and maintains a comprehensive register of documents that will be generated throughout the contract including all quality related documents as part of its Quality Plan.

4.5.3 The Quality Plan means the Contractor's statement, which outlines strategy, methodology, resources allocation, QA, and Quality Control co-ordination activities to ensure that the works meet the standards stated in the Works Information.

4.6 Programming constraints

4.6.1 The *Contractor* shows on each programme he submits to the *Project Manager*, the requirements as described under paragraph 2.4 of the Works Information, together with the associated environmental method statements.

4.6.2 The *Contractor* shows on each programme he submits to the *Project Manager*, the requirements of Health & Safety issues, design issues, construction operations and procurement issues.

4.6.3 The Contractor uses MS Projects or Primavera for his programme submissions or a similar programme software package subject to the prior written notification and acceptance by the Project Manager.

4.6.4 The *Contractor* presents his first programme and all subsequently revised programmes schedules showing the critical path or paths and all necessary logic diagrams demonstrating sequence of operations.

4.6.5 The Contractor's programme shows duration of operations in working days.

4.6.6 The Contractor's programme shows the following levels:

- Level 1 Master Schedule – defines the major operations and interfaces between engineering design, procurement, fabrication and assembly of Plant and Materials, transportation, construction, testing and pre-commissioning, commissioning, and Completion.
- Level 2 Project Schedule – summary schedules 'rolled up' from Level 3 Project Schedule described below.
- Level 3 Project Schedule – detailed schedules generated to demonstrate all operations identified on the programme from the starting date to Completion. Individual operations will be assigned a code The *Project Manager* notifies any subsequent layouts and corresponding filters on revised programmes.
- Level 4 Project Schedule – detailed discipline speciality level developed and maintained by the *Contractor* relating to all operations identified on the programme representing the daily activities by each discipline.

4.6.7 The *Contractor* shows on each revised programme he submits to the *Project Manager* a resource histogram showing planned progress versus actual, deviations from the Accepted Programme and any remedial actions proposed by the *Contractor*.

4.6.8 The *Contractor* submits programme report information to the *Project Manager* at weekly intervals leading up to the Coal line Shutdown.

4.6.9 The *Contractor*'s weekly programme narrative report includes:

- Level 4 Project Schedule – showing two separate bars for each task i.e., the primary bar must reflect the current forecast dates and the secondary bar the latest Accepted programme.
- 3-week Look ahead Schedule - showing two separate bars for each task i.e., the primary bar must reflect the current forecast dates and the secondary bar the latest Accepted programme.

4.7 Contract change management

4.7.1 No additional requirements apply to ECC Clause 60 series.

4.8 The *Contractor's* Invoices

4.8.1 When the *Project Manager* certifies payment following an assessment date, the *Contractor* complies with the *Employer's* procedure for invoice submission.

4.8.2 The invoice must correspond to the *Project Manager's* assessment of the amount due to the *Contractor* as stated in the payment certificate.

4.8.3 The invoice states the following:

- Invoice addressed to Transnet Limited.
- Transnet Limited's VAT No: 4720103177.
- Invoice number.
- The *Contractor's* VAT Number; and
- The Contract numbers.

4.8.4 The invoice contains the supporting detail.

4.8.5 The invoice is presented either by post or by hand delivery.

4.8.6 Invoices submitted by post are addressed to:

Transnet Freight Rail

P.O Box 20064

Empangeni

3880

For the attention of the Contract Administrator,

4.8.7 Invoices submitted by hand are presented to:

Transnet Freight Rail

Malahle House

4 Kiewet Street

Empangeni

3880

For the attention of the Contract Administrator,

4.9 People

4.9.1 Minimum requirements of people employed on the Site are as follows:

Safety File approved by Transnet safety officers.

People on site must have a valid medical certificate and they must appear on the organogram on the safety file.

Attend the compulsory Transnet Freight Rail safety induction.

Have all appropriate Personal Protective Equipment (PPE)

4.10 CONTRACTOR LIABILITY (Further to the above, the following will apply to the contractor)

4.10.1 The *Contractor* warrants that it will be liable to Transnet for any loss or damage caused by strikes, riots, lockouts, or any labour disputes by and/or confined to the *Ccontractor's* employees, which loss will include any indirect or consequential damages.

4.10.2 The *Contractor* warrants that no negotiations or feedback meetings by the *Contractor's* employees shall take place on Transnet premises, whether owned or rented by Transnet.

4.10.3 *The* Contractor shall give notice to Transnet of any industrial action by the *Contractor's* employees immediately upon becoming aware of any actual or contemplated action that is or may be carried out on Transnet's premises, whether owned or rented, and shall notify Transnet of all matters associated with such action that may potentially affect Transnet.

4.10.4 The *Contracto*r is responsible for educating its employees on relevant provisions of the Labour Relations Act which deal with industrial action processes, and the risks of non-compliance.

4.10.5

4.10.6 The *Contractor* is required to develop a Contingency Strike Handling Plan, which plan the *Contractor* is obliged to update on a three-monthly basis. The *Contractor* must provide Transnet with this plan and all updates to the Plan. The *Contractor* is responsible to communicate with its employees on site details of the plan.

5 INDUSTRIAL ACTION BY CONTRACTOR EMPLOYEES

5.1 In the event of any industrial action by the Contractor's employees, the Contractor is required to provide competent contingency resources permitted in law to carry out any of the duties that are or could potentially be interrupted by industrial action in delivering the Service.

5.2 The Contractor warrants that it will compensate Transnet for any costs Transnet incurs in providing additional security to deal with any industrial action by the Contractor's employees.

5.3 In the event of any industrial action by the Contractor's employees, the Contractor is obliged:

5.3.1 To prepare and deliver to Transnet, within two (2) hours of the commencement of industrial action an Industrial Action Report. If the industrial action persists the Contractor is required to deliver the report at 8h30 each day.

5.3.2 The Industrial Action Report must provide at least the following information:

a) Industrial incident report,
b) Attendance register,
c) Productivity / progress to schedule reports,
d) Operational contingency plan,
e) Site security report,
f) Industrial action intelligence gathered.

5.3.3 The final Industrial Action Report is to be delivered 24 hours after finalization of the industrial action.

5.3.4 The management of the Contractor is required to hold a daily industrial action teleconference with personnel identified by Transnet to discuss the industrial action, settlement of the industrial action, security issues and the impact on delivery under the contract.

5.4 The resolution of any disputes or industrial action by the Contractor's employees is the sole responsibility of the Contractor.

5.5 Access to Transnet premises by the Contractor and its employees is only provided for purposes of the Contractor delivering its services to Transnet. Should the Contractor and its employees not, for any reason, be capable of delivering its services Transnet is entitled to restrict or deny access onto its premises and unless otherwise authorized; such person will deem to be trespassing.

6. Plant and Materials

6.1 The Contractor provides Plant and Materials for inclusion in the works in accordance with SANS 1200A sub-paragraph 2.1, unless otherwise stated elsewhere in the Works Information provided by the Employer. All Plant and Materials are new, unless the use of old or refurbished goods and/or Materials are expressly permitted as stated elsewhere in this Works Information or as may be subsequently instructed by the Project Manager.

6.2 Where Plant and Materials for inclusion in the works originate from outside the Republic of South Africa, all such Plant and Materials are new and of merchantable quality, to a recognized national standard, with all proprietary products installed to manufacturers' instructions.

6.3 The Contractor replaces any Plant and Materials subject to breakages (whether in the Working Areas or not) or any Plant and Materials not conforming to standards or specifications stated and notifies the Project Manager and the Supervisor on each occasion where replacement is required.

6.4 All equipment used for the testing and commissioning of the Protection Panels must carry a valid calibration certificate.

TRANSNET

(REGISTRATION NO.1990/000900/30)

TRADING AS

TRANSNET RAIL INFRASTRUCTURE MANAGER

ADDENDUM NO. 1

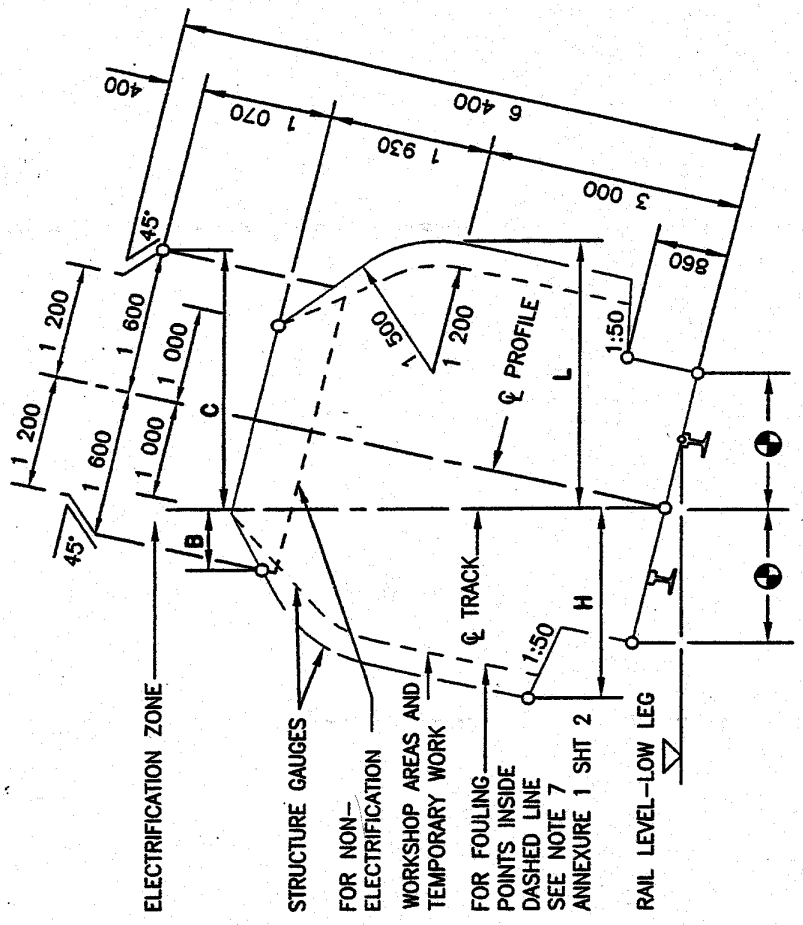
TO THE SECONDARY AND GENERAL SPECIFICATIONS OF THE CONTRACT

1) Where ever the word "South African Transport Services" or "Spoornet" appears in these specifications, please replace it with "Transnet Freight Rail".

2) Where ever the words "Technical Officer" appear in these specifications, please replace with "Supervisor".

ANNEXURE 1
SHEET 1 of 5
AMENDMENT

HORIZONTAL CLEARANCES : 1 065mm TRACK GAUGE



RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L	WITH CANT B (mm)	WITH CANT 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.

ANNEXURE 1
SHEET 2 of 5
AMENDMENT

VERTICAL CLEARANCES : 1 065mm TRACK GAUGE

LOCATION		NOT ELECTRIFIED	ELECTRIFIED (PRESENT OR FUTURE)			
			3kV & 25kV		50kV	
	RADIUS (mm)	S (mm)	V (mm)		V (mm)	
ALL AREAS OTHER THAN THOSE INDICATED BY * BELOW	100	4 470	5 050		5 400	
	300	4 410	5 020		5 370	
	600	4 370	5 000		5 350	
	1 000	4 350	4 990		5 340	
	1 500	4 310	4 960		5 310	
	2 000	4 290	4 940		5 290	
	>3 000	4 270	4 930		5 280	
* OVER OR NEAR POINTS AND CROSSING IF REQUIRED BY ELECTRICAL IRRESPECTIVE OF RADIUS			5 650		6 000	

REMARKS:

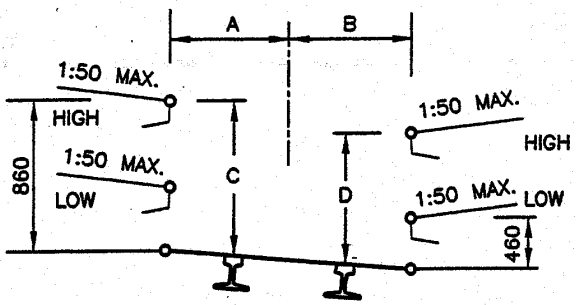
1. V IS THE REQUIRED VERTICAL CLEARANCE EXCEPT WHERE REDUCED CLEARANCE S APPLIES.
2. S IS THE MINIMUM VERTICAL CLEARANCE FOR STRUCTURES AND TEMPORARY WORK OVER NON-ELECTRIFIED LINES.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR APPLICATION AT CURVES
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 3m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON-TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 15m ALONG STRAIGHTS.
5. NEW STRUCTURES: SEE BRIDGE CODE.
6. TUNNELS: SEE DRAWING BE 82-35.
7. FOULING POINTS: SEE CLAUSE 8.1.
8. CLEARANCES ARE BASED ON 15m BOGIE CENTRES AND 2,2m VECHILE BODY LENGTH.
9. ⊕ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.

ANNEXURE 1
SHEET 3 of 5
AMENDMENT

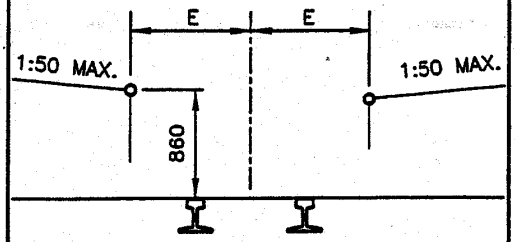
CLEARANCES : PLATFORMS

PLATFORMS : TRACK GAUGE 1 065mm

PASSENGERS



GOODS



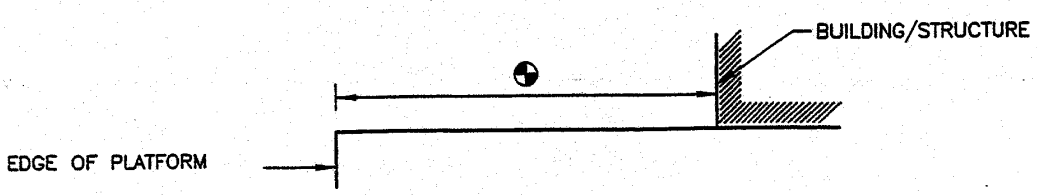
(NO CANT)

RADIUS (m)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
90	1 690	1 820	890	810	1 840
100	1 650	1 790	890	810	1 810
120	1 610	1 740	890	810	1 760
140	1 580	1 700	890	810	1 720
170	1 550	1 660	890	810	1 690
200	1 530	1 630	890	820	1 670
250	1 520	1 600	890	820	1 640
300	1 520	1 580	890	830	1 620
350	1 520	1 560	880	830	1 600
400	1 520	1 550	880	840	1 590
500	1 520	1 540	880	850	1 580
600	1 520	1 530	870	850	1 570
800	1 520	1 520	860	860	1 560
1 200	1 520	1 520	860	860	1 550
2 000	1 520	1 520	860	860	1 540
3 000	1 520	1 520	860	860	1 530
STRAIGHT	1 520	1 520	860	860	1 520

REMARKS:

1. NO CANT TO BE APPLIED EXCEPT WHEN THE GOODS PLATFORM IS ON A RUNNING LINE.
2. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
3. ⊕ 8m TO MAIN STATION-BUILDINGS AND 3m TO ALL OTHER STRUCTURES.
4. TOLERANCES : SEE CLAUSE 8.0.10.

STRUCTURES ON PLATFORMS : 1 065mm AND 610mm TRACK GAUGE



ANNEXURE 1
SHEET 5 of 5
AMENDMENT

CLEARANCES : 610mm TRACK GAUGE

RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L (mm)	V (mm)
50	2 370	2 490	2 400	4 320
70	2 310	2 420	2 330	4 310
100	2 260	2 370	2 280	4 310
140	2 220	2 340	2 250	4 310
200	2 200	2 300	2 220	4 300
300	2 190	2 270	2 200	4 300
500	2 180	2 230	2 190	4 290
700	2 170	2 200	2 180	4 270
1 000	2 170	2 170	2 170	4 270
>2 000	2 160	2 160	2 160	4 270

RADIUS (m)	F (mm)
50	1 550
60	1 510
80	1 460
100	1 430
120	1 410
140	1 390
170	1 380
200	1 370
250	1 360
300	1 350
600	1 330
1 000	1 320
>2 000	1 320
STRAIGHT	1 310

REMARKS:

1. H IS THE MINIMUM HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L IS THE MINIMUM HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. V IS THE MINIMUM VERTICAL CLEARANCE.
4. FOR APPLICATION AT CURVES:
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 2m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON–TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 18m ALONG STRAIGHTS.
5. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
6. ALSO REFER TO REMARKS 5, 6 AND 7 OF ANNEXURE 1 SHEET 2.
7. CLEARANCES ARE BASED ON 9 700mm BOGIE CENTRES AND 13 700mm VEHICLE BODY LENGTH.
8. SEE ANNEXURE 1 SHEET 3 FOR STRUCTURES ON PLATFORMS.

BE 97–01 Sht 5 of 5 DATE : JUNE 2000

Mandatary Agreement

OCCUPATIONAL HEALTH AND SAFETY ACT 85 of 1993 (AS AMENDED)

AGREEMENT WITH MANDATORY
In terms of Section 37(1) & (2)

WRITTEN AGREEMENT ENTERED INTO AND BETWEEN

Transnet SOC Ltd
(Hereinafter referred to as the Employer)

AND

(Hereinafter referred to as Mandatory (Principal Contractor)

Compensation Fund Number :

Project Name :

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7. **ACCESS TO THE OHS ACT**
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11. **COMPENSATION REGISTRATION**
12. **MEDICAL EXAMINATIONS**
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27. NON COMPLINCE

28. HEADING

PREAMBLE

WHEREAS section 37(1) & (2) of the Occupational Health and Safety Act No 85 of 1993 ("the Act") requires that parties have an agreement in writing to ensure compliance by a mandatory in line with the provisions of the Act.

AND WHEREAS Transnet SOC Ltd requires the services of the Contractors to execute certain projects within its workshops.

AND WHEREAS TRANSNET SOC LTD can be better served by Contractors who have the infrastructure, specialist employees and expertise to execute such projects at the highest level of efficiency on short notice.

NOW THEREFORE the parties agree as follows;

1. DEFINITIONS

For the purpose of this agreement, unless the context indicates otherwise, the following definitions are set out for the terms indicated:

1.1 "**Act**" means the Occupational Health and Safety Act No 85 of 1993;

1.2 "**Agreement**" means this Mandatary agreement;

1.3 **"Contractor "** means the Mandatory;

1.4 **"COID Act"** means the Compensation for Occupational Injuries and Diseases Act No 130 of 1993.

1.5 "**Effective Date**" means the date of signature of this Agreement by the last party signing hereto;

1.6 "**Employer**" refers to TRANSNET SOC LTD;

1.7 "**Mandatary**" means an agent, Contractor or sub-contractor for work, but without derogating from the status in his own right as an employer or user;

1.8 "**Parties**" means TRANSNET SOC LTD and the Contractor, and "**Party**" shall mean either one of them, as the context indicates;

1.9 **"Principal Contract"** means the appointed contractor whereby such contractor has to provide goods and or services to TRANSNET SOC LTD.

1.10 "**Regulations**" means regulations promulgated in terms of the relevant legislation.

1.11 "**Section**" means the relevant section of the Occupational Health and Safety Act No 85 of 1993

1.12 "**Services**" means the services to be provided by the Contractor to TRANSNET SOC LTD.

1.13 "**TRANSNET SOC LTD**" means Transnet Group and all its operating divisions and Specialist units with (Registration No. **1990/000900/06),** a public company incorporated in accordance with the company laws of the Republic of South Africa;

2. INTERPRETATION

2.1 Clause headings in this Agreement are included for ease of reference only and do not form part of this Agreement for the purposes of interpretation or for any other purpose. No provision shall be construed against or interpreted to the disadvantage of either Party hereto by reason of such Party having or being deemed to have structured or drafted such provision.

2.2 Any term, word or phrase used in this Agreement, other than those defined under the clause heading "Definitions" shall be given its plain English meaning, and those terms, words, acronyms, and phrases used in this Agreement will be interpreted in accordance with the generally accepted meanings accorded thereto.

2.3 A reference to the singular incorporates a reference to the plural and vice versa.

2.4 A reference to natural persons incorporates a reference to legal persons and vice versa.

2.5 A reference to a particular gender incorporates a reference to the other gender.

3. REPORTING

3.1 The Mandatary and/or his designated person appointed in terms of Section 16(2) of the Occupational Health and Safety Act 85 of 1993 ("the OHS Act") shall report to the Risk Manager and/or a Project Manager and/or a representative designated by the Employer prior to commencing the work at the premises of the Employer.

4. WARRANTY OF COMPLIANCE

4.1 In terms of this Agreement the Mandatary warrants that he agrees to any of the arrangements and procedures as prescribed by the Employer and as provided for in terms of Section 37(2) of the OHS Act for the purposes of compliance with the OHS Act.

4.2 The Mandatary further warrants that he and/or his employees undertake to maintain such compliance with the OHS Act. Without derogating from the generality of the above, nor from the provisions of the said Agreement, the Mandatary shall ensure that the clauses as hereunder described are at all times adhered to by himself and his employees.

4.3 The Mandatary hereby undertakes to ensure that the health and safety of any other person on the premises is not endangered by the conduct of his activities and that of his employees.

5. APPOINTMENTS AND TRAINING

5.1 The Mandatary shall appoint competent persons as per Section 16(2) of the OHS Act. Any such appointed person shall be trained on any occupational health and safety matter and the OHS Act provisions pertinent to the work is to be performed under his responsibility. Copies of any appointments made by the Mandatary shall immediately be provided to the Employer.

5.2 The Mandatary shall further ensure that all his employees are trained on the health and safety aspects relating to the work to be done on the premises of the Employer and that they understand the hazards associated with such work being carried out on the premises. Without derogating from the foregoing,

the Mandatary shall, in particular, ensure that all his users or operators of any materials, machinery or equipment are properly trained in the use of such materials, machinery or equipment.

5.3 Notwithstanding the provisions of the above, the Mandatary shall ensure that he, his appointed responsible persons and his employees are at all times familiar with the provisions of the OHS Act, and that they comply with the provisions of the Act.

6. SUPERVISION, DISCIPLINE AND REPORTING

6.1 The Mandatary shall ensure that all work performed on the Employer's a premise is done under strict supervision and that no unsafe or unhealthy work practices are permitted. Discipline regarding health and safety matters shall be strictly enforced against any of his employees regarding non-compliance by such employee with any health and safety matters.

6.2 The Mandatary shall further ensure that his employees report to him all unsafe or unhealthy work situations immediately after they become aware of such conditions and that he in turn immediately reports these to the Employer and/or his representative.

7. ACCESS TO THE OHS ACT

7.1 The Mandatary shall ensure that he has an updated copy of the OHS Act on site at all times and that this is accessible to his appointed responsible persons and employees, save that the parties may make arrangements for the Mandatary and his appointed responsible persons and employees to have access to the Employer's updated copy/copies of the Act.

8. COOPERATION

8.1 The Mandatary and/or his responsible persons and employees shall provide full co-operation and information if and when the Employer or his representative inquires into any occupational health and safety issues concerning the Mandatary. It is hereby recorded that the Employer and his representative shall at all times be entitled to make such inquiry.

8.2 Without derogating from the generality of the above, the Mandatary and his responsible persons shall make available to the Employer and his representative, on request, all and/or any checklists and inspection registers required to be kept by him in respect of any of his materials, machinery or equipment.

9. WORK PROCEDURES

9.1 The Mandatary shall, after having established the dangers associated with the work performed, develop and implement mitigation measures to minimize or eliminate such dangers for the purpose of ensuring a healthy and safe working environment. The Mandatary shall then ensure that his responsible persons and employees are familiar with such mitigation measures.

9.2 The Mandatary shall implement any other safe work practices as prescribed by the Employer and shall ensure that his responsible persons and employees are made conversant with such other safe work practices as prescribed by the Employer and that his responsible persons and employees adhere to such safe work practices.

9.3 The Mandatary shall ensure that work for which any permit is required by the Employer is not performed by his employees prior to the Employer obtaining such permit from the Mandatary.

10. HEALTH AND SAFETY MEETINGS

10.1 If required in terms of the OHS Act, the Mandatary shall establish his own health and safety committee(s) and ensure that his employees, being the committee members, provide health and safety representatives to attend the Employer's health and safety committee meetings.

11. COMPENSATION REGISTRATION

11.1 The Mandatary shall ensure that he has a valid proof of registration with the Compensation Commissioner, as required in terms of **COID Act**, and that all payments owing to the Commissioner are discharged. The Mandatary shall further ensure that the cover remain in force while any such employee is present on the premises.

12. MEDICAL EXAMINATIONS

12.1 The Mandatary shall ensure that all his employees undergo routine medical examinations and that they are medically fit for the purposes of the work they are to perform.

13. INCIDENT REPORTING AND INVESTIGATION

13.1 All incidents referred to in Section 24 of the OHS Act shall be reported by the Mandatary to the Department of Labour and to the Employer. The Employer shall further be provided with copies of any written documentation relating to any incident.

13.2 The Employer retains an interest in the reporting of any incident as described above as well as in any formal investigation and/or inquiry conducted in terms of section 32 of the OHS-Act into such incident.

14. SUBCONTRACTORS

14.1 The Mandatary shall notify the Employer of any subcontractor he may wish to perform work on his behalf on the Employer's premises. It is hereby recorded that all the terms and provisions contained in this clause shall be equally binding upon the subcontractor prior to the subcontractor commencing with the work. Without derogating from the generality of this paragraph:

14.1.1 The Mandatary shall ensure that training as discussed under appointments and training, is provided prior to the subcontractor commencing work on the Employer's premises.

14.1.2 The Mandatary shall ensure that work performed by the subcontractor is done under his strict supervision, discipline and reporting.

14.1.3 The Mandatary shall inform the Employer of any health and safety hazards and/or issue that the subcontractor may have brought to his attention.

14.1.4 The Mandatary shall inform the Employer of any difficulty encountered regarding compliance by the subcontractor with any health and safety instruction, procedure and/or legal provision applicable to the work the subcontractor performs on the Employer's premises.

15. SECURITY AND ACCESS

15.1 The Mandatary and his employees shall enter and leave the premises only through the main gate(s) and/or checkpoint(s) designated by the Employer. The Mandatary shall ensure that employees observe the security rules of the Employer at all times and shall not permit any person who is not directly associated with the work from entering the premises.

15.2 The Mandatary and his employees shall not enter any area of the premises that is not directly associated with their work.

15.3 The Mandatary shall ensure that all materials, machinery or equipment brought by him onto the premises are recorded at the main gate(s) and/or checkpoint(s). Failure to do this may result in a refusal by the Employer to allow the materials, machinery or equipment to be removed from the Employer's premises.

16. FIRE PRECAUTIONS AND FACILITIES

16.1 The Mandatary shall ensure that an adequate supply of fire-protection and first-aid facilities are provided for the work to be performed on the Employer's premises, save that the Parties may mutually make arrangements for the provision of such facilities.

16.2 The Mandatary shall further ensure that all his employees are familiar with fire precautions at the premises, which includes fire-alarm signals and emergency exits, and that such precautions are adhered to.

17. ABLUTION FACILITIES

17.1 The Mandatary shall ensure that an adequate supply of ablution facilities are provided for his employees performing work on the Employer's premises, save that the parties may mutually make arrangements for the provision of such facilities.

18. HYGIENE AND CLEANLINESS

18.1 The Mandatary shall ensure that the work site and surround area is at all times maintained to the reasonably practicable level of hygiene and cleanliness. In this regard, no loose materials shall be left lying about unnecessarily and the work site shall be cleared of waste material regularly and on completion of the work.

19. NO NUISANCE

19.1 The Mandatary shall ensure that neither he nor his employees undertake any activity that may cause environmental impairment or constitute any form of nuisance to the Employer and/or his surroundings.

19.2 The Mandatary shall ensure that no hindrance, hazard, annoyance or inconvenience is inflicted on the Employer, another Mandatary or any tenants. Where such situations are unavoidable, the Mandatary shall give prior notice to the Employer.

20. INTOXICATION NOT ALLOWED

20.1 No intoxicating substance of any form shall be allowed on site. Any person suspected of being intoxicated shall not be allowed on the site. Any person required to take medication shall notify the relevant responsible person thereof, as well as the potential side effects of the medication.

21. PERSONAL PROTECTIVE EQUIPMENT

21.1 The Mandatary shall ensure that his responsible persons and employees are provided with adequate personal protective equipment (PPE) for the work they may perform and in accordance with the requirements of General Safety Regulation 2 (1) of the OHS Act. The Mandatary shall further ensure that his responsible persons and employees wear the PPE issued to them at all material times.

22. PLANT, MACHINERY AND EQUIPMENT

22.1 The Mandatary shall ensure that all the plant, machinery, equipment and/or vehicles he may wish to utilize on the Employer's premises is/are at all times of sound order and fit for the purpose for which it/they is/are attended to, and that it/they complies/comply with the requirements of Section 10 of the OHS Act.

22.2 In accordance with the provisions of Section 10(4) of the OHS Act, the Mandatary hereby assumes the liability for taking the necessary steps to ensure that any article or substance that it erects or installs at the premises, or manufactures, sells or supplies to or for the Employer, complies with all the prescribed requirements and will be safe and without risks in terms of health and safety when properly used.

23. NO USAGE OF THE EMPLOYER'S EQUIPMENT

23.1 The Mandatary hereby acknowledges that his employees are not permitted to use any materials, machinery or equipment of the Employer unless the prior written consent of the Employer has been obtained, in which case the Mandatary shall ensure that only those persons authorized to make use of such materials, machinery or equipment, have access thereto.

24. TRANSPORT

24.1 The Mandatary shall ensure that all road vehicles used on the premises are in a roadworthy condition and are licensed and insured. The Mandatary shall ensure that all drivers shall have relevant and valid driving licenses and the Mandatary shall ensure that no vehicle/s shall carry passengers unless it is specifically designed to do and that all drivers shall adhere to the speed limits and road signs on the premises at all times.

24.2 In the event that any hazardous substances are to be transported on the premises, the Mandatary shall ensure that the requirements of the Hazardous Substances Act 15 of 1973 are complied with fully all times.

25. CLARIFICATION

25.1 In the event that the Mandatary requires clarification of any of the terms or provisions of this Agreement, he should take the necessary steps to contact the Risk Manager of the Employer to obtain such clarification.

26. DURATION OF AGREEMENT

26.1 This Agreement shall remain in force for the duration of the work to be performed by the Mandatary and/or while any of the Mandatary's employees are present on the Employer's premises.

27. NON COMPLIANCE WITH THE AGREEMENT

27.1 If the Mandatory fails to comply with any provisions of this Agreement, the Employer shall be entitled to give the mandatory 7 (seven) days written notice to remedy such non-compliance and if the Mandatory fails to comply with such notice, then the Employer shall forthwith be entitled but not obliged, without prejudice to any other rights or remedies which the mandatory may have in law,

271.1 to suspend the main Agreement; or

27.1.2 To claim immediate performance and/or payment of such obligations.

27.2 Should mandatory continue to breach the contract on three occasions, then the Employer is authorised to suspend the main contract without complying with the condition stated in the clause above.

28. HEADINGS

The headings as contained in this Agreement are for reference purposes only and shall not be construed as having any interpretative value in them or as giving any indication as to the meaning of the contents of the paragraphs contained in this Agreement.

Thus done and signed

at _____on the _____ day of _____ 201__

_____

For and on behalf of the Employer

Witnesses:

1. _____

2. _____

at _____on the _____ day of _____ 201__

_____

for and on behalf of the Mandatary

Witnesses:

3. _____

4. _____

TRANSNET
freight rail

A Division of Transnet SOC Limited

RAIL NETWORK (TECHNICAL)
ELECTRICAL

MANUAL

HANDBOOK FOR TESTING AND CALIBRATION OF RAILWAY ELECTRICAL PROTECTION EQUIPMENT

Author:	Manager Electrical Rail Network (Technical)	HPN du Plessis.
Approved:	Senior Engineer Rail Network (Technical)	L Webb.
Authorised:	Principal Engineer Rail Network (Technical)	C Du Toit / J Vosloo.

Date: 12 November 2012

Circulation Restricted To: Transnet Freight Rail

A Division of Transnet SOC Limited

RAIL NETWORK (TECHNICAL)

ELECTRICAL

MANUAL

HANDBOOK FOR TESTING AND CALIBRATION OF RAILWAY ELECTRICAL PROTECTION EQUIPMENT

Circulation Restricted To: Transnet Freight Rail

INTRODUCTION AND CONTENT

Commissioning and regular routine testing and calibration of protection equipment is required as an essential good practice to ensure that electrical equipment can be protected inherently in the event of abnormal conditions. It relies on sound calculations, appropriate device settings and effective earthing. Equipment that provides protection is installed in 3kV DC traction sub- & Tie stations, 25/50 kV AC Traction Substations, Distribution substations and Stepdown Signal supplies.

This handbook is a reference for testing of electrical equipment used in the railway electrification environment. It contains very important guidelines and procedures which should be followed during routine maintenance, commissioning and fault finding, and to ensure proper operation of protective devices. The intention of the manual is not to create a course in protection theory and design, but to serve as a practical guide for testing.

Testing entails different types of tests, whether routine calibration tests, conductivity earthing, commissioning, the test procedure on any piece of equipment is effectively the same. In this handbook special effort is directed towards:

- a basic explanation of the function of each device in the electrical system;
- its principle of operation;
- basic precautions;
- types of the tests;
- test equipment used;
- the test circuit;
- the test procedure;
- documentation, i.e. test sheet(s) used;
- the range of acceptable test results;
- special pitfalls;
- annexures which provides broader background to the design and application of to the equipment.

Frequent reference is be made to the content of the publication “Substation Electrician’s Handbook”, latest edition being BBF8190, and no duplication will be made of material covered in that publication. It is assumed that the reader is familiar with the contents thereof.

All personnel involved in testing of electrical installations must be thoroughly acquainted with the contents of this handbook. Each Test Officer responsible for traction substation must be issued with his own personal copy of the handbook.

This handbook also provides a basis for training of Test Officers in the duties of traction substation maintenance.

Note that it is a dismissible offence to disable protection equipment and circuits in any way.

RECORD OF AMENDMENTS

Note: Remove the existing pages and insert the new pages.

Amendment No	Section Reference	Version	Summary of amendments	Authorised by	Date
1	BBF8128_Cover-Content	2	Updated and reformatted entirely	CF du Toit	20 May 2016
2	BBF8128_Section_01	2	Updated and reformatted entirely	CF du Toit	20 May 2016
3	BBF8128_Section_02	2	Updated and reformatted entirely	CF du Toit	20 May 2016
4	BBF8128_Section_03	2	Updated and reformatted entirely	CF du Toit	20 May 2016
5	BBF8128_Section_04	2	Updated and reformatted entirely	CF du Toit	20 May 2016
6	BBF8128_Section_05	2	Updated and reformatted entirely	CF du Toit	20 May 2016
7	BBF8128_Section_06	2	Updated and reformatted entirely	CF du Toit	20 May 2016
8	BBF8128_Section_07	2	Updated and reformatted entirely	CF du Toit	20 May 2016
9	BBF8128_Section_08	2	Updated and reformatted entirely	CF du Toit	20 May 2016
10	BBF8128_Section_09	2	Updated and reformatted entirely	CF du Toit	20 May 2016
11	BBF8128_Section_10	2	Updated and reformatted entirely	CF du Toit	20 May 2016
12	BBF8128_Section_11	2	Updated and reformatted entirely	CF du Toit	20 May 2016
13	BBF8128_Section_12	2	Updated and reformatted entirely	CF du Toit	20 May 2016
14	BBF8128_Section_13	2	Updated and reformatted entirely	CF du Toit	20 May 2016
15	BBF8128_Section_14	2	Updated and reformatted entirely	CF du Toit	20 May 2016
16	BBF8128_Section_15	2	Updated and reformatted entirely	CF du Toit	20 May 2016
17	BBF8128_Section_16	2	Updated and reformatted entirely	CF du Toit	20 May 2016
18	BBF8128_Section_17	2	Updated and reformatted entirely	CF du Toit	20 May 2016
19	BBF8128_Section_18	2	Updated and reformatted entirely	CF du Toit	20 May 2016
20	BBF8128_Section_19	2	Updated and reformatted entirely	CF du Toit	20 May 2016
21	BBF8128_Section_20	2	Updated and reformatted entirely	CF du Toit	20 May 2016
22	BBF8128_Section_21	2	Updated and reformatted entirely	CF du Toit	20 May 2016

CONTENT

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01	GENERAL RESPONSIBILITIES FOR TESTING AND CALIBRATION
02	ROUTINE TESTING REQUIREMENTS
03	COMMISSIONING TESTING REQUIREMENTS
04	CURRENT TRANSFORMERS: INSULATION, RATIO, POLARITY AND MAGNETIZATION CURVES
05	TRANSFORMERS: INSULATION AND RATIO
06	TRANSFORMERS: OIL AND WINDING TEMPERATURE THERMOMETER
07	TRANSFORMERS: GAS OPERATED RELAY (BUCHHOLZ)
08	TRANSFORMERS: MAIN OVERLOAD RELAYS INSTANTANEOUS AND THERMAL
09	TRANSFORMERS: AUXILIARY OVERLOAD RELAYS INSTANTANEOUS AND THERMAL
10	AC EARTH LEAKAGE PROTECTION SYSTEM
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12	WAVE FILTER EQUIPMENT
13	DC EARTH LEAKAGE PROTECTION SYSTEM
14	EARTH RESISTANCE AND CONDUCTIVITY SYSTEM
15	PANEL METERS
16	3 KV UNDER-VOLTAGE PROTECTION
17	110 VOLT BATTERY UNDER-VOLTAGE PROTECTION
18	SECONDARY BREAKERS: 3 KV DC HIGH SPEED CIRCUIT BREAKERS
19	SECONDARY BREAKERS: 25/50 KV AC VACUUM CIRCUIT BREAKERS
20	SIGNAL AND DISTRIBUTION SUBSTATIONS: OVERCURRENT, EARTH FAULT, SENSITIVE EARTH FAULT AND CABLE PROTECTION.
21	VOLTAGE TRANSFORMERS: INSULATION AND RATIO

ACKNOWLEDGEMENTS

The contributions of Atholl Bruyns. Coert van Straaten, Pieter le Roux and others, who greatly contributed towards the compilation of this handbook through their knowledge and experience, is hereby acknowledged.

Mallon Tallies and Khimane Motupa assisted with recording some of the procedures.

***

SECTION 01

RESPONSIBILITY FOR TESTING AND CALIBRATION

1.1 GENERAL

1.1.1 Electrical Protection Staff must be appointed at various depots, to ensure the integrity of supply systems which include commissioning and routine testing of HV protection systems.

1.2 RESPONSIBILITY OF THE RESPONSIBLE ELECTRICAL ENGINEERING OFFICER

1.2.1 The responsible electrical engineering officer is responsible for:

1.2.1.1 The proper functioning of the Electrical Protection section in terms of facilities skilled manpower, facilities, vehicles and equipment. A schedule of test equipment is included in Annexure 1.1

1.2.1.2 Defining the duties to be performed and control the standard of work.

1.2.1.3 Maintaining a database of protection devices with associated calibration calculations for breakers i.e. circuits, along with loop impedance test results where available. A schedule of assets is included in Annexure 1.1

1.2.1.4 Calibration of test equipment.

1.2.1.5 Corrective action to exceptions.

1.2.1.6 Outsourcing the functions if responsibilities cannot be met with in-house staff, under strict controls of standards and work procedures.

1.3 DUTIES WITH RESPECT TO PROTECTION TESTING

1.3.1 Duties of the Electrical Protection Officer

1.3.1.1 Electrical Protection staff will be responsible for the routine testing and calibration of HV protective equipment in accordance with a routine program drawn up by the responsible electrical engineering officer. This program will be based on guidelines and a time cycle laid down by the Principal Electrical Engineer.

1.3.1.2 The settings for new equipment will be provided by the Technology Management section. Electrical Protection Officers may not change these settings.

1.3.1.3 Protection staff at depots will be responsible for maintaining a data base of all base loads and protection settings, and notifying the Manager (Resource optimisation) of any change in base loads or the protection settings.

1.3.1.5 When Infrastructure managers require special tests or assistance, the procedure to be followed are fully detailed in Engineering Instruction CEE-GI_045.

1.3.1.6 The management of protection settings is indicated in Appendix 1.

1.3.2 Duties of Substation Maintenance Electricians

1.3.2.1 The tasks with respect to substation protection and earthing safety systems are defined in the Traction Substations Electrician Handbook (BBF8190).

1.3.2.1 Electricians responsible for substation maintenance are not permitted to adjust or tamper with protection relays. They must however check all cable connections to the various components associated with DC and AC Earth Leakage protection as well as under-voltage on a routine basis, as well as after severe earth faults.

1.4 INSTRUMENTS

1.4.1 The responsible electrical engineering officer must provide the electrical protection staff with the instruments required to perform their normal duties. These tools are indicated in this handbook, for the specific equipment present in the section.

1.5 REPORTS AND TEST SHEETS

1.5.1 Protection staff at every depot shall submit copies of regular test reports to the Maintenance Manager (Electrical) concerned.

1.6 ASSOCIATED INSTRUCTION AND APPENDIX

1.6.1 CEE-GI_045: Management and Responsibilities of Infrastructure's Electrical Laboratory.

1.6.2 The following Appendix forms part of this instruction:-

Appendix 1: Protection setting data flow.

1.7 REFERENCES

- Electrical Safety Instructions (BBF3690)
- Traction Substations Electrician Handbook (BBF8190)
- Relevant Manufacturers Specifications And Manuals Of Substation Equipment
- Substation Wiring Diagrams
- Electrical Engineering Instructions: CEE-GI _012, CEE-S_013 & CEE-GI_029

1.8 COMPETENCY

1.8.1 Only persons authorised in terms of clauses 303.1.4.6 or 303.1.7.1 of the Electrical Safety Instructions (BBF3690) shall be allowed to perform high voltage tests in the substations.

1.9 PREPARATION

- Ascertain that all required tools & equipment as per Appendix 1 are available.
- Obtain reference handbooks, engineering instructions and substation schematic diagrams.
- Arrange with the relevant depot staff for access to the substation or tie-stations for taking out the relevant work/test permits.
- Obtain copies of the previously completed test results and substation reports.
- Ensure that all relevant test sheets are available for testing.

Annexure 1.1

DATABASE PROFILE FOR ELECTRICAL PROTECTION ASSET REGISTER

	Aspect and technical reference	*file*	*Subsection*	*Detail*
1.1	*ELECTRICAL PROTECTION EQUIPMENT*	Inventory of Protection installed.	Substation site (50kV, 25kV or 3kV). (workload or Electrical Protection Officers)	Equipment detail per site: -Substations 3kV -Substations 25kV -Switching stations 25kV -Distributions subs -Distributions intake subs
1.2		*3kV HSCBs*	Inventory o HSCB's (workload or Substation electricians)	Substation site Reports sheet per equipment -HSCB type -Equipment detail per site. -HSCB Setting -Work procedure (TA Handbook, specific manufacturer instructions)
1.3		Protection calculations and settings	Equipment material per circuit.	-OHTE/Cable/Return material per circuit. -Loop-impedance calculations per circuit. (AC & DC). -Calculations
1.4			Substation protection settings per equipment	Per installation: -Types relays, CT ratios, -Schedule o testing. -PCB (Main transformer) -HSCB/Track breaker -AC Earth Leakage -DC Earth Leakage -Auxiliary Transformer OL -Battery Under-voltage -Substation Under-voltage (DC)
1.5			Commissioning test recordings & sign-offs per sub	Commissioning sign-offs (3kV: BBC9921).
1.6			Test sheet per Sub	-Status o protection testing -DC Traction Substation: BBB0342, BBB0343 & BBB0344. -Traction Substation (Brown Boveri): BBB0345. -E L & P Substation BBB0346 -E L & P Intake Substation: BBB0348. -Sub defect report: BBB0347.
2.1	*PROTECTION MAINTENANCE RESOURCES*	Availability of test resources,	Skilled personnel in place	-Skilled personnel in place

	Aspect and technical reference	*file*	*Subsection*	*Detail*
2.2		Availability of test equipment	Schedule of test instruments and equipment	-3 Phase Generator, Hand tools, Extension leads, Test Leads, -Water container and Petrol container -Null Balance Digital Earth Megger -10kV Digital Megger -4 kV DC Hi Pot Test Set -25 kV AC Hi Pot Test Set -Primary Injection Test set variable 500/1000 Amps. -Secondary Injection Test set, variable from 0 to 100 Amps -AC / DC Injection Test Set, 200A, variable 0 to 250V -LCR Meter -Digital Millisecond Timer, 999 seconds -Multimeter Analog (A.V.O.) -2 x Multi-meters Digital (R.M.S.) -DC Milli-volt Injection Set, 100mV -Bucholtz Pump (air compressed pump or bicycle pump) -Heating Apparatus (Oil heating) -Thermometer -Emergency Lighting -Boom crane
2.3			Calibration of instruments	Calibration intervals - BBD5294. Calibration certificates.
3.1	*PROTECTIVE DEVICES – LIGHTNING PROTECTION*	Inventory. Workload (of Electricians)	Equipment detail per site. Reports sheet per equipment	-Equipment location -Earth tests results -**BBD…(standard report sheet)**
3.2	*AC/DC PROTECTIVE DEVICES*	Inventory of devices (workload of Electricians)	Changeover sites	Equipment detail per site. -Reports sheet per equipment Location (e.g. Mast location) -Prescribed report sheet **(BBC…)**

***

SECTION 2

ROUTINE TESTING REQUIREMENTS

2.1 DC TRACTION SUBSTATIONS

2.1.1 The following routine testing must be performed

BBF9000: CT Ratio and Magnetisation curves. Overload relays: Thermal & Instantaneous. AC earth Leakage, Buchholz, Over-temperature and Pressure Relief Device.

BBF9001: DC Earth Leakage, Metering, Wave Filter Equipment, Diode & Rectifier Over temperature, 3 kV DC Under voltage Relay, Battery Under voltage Relay and Phase Fail relay.

BBF9295: Earth and Insulation Measurements.

BBB0344: Transformer / Rectifier protection Trafogaurd T100.

BBB0345: Transformer / Rectifier protection Brown Boveri.

BBB0347: Substation Defect Report.

BBB0348: Transformer Insulation & Ratio tests.

BBB0349: Insulation oil report.

2.2 DC TRACTION TIE-STATIONS

2.2.1 The following routine testing must be performed

BBF9294: Battery and 3kV Under-voltage protection, kV Meter, DC Earth Leakage, Earth and Insulation Measurements.

BBB0347: Substation Defect Report.

2.3 25KV TRACTION SUBSTATIONS

2.3.1 The following routine testing must be performed

BBF8995: Current transformers: Ratio and Magnetisation curves. Protection Relays Main Overload- and Restricted/Duo Biased Earth Fault Protection. Buchholz, Over-temperature, PRD, Battery Under voltage Relay and Earth Resistance measurement.

BBF8996: Current transformer: Ratio and Magnetisation curves. Battery Under voltage Relays. Protection Relays: IDMT, Reverse power, Thermal Overload and Distance Protection.

BBF8998: Primary Circuit Breakers: Contact Resistance and Operational Timing tests. Secondary Circuit Breakers (VCB's): Contact Resistance and Operational Timing tests.

BBB0347: Substation Defect Report.

2.4 DISTRIBUTION INTAKE SUBSTATIONS

2.4.1 The following routine testing must be performed

BBF9296: Frame Leakage Protection: Current Transformer Ratio and Mag Curves. Zone Relay inter-tripping. Insulation Resistance and Pressure tests. Voltage Transformer and Indication tests. Battery Under-voltage protection. Earth Resistance Measurement.

BBF9297: Current Transformers: Ratio, Magnetisation curves and Polarity tests. Protection Relays: Overload, Earth fault, Sensitive Earth Fault and Cable Protection. Transformer Protection.

BBB0344: Transformer protection Trafogaurd T100.

BBB0346: Electrical Light and Power.

BBB0347: Substation Defect Report.

BBB0348: Transformer Insulation & Ratio tests.

2.5 DISTRIBUTION RING SUBSTATIONS

The following routine testing must be performed

BBF9296: Frame Leakage Protection: Current Transformer Ratio and Mag Curves. Zone Relay inter-tripping. Insulation Resistance and Pressure Tests. Voltage Transformer and Indication tests. Battery Under voltage protection. Earth Resistance Measurement.

BBF9297: Current Transformers: Ratio, Magnetisation curves and Polarity tests. Protection Relays: Overload, Earth fault, Sensitive Earth Fault and Cable Protection. Transformer Protection.

BBB0344: Transformer protection Trafogaurd T100.

BBB0346: Electrical Light and Power.

BBB0347: Substation Defect Report.

BBB0348: Transformer Insulation & Ratio tests.

2.6 EQUIPMENT REQUIRING EARTHING TESTS

2.6.1 The following routine testing must be performed:

- Earth spike readings at transmission line terminations and stepdown points, according to Section 14.2.0 of the Technical Assistant Handbook EP001. This testing must be performed at 5-yearly intervals and proper records kept.
- Spark gap testing at all locations, excluding substations, where installed to provide a fault path between AC and DC negative return circuits.

2.7 FREQUENCY OF TESTING

Routine tests on 3kV DC Substations to be conducted as per yearly time cycle are described below.

At all other substations the routine tests to be conducted as per 2 yearly time cycle are described below.

NOTE: All high voltage tests (>1000V) must be carried out in accordance with clause 609 of the Electrical Safety Instructions (BBF3690)

2.8 ANNEXURES: ELECTRICAL TEST LABORATORY TEST SHEETS

BBF9000: CT Ratio and Magnetisation curves. Overload relays: Thermal & Instantaneous. AC earth Leakage, Buchholz, Over temperature and Pressure Relief Device.

BBF9001: DC Earth Leakage, Metering, Wave Filter Equipment, Diode & Rectifier Over temperature, 3 kV DC Under voltage Relay, Battery Under voltage Relay and Phase Fail relay.

BBF9294: 3 kV DC Traction Tie Station Test Sheet. 3 kV and Battery under voltage protection, KV Meter, DC Earth Leakage protection, Earth and Insulation measurements.

BBF9295: Earth and Insulation Measurements.

BBB0344: Transformer / Rectifier protection Trafogaurd T100.

BBB0345: Transformer / Rectifier protection Brown Boveri.

BBB0347: Substation Defect Report.

BBB0348: Transformer Insulation & Ratio tests.

BBB0349: Insulation oil report.

BBF8995: Current transformers: Ratio and Magnetisation curves. Protection Relays Main Overload- and Restricted/Duo Biased Earth Fault Protection. Buchholz, Over-temperature, PRD, Battery Under voltage Relay and Earth Resistance measurement.

BBF8996: Current transformer: Ratio and Magnetisation curves. Battery Under voltage Relays. Protection Relays: IDMT, Reverse power, Thermal Overload and Distance Protection.

BBF8998: Primary Circuit Breakers: Contact Resistance and Operational Timing tests. Secondary Circuit Breakers (VCB's): Contact Resistance and Operational Timing tests.

BBF9296: Frame Leakage Protection: Current Transformer Ratio and Mag Curves. Zone Relay inter-tripping. Insulation Resistance and Pressure tests. Voltage Transformer and Indication tests. Battery Under voltage protection. Earth Resistance Measurement.

BBF9297: Current Transformers: Ratio, Magnetisation curves and Polarity tests. Protection Relays: Overload, Earth fault, Sensitive Earth Fault and Cable Protection. Transformer Protection.

BBB0346: Electrical Light and Power.

Rail Network Maintenance												BBF9000 Version 3
3 kV DC Traction Substations Test Sheet: Main and Auxilliary Transformer protection. Current transformers Ratio and Magnetisation Curves. Overload relays:Thermal & Instantaneous. AC earth Leakage Protection. Buchholtz, Overtemperature, Pressure Relief Device.												TRANSNET freight rail
Substation:				Single / A / B Unit			Routine :			Commissioning:		
CT Ratios												
Main Overcurrent/Metering I_{FL}=				Auxilliary Overcurrent I_{FL}=			AC earth Leakage			Winding Overtemp		
Marked		Measured		Marked		Measured	Marked		Measured	Marked		Measured
Magnetization curves												
Main Overcurrent				Main Metering			Auxilliary Overcurrent			AC earth Leakage		Winding Overtemp	
Volts	Red	White	Blue	Volts	Red	Blue	Volts	Red	Blue	Volts	Amps	Volts	Amps
Overcurrent Relay elements			Relay makes and types.			Mains:			Auxilliary :			AC Earh Leakage:	
Main thermal		Iset=	xIn	Tset=		Main Instantaneous		Iset=	xIn	T set= 0		AC Earth Leakage	I set	Tset
Operating time in seconds	Multiple	Amps	Specified	Actual		Operating time in seconds	Multiple	Amps	Specified	Actual		Relay Trips Primary Circuit Breaker to Lockout and indication from PCB & CT bases,Main transformer Tank & Auxiliary Transformer fence.		Primary trip amps
	2 x I_{FL}						3.5 x I_{FL}							
	3 x I_{FL}						4 x I_{FL}							
Trip PCB giving indication:			Yes/No			Trip PCB giving indication:			Yes/No					
Auxilliary thermal		Iset=	xIn	Tset=		Auxilliary Instantaneous		Iset=	xIn	T set= 0		Test for parallel paths to main earth from:	PCB structure	
Operating time in seconds	Multiple	Amps	Specified	Actual		Operating time in seconds	Multiple	Amps	Specified	Actual			CT structure	
	2 x I_{FL}						3.5 x I_{FL}						Main Transformer	
													Aux transformer fence	
Trip PCB giving indication:			Yes/No			Trip PCB giving indication:			Yes/No					
Main Transformer Protection														
Buchholtz: Relay trips PCB giving Lockout & Indication with _____cc of air . **Pressure Relief Device**: Simulation trips PCB giving Lockout & Indication. Yes/No														
Oil Over temp: Relay trips PCB giving Indication at _____°C dail setting. **Winding Over temp**: Relay trips PCB giving Lockout & Indication at _____°C dail setting.														
Auxilliary Transformer Protection														
Buchholtz: Relay trips PCB giving Lockout & Indication with _____cc of air .														
Tested by: Name:			Signature:			Witnessed by: Name:			Signature:			Date:		

Rail Network Maintenance												BBF9001 Version 3
3 kV DC Traction Substations Test Sheet: 3 kV DC Protection DC Earth Leakage, Metering, Wave Filter Equipment, Diode & Rectifier Overtemperature. 3 kV DC Undervoltage Relay. Battery Undervoltage Relay. Phase Fail relay.												TRANSNET freight rail
Substation:								Routine :		Commissioning:		
DC Earth Leakage Protection	Tested by DC current injection											
Relay operates at _____ amps tripping PCB and HSCB's to lockout with indication from the following:												
Control Panels	Rectifier screen	Rectifier Base	Anode Wall Plates	Positive Isolator	LV Distribution board	Wave Filter Room	Chequer plates	HSCB Cells	Battery charger	Telecontrol Panel	3 kV DC UVR Base	3 kV DC Busbar Chamber
4 kV DC Voltmeters					4 kA DC Ammeter			Wave Filter Equipment				
Substandard	Rectifier	% Error	Pos.Isolator	% Error	Indication	Mv	% Error	Harmonic	6 th	12 th	18 th	24 th
1000					1000			Frequency	(300 hz)	(600 hz)	(900 hz)	(1200 hz)
2000					2000			Capacitance uF				
3000					3000			Inductance mH				
4000					4000			Coil Spacing mm				
								Discharge Resistor: kOhm				Fuse:
Rectifier Protection												
Rectifier Pressure tested on Commissioning at 10.5 kV AC for 60 sec.						Passed/Failed						
Rectifier diode Monitoring	Tested by fibre optic simulation tost											
Diode failure indication switch on with PCB trip to lockout with indication: Yes/No												
Rectifier temperature control	Tested by fibre optic simulation test											
Fans switch on at 50 ° C:						Yes/ No	Primary Circuit Breaker trip at 80 ° C with indication:					Yes/No
Fan failure trip Primary Circuit Breaker to lockout with indication :						Yes/No	Fan switch on at 700 amps load current @ _____mVolt injection					Yes/No
Rectifier Attenuation Protection:	PCB trips to lockout with indication by simulating striker pin fuse operation on both 1.5 kV and 3kV circuits											Yes/No
3kV DC Undervoltage Protection	Tested by applied DC High Voltage											
Relay tested to pick up at _____ volts and drop out at _____volts tripping HSCB's with indication.												
Battery undervoltage protection: Relay tested to pickup at _____ and dropout at _____ Volts tripping PCB and HSCB's with indication and Lockout.												
Phase Fail Protection: Relay tested to trip PCB giving lockout and indication on simulation phase fail.									Yes / No			
Tested by: Name:	Signature:				Witnessed by: Name:			Signature:				Date:

Rail Network Maintenance	BBF9294 Version 3
3 kV DC Traction Traction Tie Station Test Sheet **3 kV and Battery Undervoltage Protection. KV Meter** **DC Earth Leakage Protection. Earth and Insulation Measurements.**	TRANSNET freight rail
Substation: **Routine :** **Commissioning:**	

3kV DC Undervoltage Relay	Tested by appliec voltage
Relay tested to pick up at _____ volts and drop cut at _____volts tripping HSCB's with lockout and flag indication.	

Battery Undervoltage Relay	Tested by appliec voltage
Relay tested to pick up at _____ volts and drop out at _____volts tripping HSCB's with lockout and indication	

DC Earth Leakage Protection	Tested by DC current injection
Relay operates at _____ amps tripping PCB and HSCB's to lockout with flag incicatien from the following:	

Chequer plates	HSCB Cells	Control Panels	UVR	Battery charger	Telecontrol Panel

4 kV DC Voltmeter

Standard	Indication	% Error
1000		
2000		
3000		
4000		

Earth and Insulation Measurements

Soil Condition:	Wet	Dry	Sand	Gravel	Clay	Rock	Filled

Earth Measurements	Measured	Acceptable	Insulation Measurements	Measured	Acceptable
Resistance between spikes		>2000 Ω	Tie Station Earth to Negative		>3000 Ω
Test Spike to Tie station Earth		<5 Ω	Tie Station Earth to DC Earth Leakage		>25 Ω
Test Spike to Tie station Negative		>3000 Ω	Tie Station Earth to Rail		>5 Ω
Test Spike to Tie station DC Earth Leakage		>25 Ω	Negative to DC Earth Leakage		>3000 Ω
Test Spike to Rail		>5 Ω	Negative to Rail		>3000 Ω
Test Spike to Track Switch Earth		<5 Ω	DC Earth Leakage to Rail		>30Ω

Tested by: Name:	Signature:	Witnessed by: Name:	Signature:	Date:

Rail Network Maintenance	BBF9295 Version 3
3 kV DC Traction Traction Substation Test Sheet **Earth and Insulation Measurements.**	TRANSNET freight rail
Substation: **Routine :** **Commissioning:**	

Earth and Insulation Measurements

Soil Condition:	Wet	Dry	Sand	Gravel	Clay	Rock	Filled

Earth Measurements	Measured	Acceptable	Insulation Measurements	Measured	Acceptable
Resistance between spikes		<2000 Ω	Sub Earth to AC Earth Leakage Unit A		>10 Ω
Test Spike to Substation Earth		<5 Ω	Sub Earth to AC Earth Leakage Unit B		>10 Ω
Test Spike to Substation AC Earth Earth Leakage Unit A		>10 Ω	Sub Earth to Negative		>3000 Ω
Test Spike to Substation AC Earth Earth Leakage Unit B		>10 Ω	Sub Earth to DC Earth Leakage		>25 Ω
Test Spike to Substation Negative		>3000 Ω	Sub Earth to Rail		>5 Ω
Test Spike to Substation DC Earth Leakage		>25 Ω	AC Earth Leakage Unit A to Substation Negative		>3000 Ω
Test Spike to Rail		>5 Ω	AC Earth Leakage Unit A to DC Earth Leakage		>35 Ω
Test Spike to Track Switch Earth		<5 Ω	AC Earth Leakage Unit A to Rail		>15 Ω
			AC Earth Leakage Unit B to Substation Negative		>3000 Ω
			AC Earth Leakage Unit B to DC Earth Leakage		>35 Ω
			AC Earth Leakage Unit B to Rail		>15 Ω
			Negative to DC Earth Leakage		>3000 Ω
			Negative to Rail		>3000 Ω
			DC Earth Leakage to Rail		>30 Ω

Tested by: Name:	Signature:	Witnessed by: Name:	Signature:	Date:

Infrastructure (Maintenance) **BBB0344 Version 2**

Electrical Test Laboratory
Traction Substation
Test Sheet

TRANSNET freight rail

SUBSTATION: **DATE:**

MAIN/AUX TRANSFORMER PROTECTION

TRAFOGAURD T100

LIST OF AVAILABLE ADJUSTMENTS
*SET NOMINAL TRFO CURRENT, ITN (30% - 100%) OF IN1 RATED CT PRIMARY CURRENT
*SET INSTANTANEOUS OVERCURRENT TRIP LEVEL, 1>> (200% - 500%) OF IT 400%
*SET INVERSE – TIME CURVE CURRENT THRESHOLD, 1> (100% - 400%) OF IT 200%
*SET INVERSE – TIME CURVE TIME MULT.KT (10MIN – 60MIN) NB: 30MIN

EXAMPLE:
CT RATIO 150/5
NOMINAL EXPECTED CT PRIMARY CURRENT ITN = 105AMP (FULL LOAD OF TRAFO)
THUS ITN/IN1 = 105/150
= 70%
ITN SETTING = 70%

NOTE: AFTER THE SYSTEM IS ENERGISED, 105 AMP IN THE CT PRIMARY CIRCUIT NOW CORRESPOND TO A 100% READING WHEN THE CONTINUOUS IT DISPLAY IS SELECTED. INDICATING FULL LOAD CURRENT.
200% WILL TRIP OCB/SF6 IN 1800 SEC
300% WILL TRIP OCB/SF6 IN 118 SEC
400% WILL TRIP OCB/SF6 IN 30 MILLISECONDS

TEST AND CALIBRATION OF TRAFOGAURD T100

CT RATIO	R PHASE	Y PHASE	B PHASE
MARKED			
MEAS.			

SETTINGS

KT = 30 MINUTES
I>> = 400%
I> = 200%

ITN SETTING

*FULL LOAD OF TRAFO = AMP
*CT RATIO =
*ITN = F/L DEVIDED BY CT PRIMARY TIMES 100%
THUS ITN= = %

BITT SWITCHES

1 = OFF
2 = OFF (STANDARD CURVE
3 = ON (30 MILLISECONDS)
4 – 8 = OFF

TEST RELAY BY PRIM/SEC INJECTION AS FOLLOWS:

300%	R PHASE	Y PHASE	B PHASE
TIME:	S	S	S
TRIP OCB			

400%	R PHASE	Y PHASE	B PHASE
TIME:	M/S	M/S	M/S
TRIP OCB			

TESTED BY: _____

Infrastructure (Maintenance) **BBB0345 Version 2**

Electrical Test Laboratory
Traction Substation (Brown Boveri)
Test sheet

TRANSNET freight rail

Name: _____

Date: _____

Nature: R/C _____

Relay Type: **Red Phase:** _____ **Blue Phase:** _____

Full Load Current: Primary: _____ A Secondary: _____ A

Current Transformer Ratio:

Relay Tested: Prim/ Sec/ TW Injection

Thermal O/L: Red Phase Setting: _____

Preheat Relay At 2 X Full load = _____ A to 22 °C

Inject 3 X Full load = _____A Relay Operate In _____ Seconds

Relay Trip OCB: Yes / No Relay Indication: Yes / No

Instantaneous O/L: Red Phase Setting: _____

Inject 3,75 X Full load = _____ A

Relay Trip OCB: Yes / No Relay Indication: Yes / No

Thermal O/L: Blue Phase Setting: _____

Preheat Relay At 2 X Full load = _____ A to 22 °C

Inject 3 X Full load = _____A Relay Operate In _____ Seconds

Relay Trip OCB: Yes / No Relay Indication: Yes / No

Instantaneous O/L: Blue Phase Setting: _____

Inject 3,75 X Full load = _____ A

Relay Trip OCB: Yes / No Relay Indication: Yes / No

Tested By: _____ Date: _____

Approved By: _____ Date: _____

Infrastructure (Maintenance) **BBB0347 Version 2**

Electrical Test Laboratory
SUB DEFECT REPORT

TRANSNET freight rail

GRADE: SENIOR ENGINEERING TECHNICIAN
ADDRESS:

TO: MAINTENANCE MANAGER
DEPOT:
DATE:

OUR REF.:

PROTECTION DEFECT REPORT

The following DEFECTS were found during commissioning / routine testing:

At : E.L.&P. /TRACT. Sub-, Tie station:

TESTED BY : _____ SIGNATURE : _____

*Please attend to these defects and complete bottom portion of this form within two months after receiving report and send back to **TEST LAB**.*

TO: SENIOR ENGINEERING TECHNICIAN

FROM : MAINTENANCE MANAGER
DEPOT:

YOUR REF:

CORRECTION ACTION REPORT

The following REPAIRS were done for :

At : E.L.&P. / TRACT. Sub-, Tie-station :

These defects were repaired by :

Technician : _____ Technical Supt. : _____
And reported to TECHNICAL MANAGER/SUPT.

Checked by
Date : _____ Chief Eng. Technician : _____

If any assistance is needed to solve or repair a defect and re-testing is necessary, please contact Senior Engineering Technician. Before the Final correction report is sent through.
THANK YOU FOR YOUR CO-OPERATION.

Infrastructure (Maintenance) BBB0348 Version 2

Electrical Test Laboratory
Traction / E L & P Substation
Test Sheet

TRANSNET freight rail

SUBSTATION: _____ **DATE:** _____

TRANSFORMER: _____

MAKE: _____ KVA : _____

SERIAL NO.: _____ VOLTAGE: _____

DATE OF MANUFACTURE: _____ VECTOR: _____

INSULATION RESISTANCE TEST: 2 500 V MEGGER (2 mΩ/kV = Good norm)

EARTH TO HT: _____ HT TO LT1: _____

EARTH TO LT1: _____ HT TO LT2: _____

EARTH TO LT2: _____ HT TO AUX.: _____

EARTH TO AUX.: _____ LT1 TO LT2: _____

LT2 TO AUX.: _____ LT1 TO AUX.: _____

VOLTAGE RATIO TEST: 3 PHASE GENERATOR

SUPPLY VOLTAGE (3 phase) _____V

	Primary	Secondary	TAP 1	TAP 2	TAP 3	TAP 4	TAP 5
LT1:			V	V	V	V	V
			V	V	V	V	V
			V	V	V	V	V
			V	V	V	V	V
LT2:			V	V	V	V	V
			V	V	V	V	V
			V	V	V	V	V
			V	V	V	V	V
AUXILIARY:			V	V	V	V	V
			V	V	V	V	V

AT TAP No. 3: CALCULATED RATIO = HT/LT = _____ / _____ = _____

MEASURED VOLTAGE = SUPPLY V / RATIO = _____ / _____ = _____ V

TESTED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

Infrastructure (Maintenance) BBB0349 VER 2

Electrical Test Laboratory
TEST CERTIFICATE

TRANSNET freight rail

SUBSTATION: _____ DATE: _____

OIL TEST REPORT

	DESCRIPTION
SUBSTATION	
TRANSFORMER	
MAKE	
DATE OF MANUFACTURE	
SERIAL No.	
KVA RATING	
VOLTAGE HV/LV	
DATE OF SAMPLE	
OIL VOLUME GAL/LITRE	

	TEST RESULTS BOTTOM SAMPLE	ACTION REQUIRED
OIL TEMPERATURE DEG. C		
WATER CONTENT/KARL FISCHER (ppm)		
APPEARANCE/COLOUR OF OIL		
N.N. ACIDITY mg KOH/g OIL		
DIELELECTRIC BREAKDOWN STRENGTH AVR. (kV)		
RECOMMENDATION		

A THE SAMPLE COMPLIES WITH THE REQUIREMENTS.

B THE OIL MUST BE FILTERED IN ORDER TO IMPROVE ITS DIELELCTRIC BREAKDOWN STRENGTH.

C THE OIL MUST BE FILTERED WITH HEAT AND VACUUM IN ORDER TO REMOVE THE EXCESS MOISTURE.

D OIL MUST BE REGENERATED/REPLACED AND A SAMPLE SUBMITTED AFTER 6 MONTHS. (SHOULD THE ACIDITY HAVE INCREASE BY MORE THAN 0,03mg KOH/g OIL, THE TRANSFORMER SHALL BE DE-SLUDGED).

E A SLUDGE TEST MUST BE CARRIED OUT. PLEASE SUBMIT SAMPLE FOR TEST.

TESTED BY: _____

Rail Network Maintenance												BBF8995 Version 2	
25 kV AC Traction Substations Test Sheet: Main Transformer Protection. Current transformers:Ratio and Magnetisation Curves Protection Relays Main Overload- and Restricted/Duo Biased Earth Fault Protection. Buchholtz, Overtemperature & PRD. Battery Undervoltage Relay. Earth Resistance measurement.												TRANSNET freight rail	
Substation:				Single / A / B Unit		Routine :		Commissioning:					
;									Main Transformer IFL			Primary: A	Secondary A
HV Overcurrent		LV Overcurrent		HV REF/Duo Bias Ph 1		HV REF/Duo Bias Ph 2		LV REF/Duo Bias Ph 1		LV REF/Duo Bias Ph 2		Winding Overtemp	
Magnetization curves													
HV Overcurrent		LV Overcurrent		HV Restr. E/Fault Ph 1		HV Restr. E/Fault Ph 2		LV Restr. E/F Ph 1		LV Rest. E/F Ph 2		Winding Overtemp	
Volts	m Amps	Volts	m Amps	Volts	m Amps	Volts	mAmps	Volts	mAmps	Volts	mAmps	Volts	Amps
Overcurrent Relay elements		Relay makes and types				Overcurrent:			Restricted E/F:			Duo Biased:	
HV IDMTL (NI)		Iset= xIn		Tset=		HV Instantaneous		Iset= xIn		T set= 0		Restricted Earth Fault V/I set =	
Operating time in seconds	Multiple	Amps	Specified	Actual		Operating time in seconds	Multiple	Amps	Specified	Actual		Operating voltage/current	Phase to N
	1.25 x Iset						4.00 x Iset					HV Secondary voltage/current	
	2.00 X Iset						6.00 x Iset					LV Secnary voltage/ current	
LV IDMTL (NI)		Iset= xIn		Tset=		LV Instantaneous		Iset= xIn		T set=		Duc Biased Fault I HV set = I LV set=	
Operating time in seconds	Multiple	Amps	Specified	Actual		Operating time in seconds	Multiple	Amps	Specified	Actual		Operating current	Phase to N
	1.25 x Iset						4.00 x Iset					HV secondary injected curren:	
	2.00 X Iset						6.00 x Iset					LV secondary injected current	
Trip PCB giving indication:			Yes/No			Trip PCB giving indication:			Yes/No			Trip PCB to lockcut & indication:	Yes/No
MainTransformer Protection													
Buchholtz: Relay trips PCB giving Lockout & Indication with _____ cc of air .						Pressure Relief Device: Simulation trips PCB giving Lockout & Indication. Yes/No								
Oil Over temp: Relay trips PCB giving Indication at _____ °C dail setting.						Winding Over temp: Relay trips PCB giving Lockout & Indication at _____ °C dail setting.							
Battery undervoltage protection: Relay tested to pickup at _____ and dropout at _____ Volts tripping PCB with indication and Lockout													
Phase Fail Protection: Relay tested to trip PCB giving lockout and indication on simulation phase fail.										Yes / No			
Earth resistance test: Resistance between spikes=_____ohms								Resistance from spikes to main earth= _____ ohms					
Tested by: Name:		Signature:		Witnessed by: Name:				Signature:				Date:	

Rail Network Maintenance								BBF8996 Version 2			
25 kV AC Traction Substations Test Sheet Incomer and Track Feeder VCB's: Current Transformer Ratio and Mag. curves. Battery Undervoltage Relays. Protection Relays: IDMT, Reverse power, Thermal Overload and Distance Protection.								TRANSNET freight rail			
Substation:	Single / A / B Unit		Routine :		Commissioning:						
Panel No											
Designation	Incomer										
CT Winding	P1/1S		P1/1S Dist. Prot		P1/2S Therm O/load			P1/1S Dist. Prot		P1/2S Therm O/load	
CT Ratio Marked	1200/1		1200/1		1200/1			1200/1		1200/1	
CT Ratio Measured											
Magnetisation curves	Volts	Amps	Volts	Amps	Volts	Amps		Volts	Amps	Volts	Amps
Time delay Overcurrent Protection Relays	IDMTL Relay:				Thermal Relay:				Thermal Relay :			
	(NI) I>set= xIn		t set =		Ith>set= xIn		t set =		Ith>set= xIn		T set =	
Operating time in seconds to trip VCB's with indication.	Multiple	Amps	Specified	Actual	Multiple	Amps	Specified	Actual	Multiple	Amps	Specified	Actual
	2 x Iset				2.00 x Iset				2.00 x Iset			
Instantaneous Overcurrent Protection Relays:	IDMT Relay:				(1)IDMT (2)Backup Relay:				(1)IDMT (2)Backup Relay:			
	(NI) Iinstset= xIn		t set =		(1)IIDMTset= xIn		t set =		(1)IIDMTset= xIn		t set =	
					(2) Iinstset= xIn		t set =		(2) Iinstset= xIn		t set =	
Operating time in seconds to trip VCB's with indication.	Multiple	Amps	Specified	Actual	Multiple	Amps	Specified	Actual	Multiple	Amps	Specified	Actual
	4 x Iset				(1)2 x Iset				(1)2 x Iset			
					(2)4 x Iset				(2)4 x Iset			
Reverse power and Distance Protection Relays: Make & Type:	Reverse power:				Distance Protection:				Distance Protection:			
	Current direction	Tripping Amps			Zone	R X	Specified	Operating	Zone	R X	Specifiec	Operating
Operating values to trip VCB's with indication.	Forward				1				1			
	Reverse				2				2			
	Voltage applied				3				3			
					4				4			
					5				5			
Battery undervoltage protection relays	Set to pickup at_____and dropout at _____volts tripping VCB to lockout				Set to pickup at_____and dropout at _____volts tripping VCB to lockout				Set to pickup at_____and dropout at _____volts tripping VCB to lockout			
Tested by: Name:	Signature:		Witnessed by: Name:			Signature			Date:			

Rail Network Maintenance								BBF8998 Version 2
AC Traction Supply Substations Test Sheet Primary Circuit Breakers: Contact Resistance and Operational Timing tests. Secondary Circuit Breakers(VCB's): Contact Resistance and Operational Timing tests.								TRANSNET freight rail
Substation:				Commissioning:		Routine:		
Primary Circuit Breakers								
Contact Resistance Test		Red		White		Blue		
Test current applied: 100 Amps DC	mVolt Specified	3.5 ± 0.3mV		3.5 ± 0.3mV		3.5 ± 0.3mV		
	mVolt Measured							
Operational Timing tests								
Make of Test Instrument applied: _____ Operating Time mSec		Red		White		Blue		
	Closing time Specified	56 ± 5mS		56 ± 5mS		56 ± 5mS		
	Closing time Actual							
	Opening time Specified	33 ± 3mS		33 ± 3mS		33 ± 3mS		
	Opening time Actual							
Secondary Circuit Breakers								
Contact Resistance Test		Incomer VCB No.:		Feeder VCB No.:		Feeder VCB No.:		
Test current applied: 100 Amps DC	Contact No	1	2	1	2	1	2	
	mVolt Specified	< 6 mV	< 6 mV	< 6 mV	< 6 mV	< 6 mV	< 6 mV	
	mVolt Measured							
Operational Timing tests								
Make of Test Instrument applied: _____ Operating Time mSec		Incomer VCB No.:		Feeder VCB No.:		Feeder VCB No.:		
	Contact No	1	2	1	2	1	2	
	Closing time Specified	60 ± 5mS	60 ± 5mS	60 ± 5mS	60 ± 5mS	60 ± 5mS	60 ± 5mS	
	Closing time Actual							
	Opening time Specified	35 ± 3mS	35 ± 3mS	35 ± 3mS	35 ± 3mS	35 ± 3mS	35 ± 3mS	
	Opening time Actual							
Tested by: Name:	Signature:	Witnessed by: Name:			Signature:		Date:	

Rail Network Maintenance	BBF9296 Version2
Signal and Distibution Substations Test Sheet Bus coupler VCB **Frame Leakage Protection. Current Transformer Ratio and Mag Curves. Zone Relay intertripping.** **Insulation Resistance and Pressure Tests. Voltage Transformer and Indication tests.** **Battery Undervoltage Protection. Earth Resistance Measurement**	TRANSNET freight rail

Substation:	**Panel No:**	**Designation:**	**Routine : Commissioning:**

Current Transformers		Zone 1	Zone 2	Zone 3	**Frame Leakage**	Make/Type of relay: _____/_____			Tested by Pri/Sec/TW		
CT Ratio	Marked				Zones	Zone 1	Zone 2	Zone 3	Parallel paths test	Zone 1 to Zone 2	
	Measured				I set =				at Iset amps	Zone 1 to Zone 3	
Mag curves	Volts	Amps	Amps	Amps	I trip (amps)					Zone 2 to Zone 3	
									Insulation Resistance	Zone 1 to Main Earth	
					Intertripping tests					Zone 2 to Main Earth	
					Zone 1 tripping	Zone 1	Zone 2	Zone 3		Zone 3 to Main Earth	
					Zone 2 tripping	Zone 1	Zone 2	Zone 3		Zone 1 to Zone 2	
					Zone 3 tripping	Zone 1	Zone 2	Zone 3		Zone 1 to Zone 3	
										Zone 2 to Zone 3	

Insulation Resistance Tests

Megger tests at 2500 volts							
	Red	Earth			Red	White	
	White	Earth			White	Blue	
	Blue	Earth			Blue	Red	

HiPot test @ 18 kV for 60 sec(VT's out)			VT and KV Meter reading at 11kV		
Red	White+Blue+Earth	mA	Red	White+Blue+Earth	
White	Red+Blue+Earth	mA	White	Red+Blue+Earth	
Blue	White+Red+Earth	mA	Blue	White+Red+Earth	

Battery undervoltage protection:	Relay tested to pickup at _____ and dropout at _____ Volts tripping all VCB's with indication and Lockout

Earth Resistance test:	Resistance between spikes: _____ohms		Resistance between spikes and Substation Earth _____ohms	

General Remarks

Tested by: Name	Signature:	Witnessed by: Name:	Signature:	Date:

Rail Network Maintenance

BBF 9297 Version 2

Signal and Distibution Substations Test Sheet **Ring, Transmission Line and Transformer Feeder VCB's** **Current**

Transformers: Ratio, Magnetisation curves and Polarity tests.

Protection Relays: Overload, Earth fault, Sensitive Earth Fault and Cable Protection. Transformer Protection

TRANSNET freight rail

Substation:	**Panel No:**	**Designation:**	**Routine : Commissioning:**

p		Protection Class 10P10				Metering Class 0.5				SOLKOR/TRANSLAY Class X				LED Configuration	
		Red	White	Blue		Red	White	Blue		Red	White	Blue			
CT Ratio	Marked				Marked				Marked					LED 1	
	Measured				Measured				Measured					LED 2	
Mag curves	Volts	Red A	White A	Blue A	Volts	Red A	White A	Blue A	Volts	Red A	White A	Blue A		LED 3	
														LED 4	
														LED 5	
														LED 6	
														LED 7	
														LED 8	
														LED 9	
Polarities															

Protection Relays: Make/Type: _____/_____

Overcurrent Elements		Tested by Pri/Sec/TW				Tested by Pri/Sec/TW						Output relay Configuration	
IDMT (NI)		**I set=**		**T set=**		**Instantaneous**		**I set =**		**T set =**		B01	
Operating	Multiple	Amps	R to W	R to B	B to W	Operating	Multiple	Amps	R to W	R to B	B to W	B02	
time in	1.25 x Iset					times in	4.00 x Iset					B03	
seconds	2.00 x Iset					seconds	6.00 x Iset					B04	

Earth Fault Elements		Tested by Pri/Sec/TW				Tested by Pri/Sec/TW						Tested by Pri/Sec/TW					
IDMT (NII)		**I set=**		**T set=**		**Instantaneous**		**I set=**		**T set=**		**Sensitive Earth Fault**		**I set=**		**T set=**	
Operating	Multiple	Amps	R to E	W to E	B to E	Operating	Multiple	Amps	R to E	W to E	B to E	Operating	Multiple	Amps	R to E	W to E	B to E
time in	1.25 x Iset					times in	4.00 x Iset					times in	1.00 x Iset				
seconds	2.00 x Iset					seconds	6.00 x Iset					seconds	1.25 x Iset				

Feeder Protection			**Solkor:Overall Fault setting**			Tested by Pri/Sec/TW			**Translay:Overall Fault setting**			Tested by Pri/Sec/TW	
Pilot Cable			Phases	Expected %	Local sub Trip Amps	Local sub. m Amps	Distant sub. Trip Amps	Distant sub. m Amps	Fault	Current	Relay Output		Pilot mAmps
Loop Resistance	T1+T2	Ohm	R-E	22					R-E				
Insulation Resistance	T1-E	MOhm	W-E	27.5					W-E				
	T2-E	MOhm	B-E	37					B-E				
	T1-T2	MOhm	R-W	110					R-W				
			W-B	110					W-B				
			B-R	55					B-R				
Stability test by Primary injection Red to White in Local sub with Short circuit in Distant sub													
Current injected: _____ Amps			mAmps in pilot wire confirmed to be zero						Yes		No		

Transformer Protection

Transformer No:	Buccholtz: Relay trips VCB giving Lockout & Indication with _____cc of air	Oil Over temperature: Relay trips VCB giving Trip & Indication at _____°C dail setting.
		Winding Over temperature: Relay trips VCB giving Lockout & Indication at _____°C dail setting.

Tested by:: Name	Signature:	Witnessed by: Name:	Signature:	Date:

Infrastructure (Maintenance) BBB0346 VER 2

Electrical Test Laboratory
E L & P Substation
Test Sheet

TRANSNET freight rail

NAME :

DESIGNATION : OCB No. :

PANEL NO. : DATE : NATURE : R/C

D.M.I.T. RELAY.			
CT RATIO :			
V	R Amp	Y Amp	B Amp

SOLKOR R/TRANSLAY			
CT RATIO :			
V	R Amp	Y Amp	B Amp

POLARITIES :

O/L SETTING : A/% T.M.S. :

E/L SETTING : A/% T.M.S. :

RELAY TESTED PRIM/ SEC/ TW. INJECTION

MULTIPLE	O/L R ph.		O/L Y ph.		O/L B ph.		E/L	
Of P.C.S.	A	Sec	A	Sec	A	Sec	A	Sec
2								
4								
6								

INSTANTANEOUS RELAY

O/L Setting		E/L Setting	
R ph. Trips at	A		
Y ph. Trips at	A	Relay trips at	A
B ph. Trips at	A		

BUCHOLZ RELAY cc

Relay trip & lock-out OCB. Give indication.

TEMPERATURE RELAY C

Relay trip OCB. Give indication.

FRAME LEAKAGE RELAY :

V	1 A	2 A	3 A	ZONE	1	2	3
				TYPE			
				PLUG			
				P / Amp			
				TRIPS			
				RATIO			
				TEST SPIKES :		Ohm	
				EARTH MAT :		Ohm	

PILOT CABLE

Loop resistance :

Insulation resistance :

T1 – E :

T2 – E :

T1 – T2 :

OVERALL FAULT SETTING

FAULT	T.W./ Sec. A	A mA	B mA	AC mA	OPERATION %
R – E					
Y – E					
B – E					
R – Y					
B – Y					
R - B					

CURRENT BETWEEN		RELAY OUTPUT
R – E	1.10A	V
Y – E	1.40A	V
B – E	2.00 A	V
R – Y	4.50 A	V
B – Y	4.50 A	V
R - B	2.25 A	V

RELAY TYPE :

SETTING :

RESISTANCE MEASUREMENTS

ZONE	1	2	3
E			
1			
2			

TESTED BY APPROVED BY DATE

***

SECTION 03

COMMISSIONING TESTING

3.1 COMMISSIONING PROCESS

3.1.1 The purpose of commissioning testing is to verify that the installation is complete, installed in terms of the specification and that all aspects are functioning correctly. It is a prerequisite for handing the equipment over to the maintenance section. The process of accepting new or repaired equipment into service is performed in terms of two engineering Instructions:

3.1.2 Engineering Instructions CEE-GI_018: “Inspection and Handing over of Electrical Equipment” according to which a handing over certificate guides the handshake process:

- Portion A: Description of equipment.
- Portion B: Preliminary inspection of the equipment.
- Portion C: Withdrawal of staff. (Applicable to High-Voltage equipment only).
- Portion D: Authority to commission equipment.
- Portion E: Acceptance of Equipment for Service and Maintenance.
- Portion F: Defects still requiring attention.

3.1.3 Engineering instructions CEE-GI_019 “Procedures for Energising / De-Energising of High-Voltage Electrical Equipment” stipulates the process for bringing the equipment on load after outage of new constructions, or removing it from service.

3.1.4 For minor alterations or additions to the installations the process laid down in engineering instruction CEE-GI_013 "Safety Precautions to Be Taken When Minor Alterations are Carried Out on Electrification Installations Not Covered by Handing Over Certificates" must be followed. Testing may be required before energising or cancelling the work permit.

3.1.5 In case of repairs to equipment, testing may be required before energising or cancelling the work permit.

3.2 TRACTION SUBSTATION COMMISSIONING

3.2.1 TYPE TESTS

- Where type tests are specified they shall be carried out in accordance with the recommended standards or specification referred to this specification.
- Type tests certificates shall be submitted with tender documents and copies must be available on site with commissioning.

3.2.2 INITIAL FACTORY TESTS

- The following initial factory tests shall be carried out on the completed switchgear or control gear at the manufacturers works prior to delivery. Test certificate for these tests shall be supplied.
- The ratio, polarity and magnetization curve of each current transformer.
- The characteristic curves of each protection relay where applicable.
- On DC Traction rectifiers the operation of all fan control and diode indication circuits is to be tested.
- The errors of all indicating instruments.

- A functional test of the complete board including all protective relays by secondary injection. Test certificate for these shall be supplied.
- Four copies of all approved factory test certificates shall be supplied, at the date nor later than the delivery date of the switchgear or control gear.
- All testing shall be witnessed and inspection carried out by the Quality Assurance Section of Transnet Freight Rail's Technology Management.

3.2.3 FUNCTIONAL TESTS

Complete functional tests must be done according to BBC9921.

3.3 DISTRIBUTION SUBSTATION COMMISSIONING

3.3.1 TYPE TESTS

- Where type tests are specified they shall be carried out in accordance with the recommended standards or specification referred to this specification.
- Type tests certificates shall be submitted with tender documents.

3.3.2 INITIAL FACTORY TESTS

- The following initial factory tests shall be carried out on the completed switchgear or control gear at the manufacturers works prior to delivery. Test certificate for these tests shall be supplied.
- The ratio, polarity and magnetization curve of each current transformer after their installation in the board.
- The characteristic curves of each protection relay where applicable.
- The ratio of each voltage transformer.
- The errors of all indicating instruments.
- A functional test of the complete board including all protective relays by primary injection. Test certificate for these shall be supplied.
- Breakers' opening times.
- Four copies of all approved factory test certificates shall be supplied, at the date nor later than the delivery date of the switchgear or control gear.
- All testing shall be witnessed and inspection carried out by the Quality Assurance Section of Transnet Freight Rail's Technology Management.

3.3.3 FUNCTIONAL TESTS

Complete functional tests must be done according to BBB4182**.**

3.4 REFERENCES

- Engineering instruction CEE-GI_018
- Engineering instruction CEE-GI_013
- Engineering instruction CEE-GI_019

3.5 ANNEXURES

BBC9921: "3kV Traction Substations: Commissioning Tests by Contractor Prior to Final Commissioning by Transnet Freight Rail" (Pre-commissioning).

BBB4182: "Distribution Substations: Commissioning Tests by Contractor Prior to Final Commissioning by Transnet Freight Rail" (Pre-commissioning).

BBC9921 Version2

TEST SHEET: TRACTION 3kV DC SUBSTATION

TRANSNET freight rail

COMMISSIONING TESTS BY CONTRACTOR PRIOR TO FINAL COMMISSIONING BY TRANSNET FREIGHT RAIL

CONTRACT NO:

SUBSTATION NAME	DEPOT	DATE

	FUNCTION	*COMPLY (YES/NO)*	*COMMENTS*
1.0	**FUNCTIONAL TESTS IN AC YARD**		
1.1	AC Disconnects to trip P.C.B when operating under load conditions		
1.2	Operation of Wave Filter Door switches to trip P.C.B		
1.3	Main Transformer Bucholz Relay to trip and lockout P.C.B giving indication		
1.4	Main Transformer Oil temp Relay to trip P.C.B giving indication		
1.5	Main Transformer Winding temp. Relay to trip and lockout P.C.B giving indication		
1.6	Winding and Oil Temp relays will only trip Unit Breaker if still in use.		
1.7	All lockout circuits will also trip the Unit Breaker with P.C.B if Unit Breakers are still in use		
1.8	Auxiliary Transformer Bucholz Relay to trip and lockout P.C.B giving indication		
1.9	P.C.B operation only when selector switch is in the Local position		
1.10	P.C.B to trip when 110V DC Supply is removed from the No Volt Coil		
1.11	All cables to Substation to be block jointed and covered with suitable heat shrink		
1.12	Operation of S.F.6 Low gas to trip and lockout P.C.B giving indication		
2.0	**FUNCTIONAL TESTS INSIDE SUBSTATION**		
2.1	Operation of P.C.B giving indication Spring Charged and Spring Discharged with selector switch in the Local position		
2.2	Check that P.C.B does not operate when Local/Remote switch is in the Remote position		
2.3	Operation of DC Earth Leakage relay to trip P.C.B as well as all Track Breakers giving lockout and Indication		
2.4	Operation of AC Earth Leakage relay to trip P.C.B giving lockout and indication		
2.5	Operation of all Track Breakers in Local position to close and drop out after delay period giving		

	FUNCTION	*COMPLY (YES/NO)*	*COMMENTS*
	indication		
2.6	Auxiliary Transformer protection relay operation to trip P.C.B giving indication – all phases		
2.7	Main Transformer protection relay operation to trip P.C.B giving indication – all phases		
2.8	Battery Under Voltage protection to trip G.C.B giving lockout and Indication		
2.9	3kV DC Under Voltage protection to Pick up and Drop out all Track Breakers		
2.10	Check direction of fans on Rectifier unit		
2.11	Operation of attenuation fail protection to trip and lockout P.C.B		
2.12	Operation of fan failure vane switches to trip and lockout P.C.B		
2.13	Operation of Current Monitor relay to start Rectifier fans for cooling		
2.14	Operation of Temp. Sensor to start Rectifier fans at 80 degrees C for cooling		
2.15	Operation of Over Temp. Sensor to Trip and lockout P.C.B giving indication		
2.16	Check that the key interlocking is in place and in the right sequence to enter Rectifier bay		
2.17	When Unit Breaker is still in use – Check intertripping between P.C.B and Unit Breaker		
2.18	Check Main Transformer Oil and Winding temp to trip Unit Breaker only, and to close again with temp normal		
2.19	Emergency Stop button to operate and give complete shutdown with latching device giving lockout		
2.20	Where telecontrolled devices have been replaced or repaired, the correct operation and indication must be checked with Control and Telecontrol.		

Contractor: _____

Name: _____

Signature: _____ **Date:** _____

Tests witnessed by: **Transnet Freight Rail**

Name: _____

Signature: _____ **Date:** _____

***

SECTION 4

CURRENT TRANSFORMERS

4.1 THE FUNCTION OF THE CURRENT TRANSFORMER IN THE ELECTRICAL SYSTEM.

Current transformers are installed to obtain a proportional value of the current which flows in the power circuit to drive measuring and protection equipment.

AC and DC Traction substations

Primary side: Free standing Current Transformers' are connected in series between the AC disconnects and the transformer. The actual position varies depending on yard layout. The Current Transformers may thus be between the transformer and primary breaker or between the disconnects and primary circuit breaker. The actual position varies depending on the outdoor yard layout.

Secondary side: Current Transformers' are connected in series between the secondary side of the transformer and the rectifier in DC substations. In AC Traction Substations current transformers are installed in the roof bushings of VCB cubicles but the latter are being replaced with outdoor VCB's with associated current transformer mounted on the extensions from the VCB support structure.

Alternatively the Current Transformers may be located in the transformer being fitted around the bottom of the HT (Primary) and LT (Secondary) bushings.

Signal and Distribution Substations

Similar installations are done for Signal and Power Supply Intake substations on the primary side. In Distribution substations (E L & P) current transformers are installed in the cable entry enclosures as part of the single or multi panel structure construction.

4.2 PRINCIPLE OF OPERATION

Current transformers are graded according to the intended purpose, namely measurement of energy, metering instruments and protection in terms of:

- Current ratio Accuracy Ability to protect against high currents

Current Transformers consist of magnetically coupled primary and secondary windings, wound on a common iron core, the primary winding being connected in series with the network. The flow of current in the primary winding produces an alternating flux in the core and this flux induces an e.m.f in the secondary winding which results in the flow of secondary current when this winding is connected to an external closed circuit. For further information refer to Annexure 1: THEORY AND PRACTICE OF CURRENT TRANSFORMERS.

4.3 BASIC PRECAUTIONS

Work to be done under the cover of a work permit. All possible sources of supply are to be isolated and earthed.

Current Transformers normally work at a low flux density and the core is made of high quality steel which has a low magnetising current. On open circuit (under load) the secondary impedance becomes infinite and the core saturates. This induces a very high voltage in the secondary winding and damage to insulation may occur as well as creating a serious electrical shock hazard.

4.4 CURRENT TRANSFORMER CONNECTIONS

In DC traction substations current transformers are connected from the outdoor equipment to the related protection/metering equipment via underground multicore cables through cable entries to the relevant connection terminals in the Control panel and this must be disconnected to facilitate testing.

In the case of AC Traction and Distribution substations current transformers are connected from outdoor or indoor equipment to the related protection/metering equipment via a standard test terminal block on the control panel to shown in

figure 4.1 with the normal sequence of terminals as configured in Figure 4.2. This enables the connections from the current transformers to be either connected to the protection-/metering equipment or shorted to earth if required by changing the position of the links. Testing of current transformers and related equipment is more easily facilitated.

Figure 4.1

Relay	CT	Earth	Relay	CT	Earth	Relay	CT	Earth	Red	Yellow	Blue	Earth (N)
Red Phase			**Yellow Phase**			**Blue Phase**			**Spare or PT test terminals**			

Figure 4.2 (Shows the positions of the links for normal operation).

Relay	CT	Earth	Relay	CT	Earth	Relay	CT	Earth	Red	Yellow	Blue	Earth (N)
Red Phase			**Yellow Phase**			**Blue Phase**			**Spare or PT test terminals**			

Figure 4.3 (Shows the positions of the links shorted out).

4.5 TESTING OF CURRENT TRANSFORMERS

Commissioning tests:

- **Insulation test:** To prove insulation levels between Primary to Secondary windings and to earth (Megger to 2 Meg-ohms/kV).

- **Ratio test**: To prove primary to secondary ratios by primary injection or by test winding as well as to verify the overall operation of the circuit usually during commissioning or after a major modification.
- **Magnetization curve**: Drawn to ensure that magnetizing characteristics are correct. Comparison of magnetizing curves over time indicates a shift in performance of any defects present.
- **Polarity test**: Done on commissioning and when replacement of current transformer was done to ensure that the polarity of all current transformers is uniform.

Routine testing:

- **Ratio test**: To prove primary to secondary ratios by primary injection or by test winding
- **Magnetization curve**: Drawn to ensure that magnetizing characteristics are correct. Comparison of magnetizing curves over time indicates a shift in performance of any defects present.

4.6 TEST EQUIPMENT

- **Insulation test:** 2.5 kV -1000volt Megger
- **Ratio test:** Variac 0-250 volt @ 8 Amps (Tesset) Injection Transformer 0-50-100-200 amps Multi ratio Lab CT with Ammeters 0-1-5 amps. Set of heavy duty and light leads.
- **Magnetization curve:** Variac 0-250 volt @ 8 Amps (Tesset) Standard Volt meter 0-250-1000v. Ammeters 0-1000mA-1-5 Amps, Set of light leads.
- **Polarity test:** Battery 9 volt. Analogue voltmeter on low scale or centre zero galvanometer, Set of light leads

4.7 TEST CIRCUITS AND PROCEDURES

Insulation test

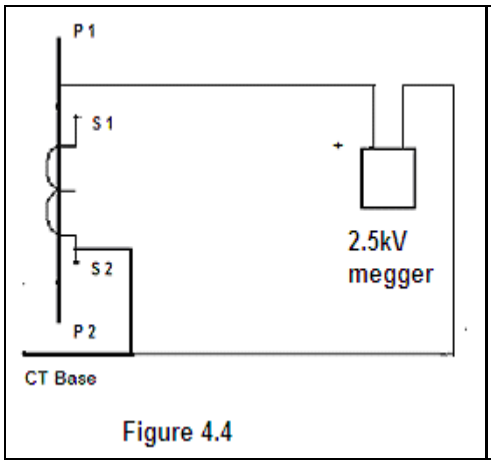


Figure 4.4

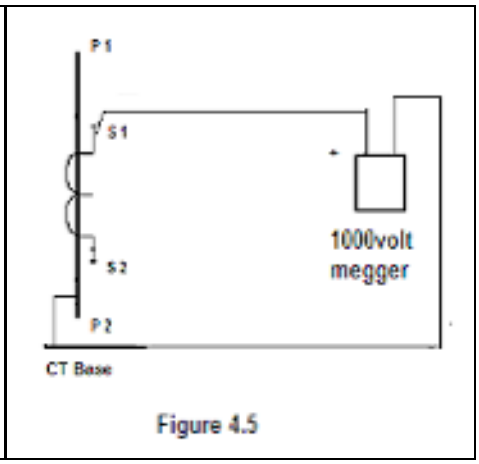


Figure 4.5

- Connect the 2.5kV megger to the CT under test as shown in Figure 4.4 for testing the primary winding to the secondary winding plus earth.
- Connect the 1000 V megger to the CT under test as shown in Figure 4.5 for testing the secondary winding to earth.
- Record the values for each current transformer in the circuit on the relevant test sheet.

Range of acceptable results

- Primary winding to Secondary winding and Earth > 2 meg-ohms per kV Secondary winding to Earth > 1 Meg-ohm,

Ratio test

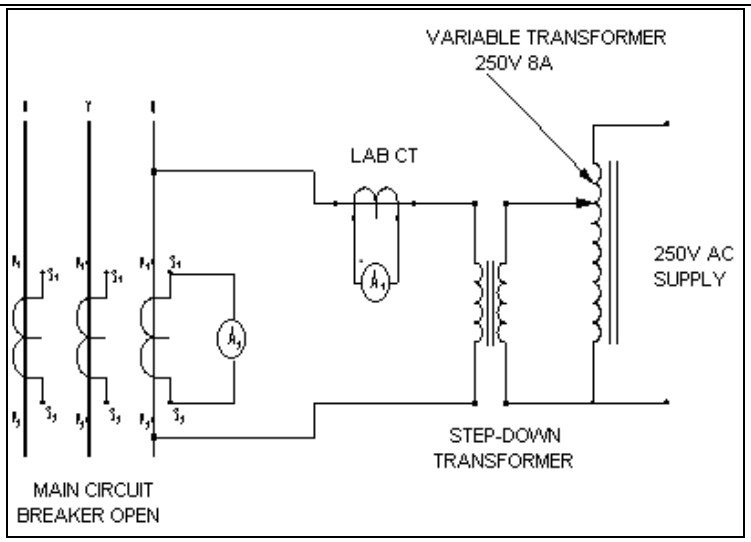


Figure 4.6: Test Circuit for Current Transformer Ratio test

The Test Procedure: Primary injection

- Isolate the current transformer from all sources of supply Remove all earth connections.
- Connect the test equipment to the CT under test as shown in Figure 4.6 selecting a suitable Lab CT ratio
- Slowly increase the injection current until the primary current (A1) corresponds with the CT rated current.
- Record the readings from ammeters A1 (primary current) and A2 (secondary current).
- Check that the ratio of the values, A1: A2 corresponds to the ratio on the current transformer (CT) nameplate.
- Test each CT individually and verify that the primary and secondary polarity markings are correct.
- Record the values for each current transformer in the circuit on the relevant test sheet.

Range of acceptable results

- The nameplate data on a current transformer indicates the tolerance applicable to that particular instrument for example 10P10 indicates that up to 10 times the full load current the accuracy is guaranteed to be within 10%.. At rated full load current as a rule of thumb a difference of 5% is acceptable.

Magnetization curve

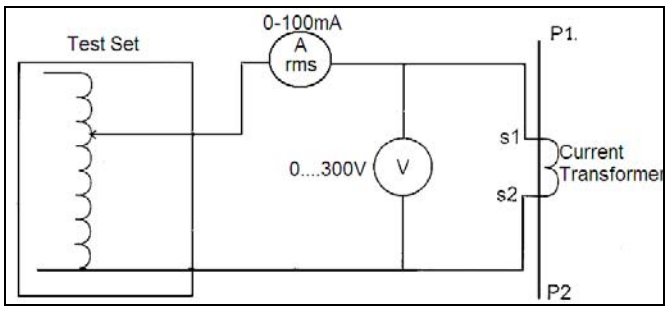


Figure 4.7: Connections for Magnetisation curve test.

- Connect the test equipment to the CT under test as shown in Figure 4.7 selecting suitable scales on the volt and ammeter.

- Slowly increase the injection voltage until the current reaches a value approximately equal to or just above to the rated full load current which will normally be the saturation point.
- Record the values for each current transformer in the circuit on the relevant test sheet.

Saturation point occurs normally at a 10% increase in Voltage and 50% increase in Current. Record all measurements on the test sheet.

Range of acceptable results

- The magnetization curve values are normally compared to the factory test results regarding the saturation point and with subsequent routine tests a history is built up that will indicate if any deterioration has taken place.

Polarity test

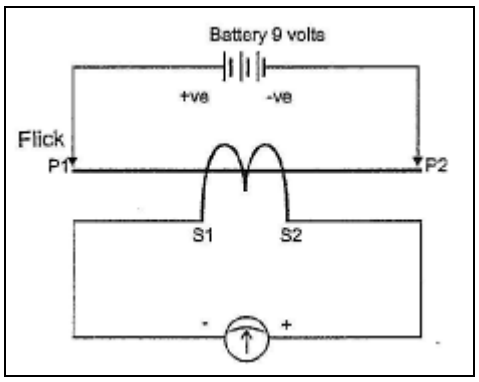


Fig. 4

- Connect centre zero galvanometer across secondary of the current transformer.
- Connect battery negative terminal to the current transformer P2 primary terminal.
- Touch or flick the positive battery connection to the current transformer P1 primary terminal.
- If the polarity of the current transformer is correct the galvanometer should flick in the positive direction.

4.8 RANGE OF ACCEPTABLE RESULTS

The polarity has to be correct according to the terminal markings as well as uniform for current transformers applied in multiphase systems.

4.9 SPECIAL PITFALLS.

When wound primary current transformer is tested an injection set with a high output voltage is to be used as the impedance will be too high for the normal low voltage high current injection set.

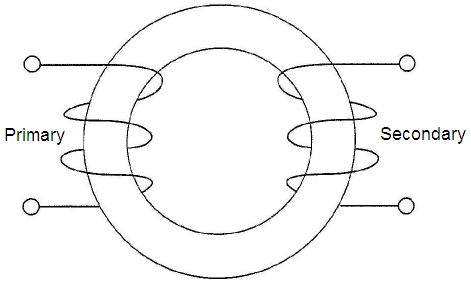
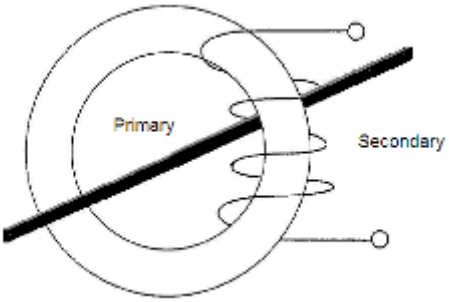
4.10 REFERENCES

- Les Hewitson Pr. Eng. PSP Training. “Power Protection course Version 3.01 May 1998, Commonwealth English Edition.
- IEC 60044 Current transformers

THEORY AND PRACTICE OF CURRENT TRANSFORMERS

All current transformers used in protection are basically similar in construction in that they consist of magnetically coupled primary and secondary windings, wound on a common iron core, the primary winding being connected in series with the network.

They must therefore withstand the networks short-circuit current.

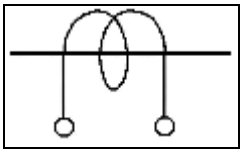
	
Wound Primary	*Bar Primary (Currents >100A)*

The wound primary is used for the smaller currents, but it can only be applied on low fault level installations due to thermal limitations as well as structural requirements due to high magnetic forces.

If the secondary winding is evenly distributed around the complete iron core its leakage reactance is eliminated.

Protection CT's are most frequently of the bar primary, toroidal core with evenly distributed secondary winding type construction.

The standard symbol used to depict current transformers is as follows:



The basis of all transformers is that:

AMP TURNS on the Primary = AMP TURNS on the secondary

The primary current contains two components:

- An exciting current which magnetises the core and supplies the eddy current and hysteresis losses etc.
- A remaining primary current component which is available for transformation to secondary current in the inverse ratio of turns.

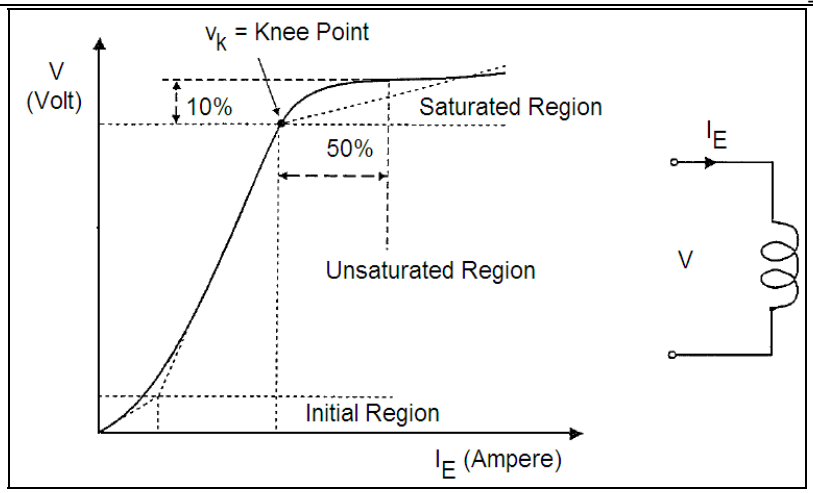
The exciting current is not transformed and is therefore the cause of transformer errors.

The amount of exciting current drawn by a CT depends upon the core material and the amount of flux that must be developed in the core to satisfy the output requirements of the CT. That is, to develop sufficient driving voltage required to push secondary current through its connected load or burden.

Magnetisation Curve

This curve is the best method of determining a CT's performance. It is a graph of the amount of magnetising current required to generate an open-circuit voltage at the terminals of the unit.

Due to the non-linearity of the core iron, it follows the B-H loop characteristic and comprises three regions, namely the initial region, unsaturated region and saturated region.



Knee-Point Voltage

The transition from the unsaturated to the saturated region of the open circuit excitation characteristic is a rather gradual process in most core materials. It is difficult to define this transition and use is made of the so-called "knee-point" voltage for this purpose.

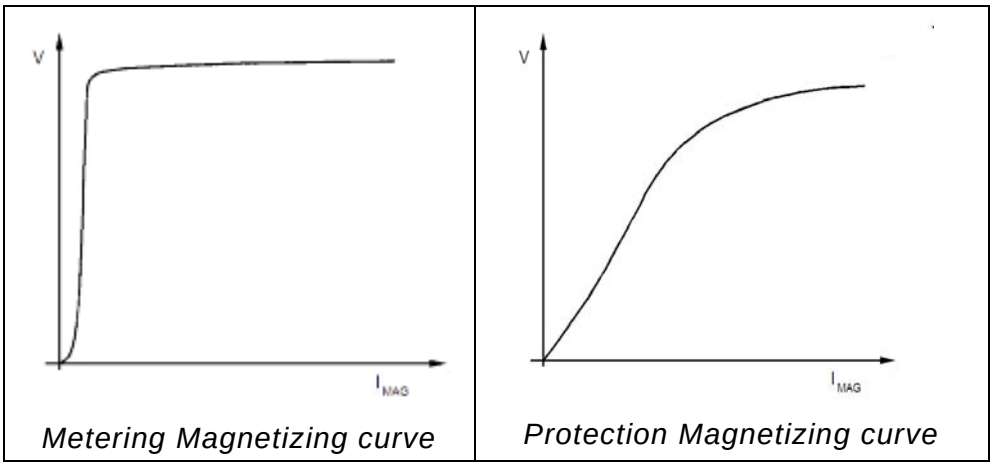
It is generally defined as the voltage at which a further 10% increase in volts will require a 50% increase in excitation current. For most applications, it means that current transformers can be considered as approximately linear up to this point.

Metering CT's

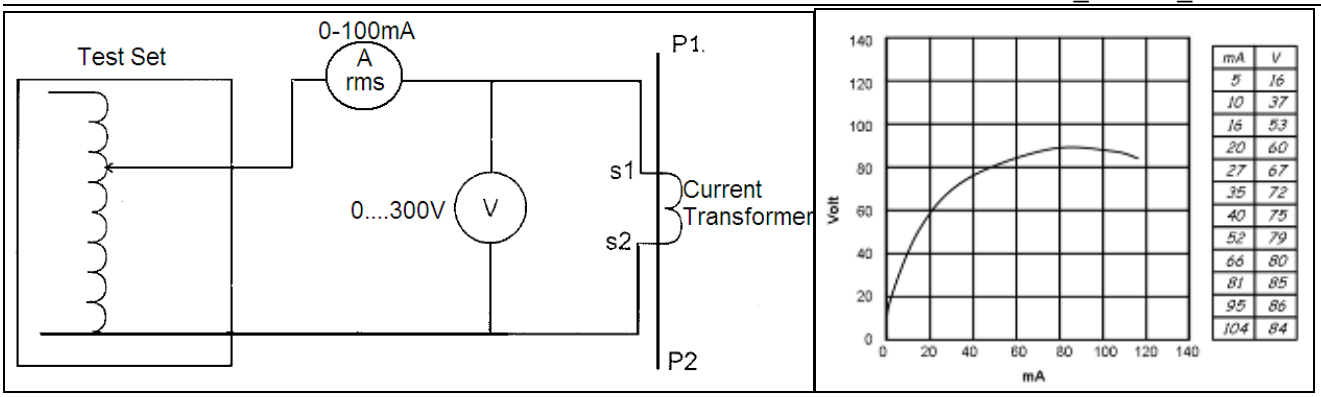
Instruments and meters are required to work accurately up to fill load current, but above this it is advantageous to saturate to protect the instruments under fault conditions. They therefore have a very sharp knee-point and a special nickel-alloy metal is used, having a very low magnetising current, in order to achieve the accuracy.

Protection CT's

Protective gear, on the other hand, is concerned with a wide range of currents from fault settings to maximum fault currents many times normal rating. Larger errors may be permitted and it is important to ensure that saturation is avoided wherever possible to ensure positive operation of the relays.



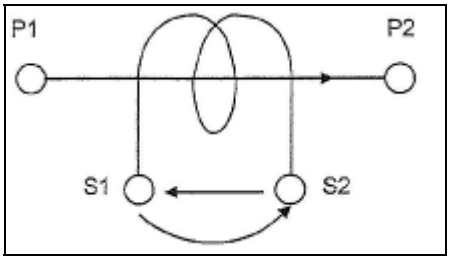
Metering Magnetizing curve | *Protection Magnetizing curve*



Magnetising curve test circuit

Polarity

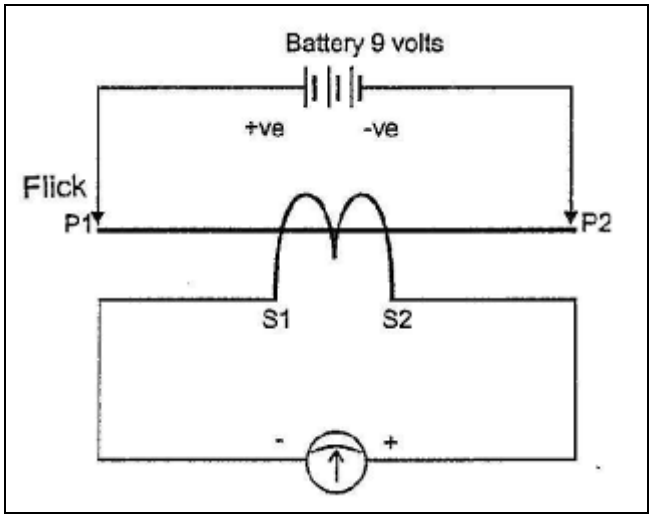
Polarity is very important when connecting relays as this will determine correct operation or not.



Polarity markings of a CT

A B.S3938 state that at the instant when current is flowing from P1 to P2 in primary then current in secondary must flow from SI to S2 through the external circuit.

To test the polarity of a CT:



Connect centre zero galvanometer across secondary of the current transformer. Connect battery negative terminal to the current transformer P2 primary terminal. Touch or flick the positive battery connection to the current transformer P1 primary terminal. If the polarity of the current transformer is correct the galvanometer should flick in the positive direction.

Secondary Resistance

The secondary resistance of a CT is an important factor as the CT has to develop enough voltage to push the secondary current through its own internal resistance as well as the connected external burden. This should always be kept as low as possible.

CT SPECIFICATION

CT Selection depends on:

For protection CT's:

CT Specification according to IEC has the following format:

- For OC & EF application,
- For Metering
- For differential protection
- The fault level. It must handle the fault level without saturating. A three phase fault is the highest possible condition.
- The full load current.

The 10P10 current transformer can take 10X the primary rated current before saturating. The 10P5 will saturate at 5X primary CT current.

E.g. for a fault current of 20000A and 10P10 CT with ratio 10:5, the CT will saturate because it is seeing 20000/5 = 4000 x primary current

You would actually require a ratio of

20000/10: 5 = 2000:5 for a 10P10 CT, or

20000/5: 5 = 4000:5 for a 10P5 CT

Overload rating

Secondary current rating

E.g. for a 10P5 CT 4000:5, the secondary current; Is = 5 X 5 = 25A. If the burden is say 1Ω the voltage is 30V.

For a 10P5 CT 4000:1, Is = 5 X 1 = 5A, and V = 5V

Name Plate information and what you can derive

e.g.	Class	10P10	10P Accuracy Class = 10% error 10 Accuracy Limit Factor (CT is not guaranteed beyond this value) Accuracy limit current = rated secondary current x ALF = 5 x 10 = 50 Amp V_{sec} = 50 x 0.6 (ignoring CT internal impedance)
	Burden	15VA	Rated burden. 15VA can be supplied at 5A $Z_{burden} = VA/I^2 = 15/5^2 = 0.6\Omega$ $V_{kneepoint} \approx 30V$
	Ratio	2000/5	Ratio Secondary rated current is 5A

A current transformer is normally specified in terms of:

- A rated burden at rated current.
- An accuracy class.
- An upper limit beyond which accuracy is not guaranteed. (Known as the Accuracy Limit Factor, ALF).

In the relevant BSS 3938 the various accuracy classes are in accordance with the following tables:

Class	± percentage current (ratio) error at percentage of rated Current shown below			± phase displacement at percentage of rated current shown below					
				Minutes			Centiradians		
	10 up to but not incl. 20	20 up to but not incl. 100	100 up to 120	10 up to but not incl. 20	20 up to but not incl. 100	100 up to 120	10 up to but not incl. 20	20 up to but not incl. 100	100 up to 120
0.1	0.25	0.2	0.1	10	8	5	0.3	0.24	0.15
0.2	0.5	0.35	0.2	20	15	10	0.6	0.45	0.3
0.5	1.0	0.75	0.5	60	45	30	1.8	1.35	0.9
1	2.0	1.5	1.0	120	90	60	3.6	2.7	1.8

Limits of error for accuracy Classes 0.1 to 1 (Metering CT).

Accuracy class	Current error at rated primary current %	Phase displacement at rated primary current		Composite error at rated accuracy limited primary current %
		Minutes	centiradians	
5P	± 1	± 60	± 1.8	5
10P	± 3			10

Limits of Error for accuracy Class 5P and Class 10P (Protection CT)

In terms of the specification a current transformer would, for example, be briefly referred to as 15VA 5P20 if it were a protection CT or 15VA Class 0.5 if it were a metering CT:

	Protection	Metering
Rated Burden	15 VA	15 VA
Accuracy Class	52	0.5
Accuracy Limit Factor	20	Class 1.0

(ALP is 20 x normal or rated current)

Class X Current Transformers

These are normally specified for special purpose applications such as busbar protection, where it is important that CT's have matching characteristics.

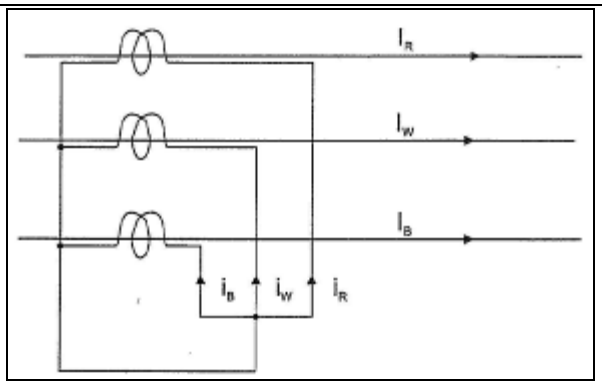
For this type of CT an exact point on the Magnetisation Curve is specified, e.g.

- Rated primary current
- Turns ratio
- Rated knee point e.m.f. at maximum secondary turns
- Maximum exciting current at rated knee point e.m.f,
- Maximum resistance of secondary winding.
- In addition, the error in the turns ratio shall not exceed ± 0.25%

Connection of Current Transformers

Current transformers for protection are normally provided in groups of three, one for each phase.

They are most frequently connected in "star" illustrated as follows:



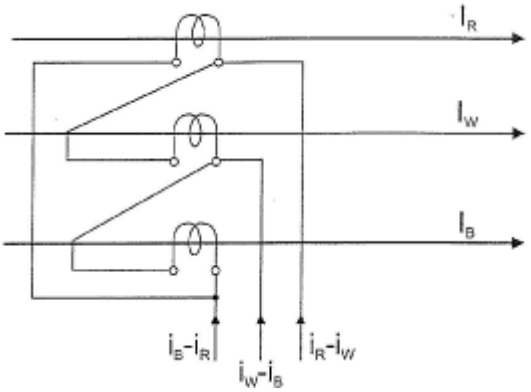
Star Connection of Current Transformers.

The secondary currents obtainable with this connection are the three individual phase currents and also the residual or neutral current.

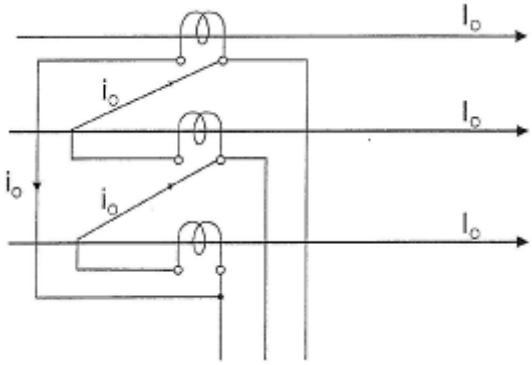
The residual is the vector sum of the three phase currents which under healthy conditions would be zero. Under earth fault conditions, this would be the secondary equivalent of the earth fault current in the primary circuit.

Sometimes, current transformers are connected in" delta". The reasons for adopting this connection are one or more of the following:

- To obtain the currents Ir-Tw, Iw-Ib, Ib-Ir.
- To eliminate the residual current from the relays.
- To introduce a phase-shift of 30º under balanced conditions, between primary and relay currents. -



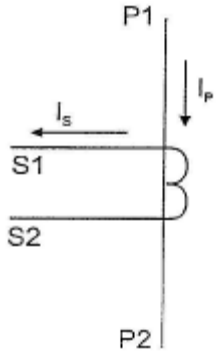
Delta connection of Current Transformers.



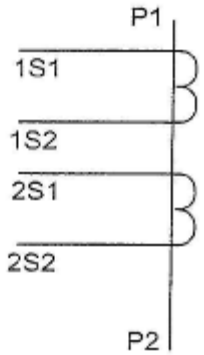
Current distribution under earth fault conditions (I, circulating inside the delta)

Terminal Designations for Current Transformers

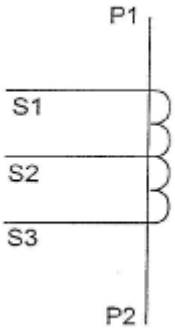
According to IEC Publication 185, the terminals are to be designated as shown in the following diagrams. All terminals that are marked P1, S1 and C1 are to have the same polarity.



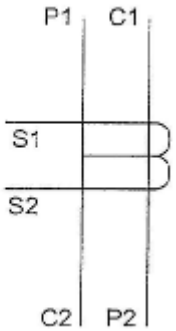
(a) One secondary winding



(b) Two secondary windings



c) One secondary winding which, has an extra tapping



(d) Two primary windings and one secondary winding.

Secondary Earthing of Current Transformers

To prevent the secondary circuits from attaining dangerously high potential to earth, these circuits are to be earthed. Connect either the S1 terminal or the S2 terminal to earth.

> NOTE: Transnet substations often provide the metering CT to Eskom. Such metering CT's should not be earthed on the AC Earth Leakage busbar, since Eskom will earth the CT's on their side, thus short circuiting the earth leakage busbar.

For protective relays, earth the terminal that is nearest to the protected objects. For meters and instruments, terminal nearest to the consumer is earthed.

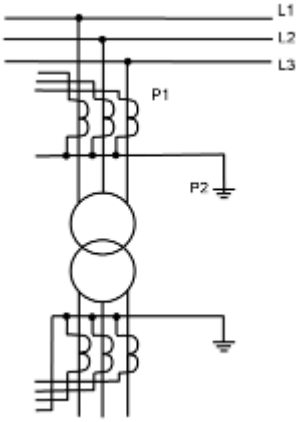
When metering instruments and protective relays are on the same winding, the protective relay determines the point to be earthed.

If there are taps on the secondary winding which are not used, then they must be left open.

If more than one current transformer are galvanic connected together they shall be earthed at one point only (e.g. differential protection).

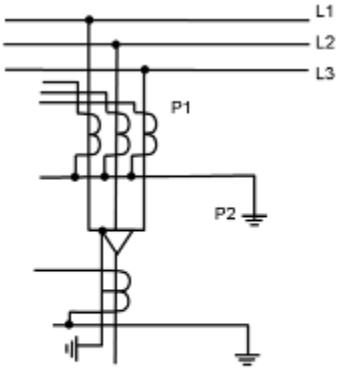
If the cores are not used in a current transformer they must be short-circuited between the highest ratio taps and shall be earthed.

It is dangerous to open the secondary circuit when the CT is in operation. High voltage will

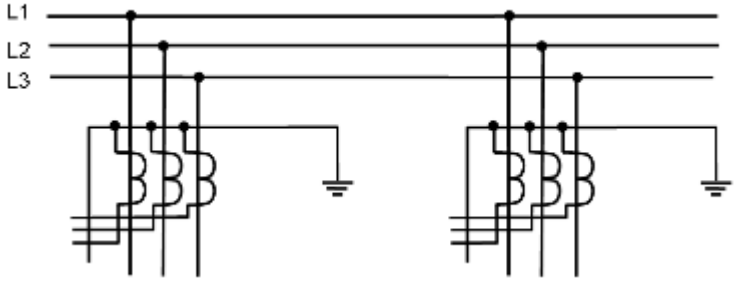


be induced.

Connections for Transformer



Connections for cable



Connections for busbars

Test Windings

It is often necessary to carry out on-site testing of current transformers and the associated equipment but it is not always possible to do primary injection because of access of test sets not being large enough to deliver the high value of current required.

Additional test windings can be provided to make such tests easier. These windings are normally rated at 10 Amps and when injected with this value of current produce the same output as the rated primary current passed through the primary winding.

NOTE: When energizing the test winding, the normal primary winding should be open-circuit; otherwise the CT will summate the effects of the primary and test currents.

Conversely, in normal operation the test winding should be left open-circuited.

Test windings do, however, occupy an appreciable amount of additional space and therefore increase the cost. Alternatively, for given dimensions they will restrict the size and hence the performance of the main current transformer.

Application of Current Transformers

In order to overcome the limitations as experienced by series trip coils, current transformers are used so that the high primary currents are transformed down to manageable levels that can be handled comfortably by protection equipment

A typical example would be Fused AC Trip Coils

These use current transformers which must be employed above certain limits i.e. when current rating and breaking capacity become excessively high. Some basic schemes are:

Overcurrent

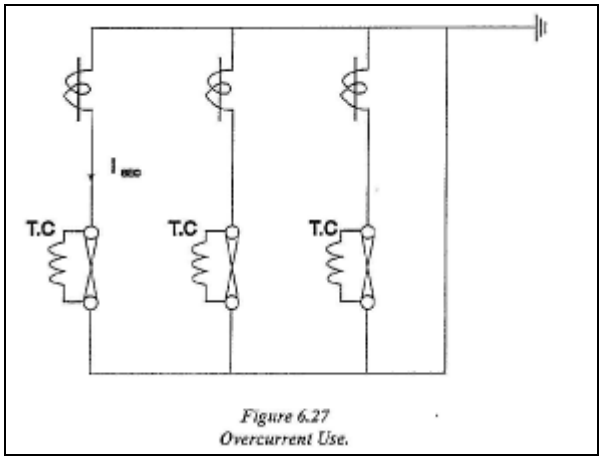
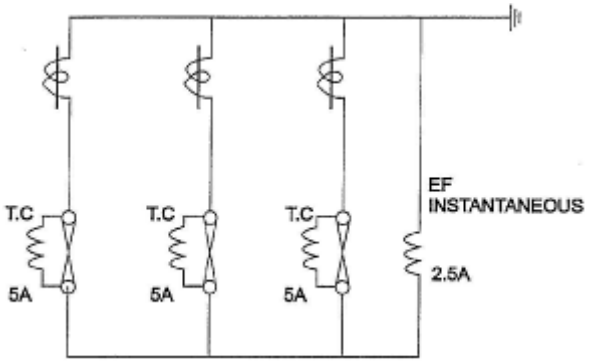


Figure 6.27
Overcurrent Use.

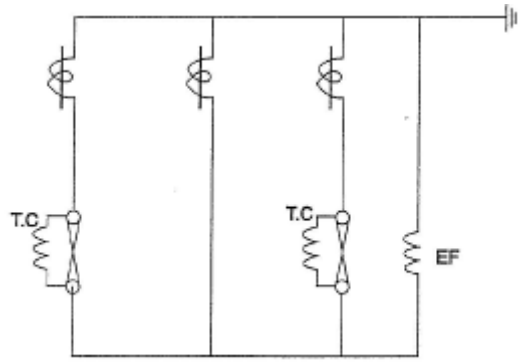
Overcurrent use

Under fault conditions, I sec having reached the value at which the fuse blows, operates trip coil IC to trip the circuit breaker. Characteristics of fuses are inversed so a limited degree of grading is achieved.

Overcurrent & Earth Fault

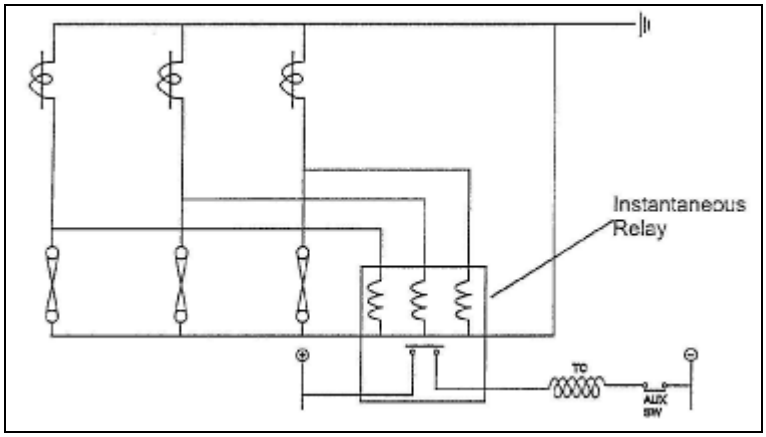


Overcurrent and Earth Fault use.

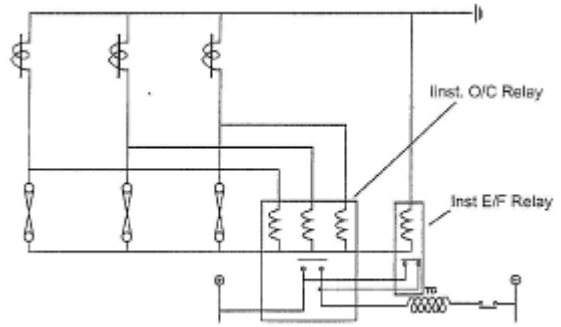


Economical use

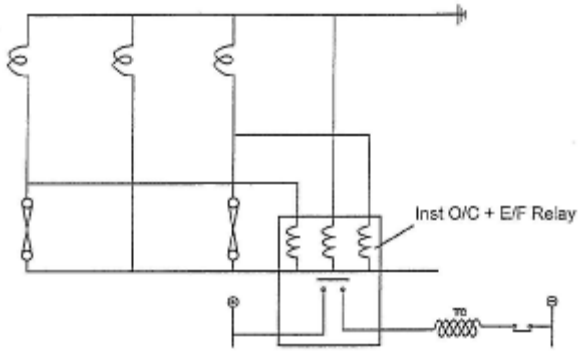
Relays in Conjunction with Fuses



Inverse Overcurrent Tripping Characteristic.

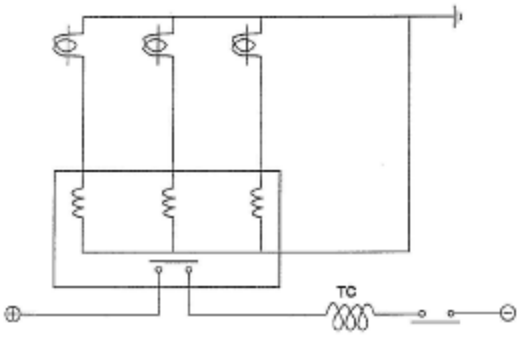


Inverse Over-current ± instantaneous earth fault

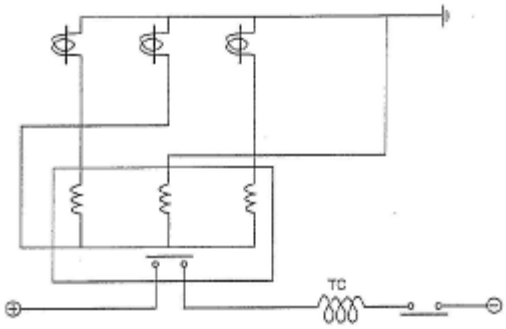


More Economic Method.

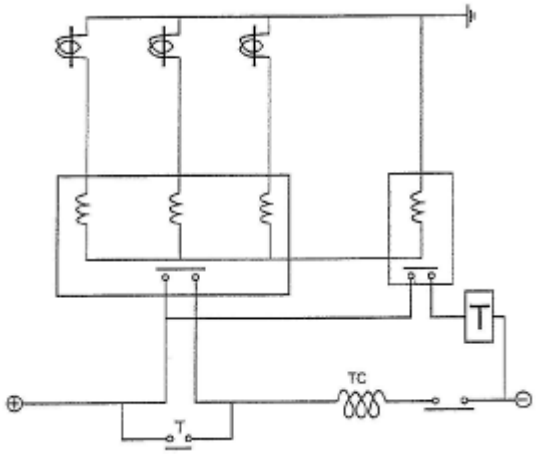
Inverse Definite Minimum Time Lag (IDMTL) Relay



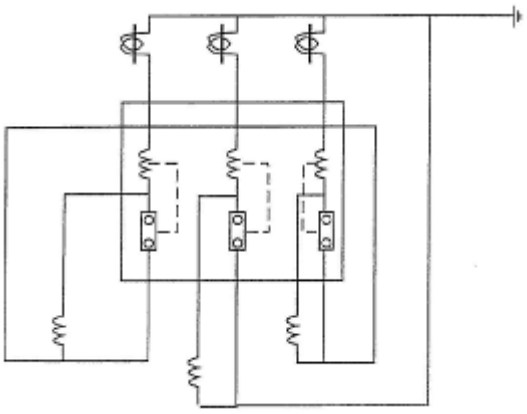
Overcurrent.



Overcurrent + Earth Fault



IDMTL Overcurrent + Time Lag Earth Fault



IDMTL OC+EF Relay with A C Trip Coils.

REFERENCE

Les Hewitson Pr. Eng. PSP Training.

Power Protection course Version 3.01 May 1998, Commonwealth English Edition.

***

SECTION 05
TRANSFORMERS

5.1 THE FUNCTION OF A TRANSFORMER IN THE ELECTRICAL SYSTEM

- Transformers are designed to step down the supplier's EHV or HV to the specified system voltage required by the consumer. The design normally facilitates tap changing to adapt secondary voltage to suitable values due to supply voltage fluctuations. Rectifier Transformers are designed with multi secondary windings for smooth rectified outputs from DC traction substations.
- Transformers use magnetic coupling between primary and secondary windings, in a step-down ratio to provide the desired load voltage in single, three or six phase configurations. Transformers are filled with oil to provide the required insulation as well as a cooling medium. The type in use on Transnet is generally of the ONAN (oil natural air natural) cooling type.

5.2 PRINCIPLE OF OPERATION

- Transformers use magnetic coupling between primary and secondary windings, which are in a step-down ratio to provide the desired load voltage from that of the Eskom transmission voltage.
- Transformers are designed to deliver specific secondary voltages on each tap setting. This is indicted on the Transformer Name Plate. The tap changers are connected to incremental windings on the primary side, which is connected on the autotransformer principle.

By reducing the tap setting to below 100% the secondary voltage is increased, and vice versa.

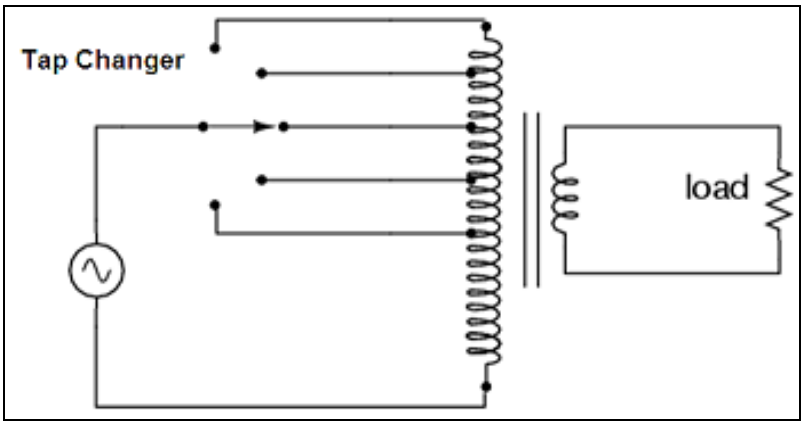


Figure 5.1

5.3 BASIC PRECAUTIONS

- Main and Auxiliary Transformer must be completely disconnected and isolated from the network before tests can proceed (Primary and secondary connections).
- The applied voltage ratio test must not be done from the secondary side since a high voltage according to the transformer ratio will be developed on the primary side, which will cause an electric shock hazard and damage to equipment
- Testing is to be done under cover of a work permit.

5.4 TYPES OF TEST

- **Insulation test**
- **Ratio test**
- **Insulation oil test**

This is done in order to confirm the condition of the transformer after the following events:

- The transformer has been damaged by lightning.
- Internal damage such as a short circuit between windings or coil damage.
- The transformer has been transported.
- The transformer has been repaired (i.e. does it have the correct name plate and does the ratio correspond to the name plate and are all the tappings connected properly).
- The transformer has been maintained / overhauled, e.g. gaskets replaced, bushings removed, etc.)

5.5 TEST EQUIPMENT USED

- Megger 2.5 to 5 kV
- Hi Pot set
- AC generator/ 3 phase supply
- Multi-meter
- Note: If with the applied voltage ratio test does not give acceptable results a high tech ratio meter test must be done by a reputable contractor.
- Sample containers for taking oil samples to do routine or after breakdown gas analysis tests.

5.6.1 THE TEST CIRCUITS

Insulation test

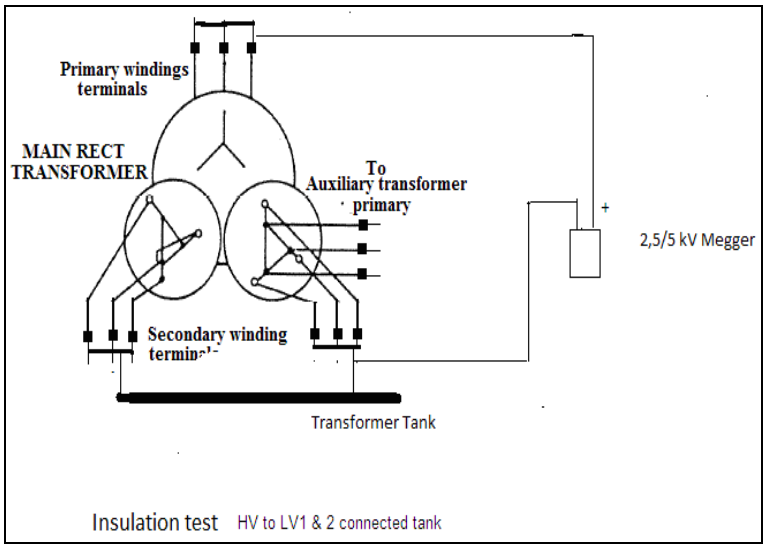


Figure 5.2: Insulation test HV to LV 1 & 2 & Earth

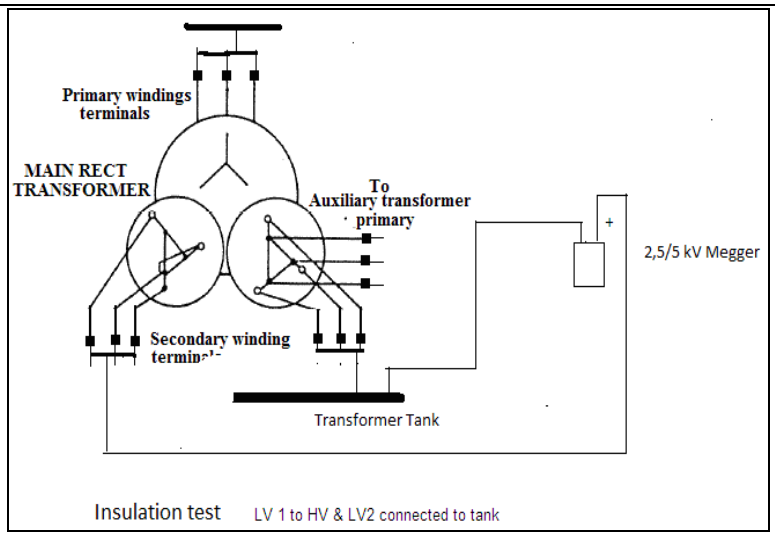


Figure 5.3: Insulation test LV1 to HV & LV 2 & Earth

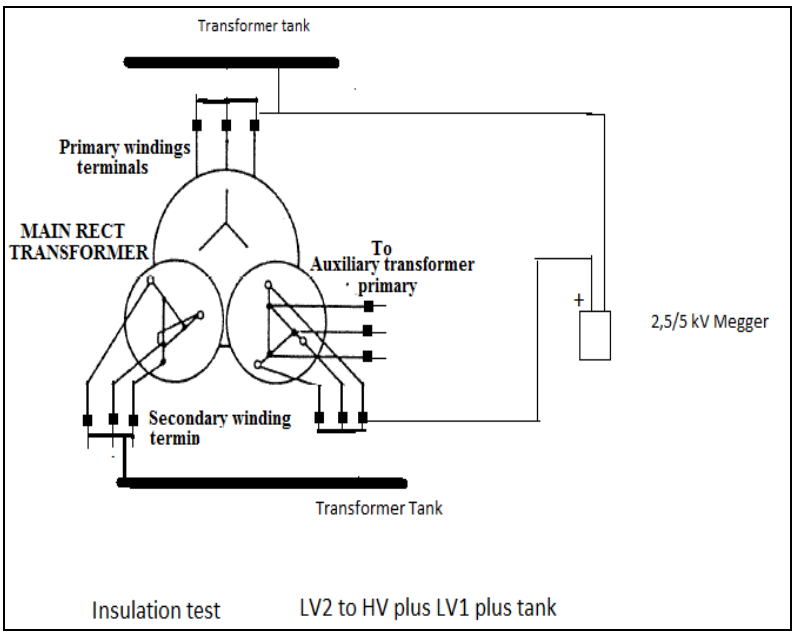


Figure 5.4: Insulation test LV 2 to HV & LV 1 & Earth

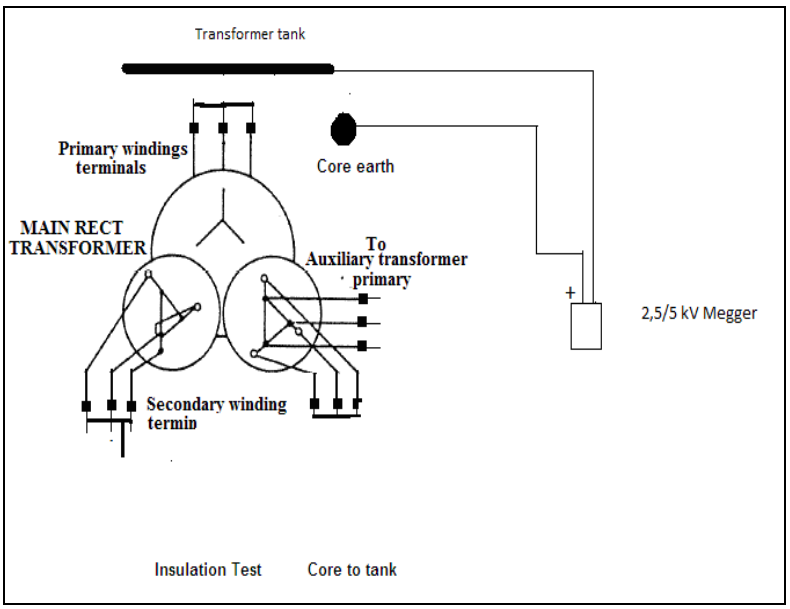


Figure 5.5 Insulation test Core to tank

5.7.1 TEST PROCEDURE

Figures 5.2, 5.3, 5.4 & 5.5 shows the connections for testing a typical traction transformer. After confirming secure connections the test voltage is applied by cranking the handle of the analogue megger for at least 30 seconds. The reading will gradually increase to a point where it stabilises and that reading will be recorded. Electronic digital instruments will "charge" up the winding under test in a similar manner. The gradual "charging" rate is due to and depends on the impedance of the winding. The core earth has to be disconnected for the test to ensure that the core to tank insulation is intact.

5.7.2 TEST CIRCUIT

Ratio test by applied voltage method

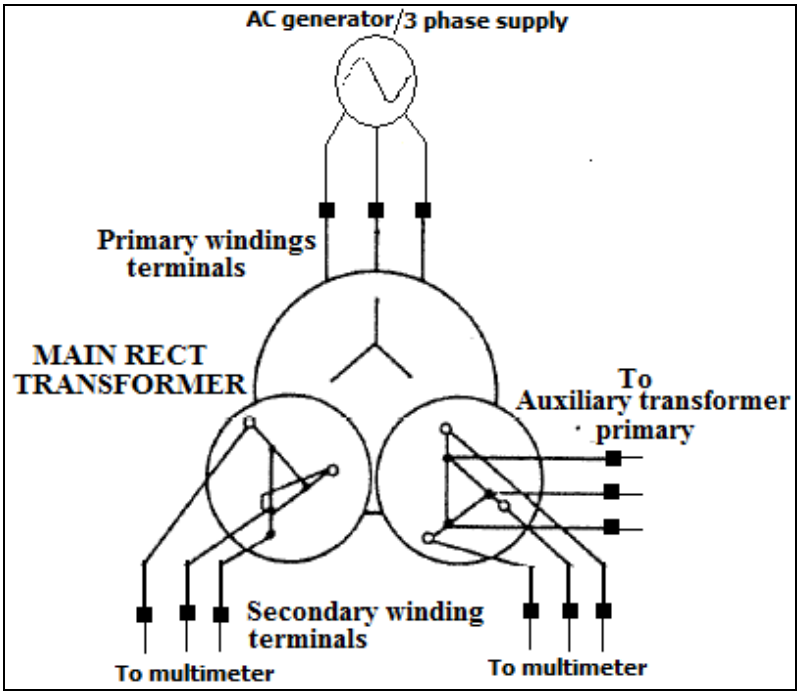


Figure 5.6: Connections for ratio test by applied voltage method

5.7.2 THE TEST PROCEDURE

Ratio test by applied voltage method

- Do the necessary calculations on test sheet to determine the Transformer Ratio as well as the secondary voltage for tap no. 3 by using test sheet formula.
- Apply three phase supply (380V) to the Primary side of the Transformer. Record all the secondary voltages on the test sheet. All the taps must be tested i.e. tap 1 to 5 and recorded on the test sheet.
- Prove that the transformer ratio is correct by comparing the secondary voltage to the calculated voltage on tap no. 3.
- Record all measurements on the test sheet.

5.7.3 THE TEST PROCEDURE

Insulation oil test

- Oil samples must be taken on a routine bases every two years as well as soon as possible after a breakdown and sent to a contractor for preferably a gas analysis test in which the following levels are determined (acceptable levels shown in brackets):
    - moisture content expressed in mg/kg or parts/million (Refer to Eng Instruction CEE-GI_012: Supervision and Maintenance of Insulating Oils in Electrical Equipment)
    - Electric strength in kV (> 30 kV)

- Acid in mg KOH /kg (< 0.50 mg KOH/g)
- Hydrogen (< 150 ppm)
- Oxygen) (not specified for free)
- Nitrogen) (breathing Xformers)
- Methane (< 25 ppm)
- Carbon Monoxide (< 500 ppm)
- Carbon dioxide (<10000 ppm)
- Ethylene (<20 ppm)
- Ethane (< 10 ppm)
- Acetylene (< 15 ppm)

5.8 DOCUMENTATION

The following documentation must be completed:

- Insulation and ratio test: BBB0348
- Insulating oil test report from contractor. (Refer to Eng Instruction CEE-GI_012)

5.9 ACCEPTABLE TEST RESULTS

- Insulation values must be equal or above the level of 2 Megohms per kV. Core to tank reading must be at a minimum of 1 Megohm for traction transformers
- The ratio if measured compared to that calculated from the name place must correspond within 5 %.
- The secondary voltage readings on every tap position must correlate to the calculated values for all tap positions.
- Insulating oil test report from contractor.

5.10 SPECIAL PITFALLS

- Note that consistent measurements are dependent on a stable supply. If the applied voltage drifts (e.g. erratic generator) the measurements will not be consistent.
- Ensure proper connections to the phases to prevent loose or weak connections. Jumper lead clamps are usually effective.
- If the transformer was damaged by lightning, accurate test results is of great importance to take a decision whether the transformer can be repaired on site or has to be transported to a contractor's works at great cost. If required obtain a second opinion from a second reputable contractor.

***

SECTION 06

TRANSFORMER PROTECTION

OIL AND WINDING TEMPERATURE THERMOMETER RELAYS

6.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

The Oil temperature thermometer monitor the temperature of the insulation oil in Traction and Distribution transformers by sampling the temperature and is set to trip the Primary Circuit Breaker if the preset "oil over temperature is reached. The Winding temperature thermometer monitor the temperature of the transformer windings mainly in Traction transformers by sampling the temperature which is superimposed onto the oil temperature by a heating resistor supplied from a current transformer. The current transformer is situated on the transformer winding connection and monitors the primary or secondary load current and the resultant temperature is set to trip the Primary Circuit Breaker if the preset "winding over temperature" is reached.

6.2 PRINCIPLE OF OPERATION

Refer to annexure 1 for further information.

The oil temperature thermometer device is in essence a closed system consisting of the sensing bulb connected by a capillary tube to a set of bellows filled with temperature sensitive fluid. Any temperature change expands or contracts this fluid in the capillary tube system and the movement is amplified by the bellows to result in the rotating movement of the indicator. Two sets of mercury tilt contacts are mounted on the dial mechanism to provide alarm and trip pulses at the predetermined settings. These contacts are normally wired in parallel to give alarm and trip pulses simultaneously to trip the Primary Circuit Breakers or Unit Breakers as applicable.

The winding temperature thermometer operates on the same principle but the indication is superimposed on the oil temperature by the heating resistor, being built in the bellows, as mentioned above. The indicated temperature is proportional to the square of voltage across the resistor which allows the resultant indication to be an accurate reflection of the winding temperature as "imaged" by the secondary current in the circuit induced by the primary load current in the main winding of the traction transformer. The time constant of the indicator at a sudden change of current is about 9 minutes, which is of the same magnitude as the time constant of the winding itself.

6.3 BASIC PRECAUTIONS

- Work permit from AC Disconnects to the Positive Isolator which must be open and locked out.
- The thermometer bulb must be withdrawn without having to drain the oil from the conservator.

6.4 TYPES OF THE TEST

Calibration and functional test by simulation of temperature increases.

6.5 TEST EQUIPMENT REQUIRED

- Oil bath of approx. 1 to 2 litre capacity.
- Heating apparatus (Electrical or gas flame)
- Standard thermometers.
- Rags and cleaning material.

6.6 THE TEST CIRCUIT (Not applicable)

6.7 THE TEST PROCEDURE

- The thermometer bulb is placed in an oil bath together with a control thermometer and container heated slowly by the electric element or gas flame. The bulbs of both

thermometers should be placed close together and the oil is continually stirred to ensure proper heat distribution.

- Compare the thermometer readings at 10 degree intervals up to approx. 120 degrees, noting the operation of the operating temperatures of 90º C for the Oil Thermometer and 115º C for the Winding Thermometer as prescribed in Engineering Instruction CEE-GI_029: Over-Temperature Protection of Traction and Power Transformers.

6.8 DOCUMENTATION

Complete the relevant test sheets BBF9000 for 3 kV DC and BBF8995 for 25 kV AC substations.

6.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- A tolerance of plus or minus 5 º C is allowed. Within this tolerance the pointer must be mechanically adjusted at the pivoting centre of the pointer with a screwdriver. If the error is greater than this, this may indicate leakage in the measuring system in which case the instrument should be returned for repair or replacement.
- For setting the winding temperature instrument, an adjustable shunt-resistor is provided, which can be adjusted to give a voltage across the heating resistor corresponding to the temperature rise of the winding hot spot above the top oil temperature. For further information, adjustments and calibration refer to the manufacturers' handbook.
- When replacing the thermometer bulb in the pocket, check that the pocket is filled with oil to ensure good heat transfer from pocket to thermometer bulb to ensure indication of the correct temperature.

6.10 SPECIAL PITFALLS

Check that the gasket between the cover and the housing of the relay is continuous and in good condition. Continual ingress of moisture causes the mechanical movement of the dial to rust and become faulty.

6.11 REFERENCES

- Manufacturer's manuals.
- Engineering Instruction CEE-GI_029: Over-Temperature Protection of Traction and Power Transformers.

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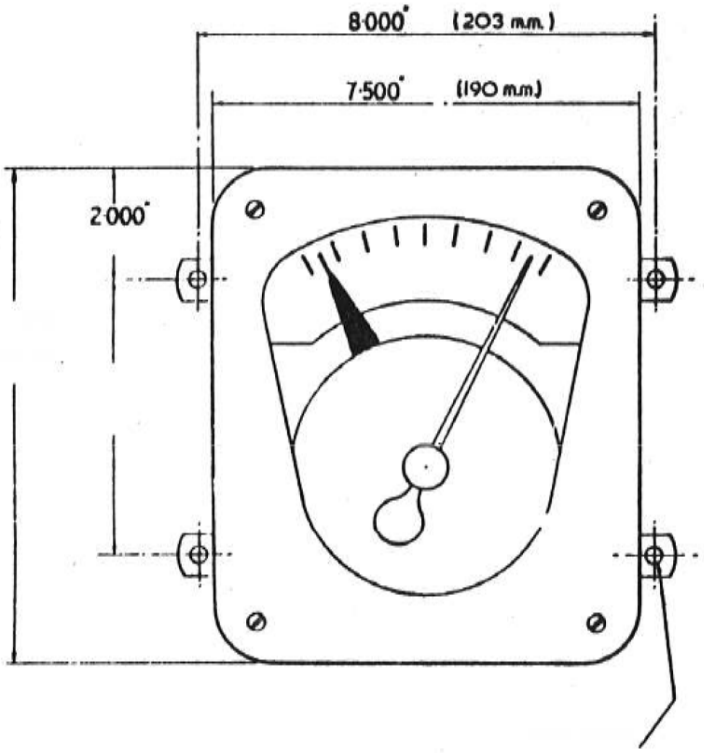
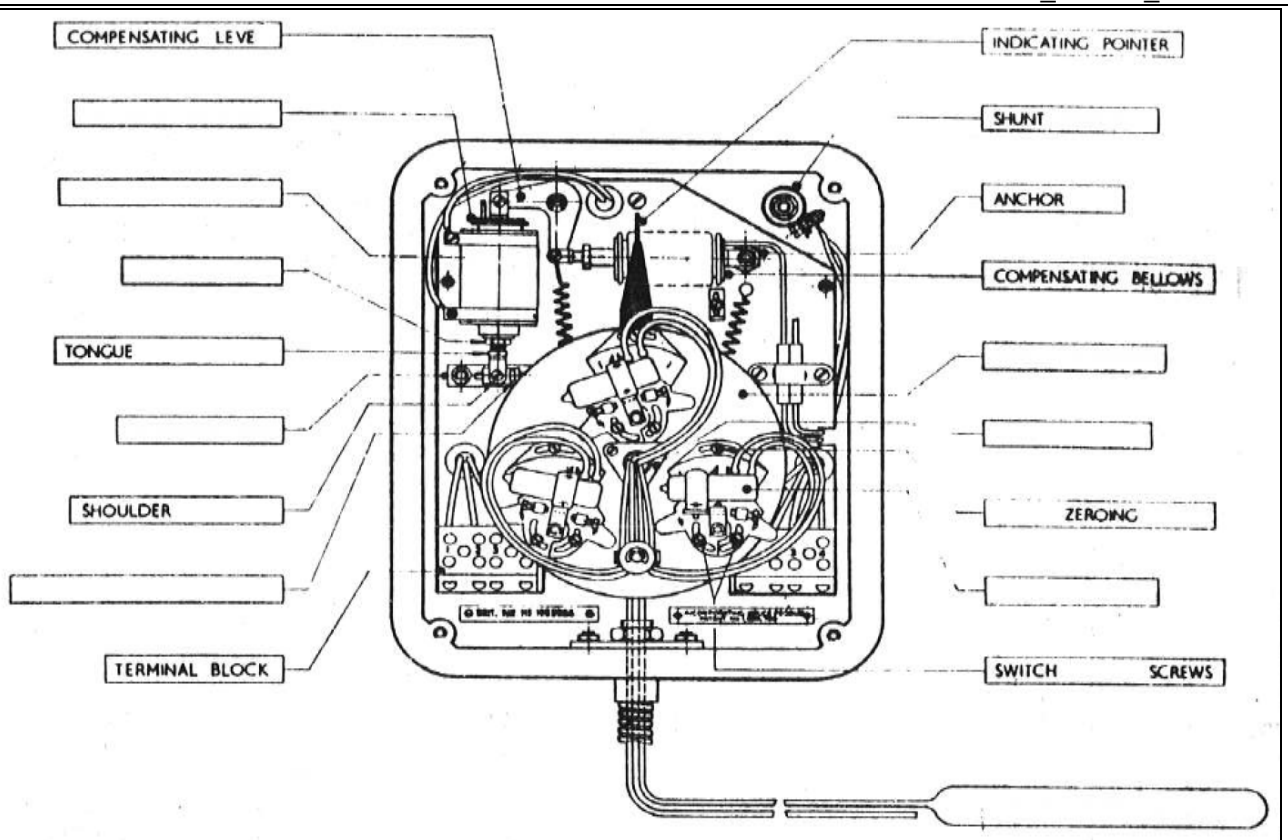


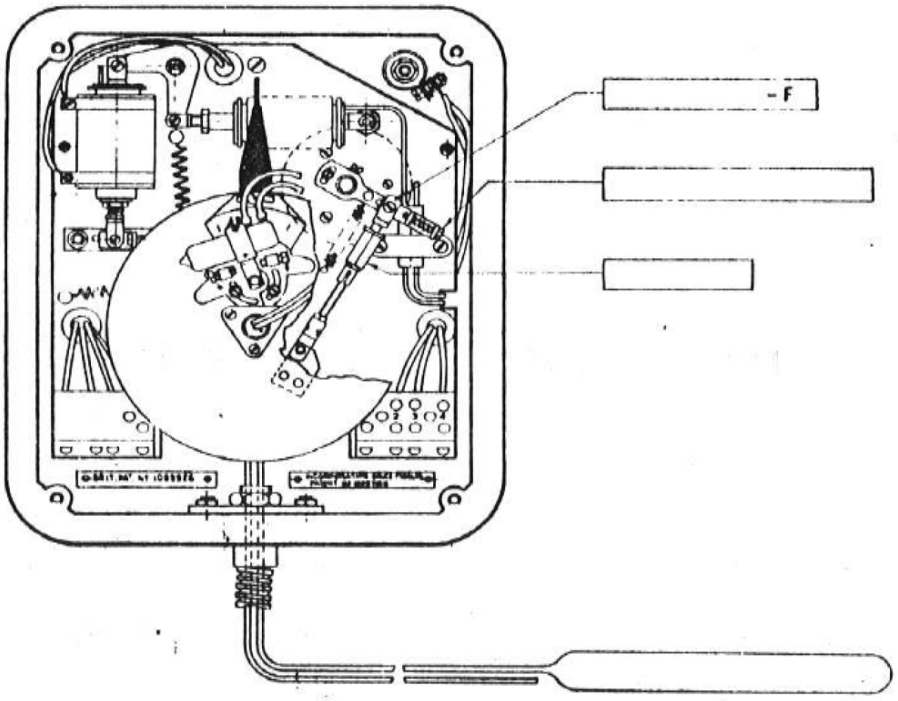
ler Model A131 which is being manufactured by Accurate Controls Ltd., Heath Works, Fordbridge Road, Sunbury-on-Thames, is designed for the protection of power transformers. The instrument is fully compensated for ambient temperature changes on capillary lines and case and operates in the following

are, however, linked together via sating lever in such a manner volume changes are cancelled ou way affects the indication.

bulb is similar to that of an ordinary distance reading thermometer and is connected to the head in the usual way by a capillary tube. A second capillary tube running parallel and close to the first is, however, provided; the two tubes being of the same bore and length. Neglecting the bulb, the twin systems are, therefore, alike and each contains the same

to the combined circular switch platform and indicating pointer. When the bulb is subjected to a rise in temperature, the bulb fluid capacity increases and this increase is transmitted to the operating bellows via the capillary tube. The operating bellows now moves downwards, since it is prevented from moving upwards by the compensating lever, the compensating bellows and the anchor





height between bulb and the head.
The fluid in system is practically
compressible a the bellows will expa
with a linear m n for a linear change

temperature. The power available from this type of system is more than adequate to operate up to four mercury switches of the dry electrode type to the C.E.G.B. specification, or three switches and a potentiometer without any visible detent. Diagram Fig. 2 shows a cutaway view through the circular switch platform to reveal the precision

The Temperature Indicator requires no maintenance but adjustment or replacement of switches and resetting of maximum pointer may become necessary.

MOUNTING

Care must be taken to ensure that the instrument is mounted in a vertical position as errors, particularly in the horizontal plane will upset the zero of the mercury switch setting scales. The use of a spirit level, placed on top of the instrument case, will ensure correct operation.

Ordinary care is needed when running the capillary, and sharp bends should be avoided, particularly where it joins the instrument and the bulb. The capillary should be supported by suitable clips at intervals of 12 to 18 inches and a suitable length left so that the bulb may be freely installed or removed. The capillary line is fully compensated, so that normal variations in

The method of adjusting the
from the diagram Fig. 1. The
justable over the range of the
scales and all switches are
differential to the same scale.

Each switch is set by slackening the
each arm and moving the left hand
the required operating temperature
nd pointer to the reset temperature a

obtained by closing the right hand pointer to the left hand pointer. A built-in stop automatically sets the minimum differential. When slackening or tightening the locking screws, steady the switch platform with the other hand to prevent undue strain on the mechanism. Care must also be taken that the dressing of the switch flexible leads are not disturbed. To obtain an accurate check on these settings the indicating pointer can be operated with the finger in a clock-wise direction to check the switch settings against the indicator dial. To obtain an accurate check on these settings the pointer must be moved slowly and steadily and must not be allowed to spring back quickly.

The mercury switches are conservatively rated and robust, but should one be damaged in any way, it may be unclipped from the switch carriage and the leads removed with a hot soldering iron. After re-soldering the leads to a new switch and fitting back into the switch carriage, it may be necessary to re-balance the switch. Check that at the instant when the mercury flows to or away from the electrodes the switch topples in its carriage between the stop pins. If the switch does not topple correctly it can be adjusted by sliding it a small amount in the appropriate direction in the plastic

been balanced correctly
the switch setting scale.
ckening the screw at the
o the required position.

No adjustments should normal
temperature controller but if
does not agree within ± 2% of
reading on a certified N.P.L.
stirred temperature bath, it may

se the instrument
before checking th
should be stirred
justes the pointer

bath temperature within ± 2% it must be reset. Fit a 2.B.A. spanner on the hexagon tongue adjuster 'C' and slacken locknut 'D'. Turn 'C' to the left a small amount to move the pointer up scale and vice versa. The locknut 'D' should then be re-tightened. Now place the instrument bulb in the hot bath for 5 minutes and the pointer should indicate this new temperature. If the instrument indicates less than the correct temperature at the high end of the range, the pointer sweep is too short and may be increased by the range adjustment.

To lengthen the pointer sweep, slacken shoulder screw 'A', turn the hexagon range adjuster screw 'B' one half turn anti-clockwise and re-tighten shoulder screw 'A'. To shorten the pointer sweep, reverse the procedure. In either case the adjustment should be made carefully and by small increments, the shoulder screw being slackened half a turn or so but not removed. Repeat the tests in the cold and hot baths until the instrument reads within ± 2% of the dial range at both ends of the scale.

A bellows heater coil is shown in Fig. 1. The bellows type of heater coil was designed by Bruce Peebles Ltd. and is covered by their Patent No. 1025785. Connections are made to the terminal block within the instrument case. The heater current with this type of unit is small. To cover normal manufacturing tolerances some means of gradient adjustment must be available. In the case of the "ACCURATE" instrument an adjustable shunt resistance mounted inside the instrument case and shown in Fig. 1 can be supplied. Coils are wound to suit customers' requirements and the adjustable shunt resistance can be factory pre-set to give the required temperature gradient for a specified current.

the other lead. To increase the temperature gradient, reverse the procedure. The position of the centre band may be altered by slackening the small screw in the retaining clip and moving the band a small amount in the appropriate direction. The small screw must then be re-tightened. Replace the shunt, dial and instrument lid before checking the gradient setting. Place the instrument bulb in a well stirred, constant temperature bath, preferably at the mid-scale temperature of the instrument. After five minutes when the instrument has

Where transformer vibrat
position it is essential
vibration mountings are
for projection mounted
tested at frequencies and
power transformers.

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suitably selected ant
These can be supplie
ments and have bee
udes applicable to larg

The instrument is
case, aluminium al
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SECTION 07

TRANSFORMER PROTECTION

GAS OPERATED (BUCHHOLZ) RELAY

7.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- The Buchholz relay is situated in the pipeline between the conservator tank and the main transformer tank.
- The main functional parts of this relay consist of the housing, float, mercury switches and a flap attached to one of the mercury switches.
- In the latest types of relay installed, a permanent magnet and a dry reed switch replace the 2 mercury switches, which in conjunction with the two floats operate the respective reed switch contacts.

7.2 PRINCIPLE OF OPERATION

- The presence of gas realised from an insulation breakdown between windings, or other electrical arcing in transformer is detected by the Buchholz relay. Voltage free contact are made, which must trip and lock out the primary circuit breaker.
- For a full description of Buchholz operation and maintenance refer to the Publication BBF8190: Traction Substations Electrician Handbook.

7.3 BASIC PRECAUTIONS

Substation condition prior to test: Work permit between AC Disconnects and Track Switches.

7.4 TYPES OF THE TEST

The Buchholz relay is test operated by pumping air (simulating gas pressure) onto the relay chamber via the petcock fitted on the transformer in such a position that the testing can be done at ground level.

7.5 TEST EQUIPMENT USED

Buchholz air injection pump or Compressed air device.

7.6 THE TEST CIRCUIT (Not applicable)

7.7 THE TEST PROCEDURE

- Connect a Buchholz pump or Compressed air device to the petcock provided for testing the relay. Pump air into the relay chamber. The air pressure will force air into the Buchholz relay chamber and causes the 2 switches (alarm and trip) to operate and trip and lockout the Primary Circuit Breaker, giving fault indication.
- Check that the indication on the control panel in the substation is detected and that the lockout circuit is energised.
- Release the air through the gas release valve, allowing the chamber to refill with oil. Reset the lockout relay and all indication flags.

7.8 DOCUMENTATION

Complete the BBF9000 for 3 kV DC or BBF8995 for 25 kV AC by recording the volume of air in cc's indicated on the sight glass of the relay during the test procedure.

7.9 THE RANGE OF ACCEPTABLE TEST RESULTS

The volume of air required to complete the test procedure will vary according to the size of the device (pipe diameter). Normally the float switches are set to half of the sight glass to achieve the required result i.e. approx. 250-300 cc for traction transformers and 150-200 cc for distribution units.

7.10 SPECIAL PITFALLS

- At times if a transformer has not tested at regular intervals, the float does not "fall" with the dropping of the oil level during the air injection process and then has to be

tapped "free" by the tapping lightly on the body of the housing with a light hammer. If this action does not give results with two or three attempts the relay will have to be repaired or replaced.

- If the control cables have been disconnected for any reason, malfunction can occur if wiring was not replaced correctly.

***

SECTION 08

MAIN TRANSFORMER OVERLOAD AND FAULT PROTECTION

8.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

The Main transformer is protected against overload and fault currents by Instantaneous and Thermal Overload Relays with Oil, Winding, Buchholz, and Pressure Relief Device protection as discussed in other sections of the Handbook.

At AC traction substations Restricted Earth Fault and Biased Differential protection is installed as well.

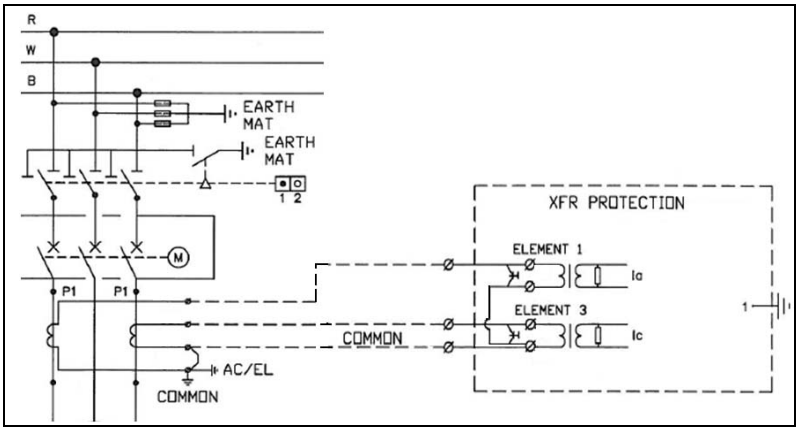


Figure 14.1 DC substation General Arrangement for Main Transformer Thermal and Instantaneous overload protection.

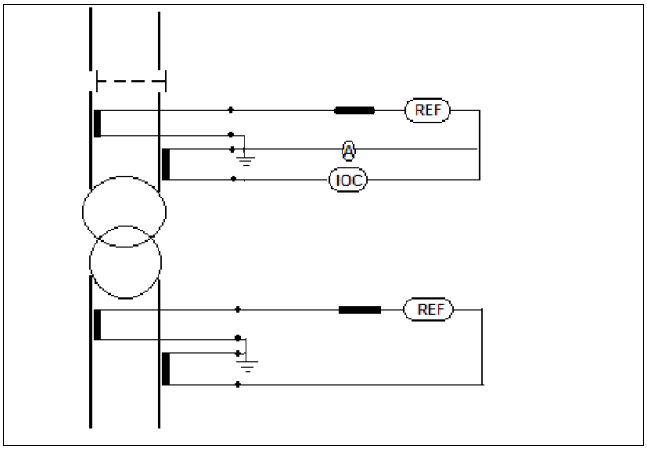


Figure 14.2: AC Substation General Arrangement for Main Transformer Restricted Earth Fault protection.

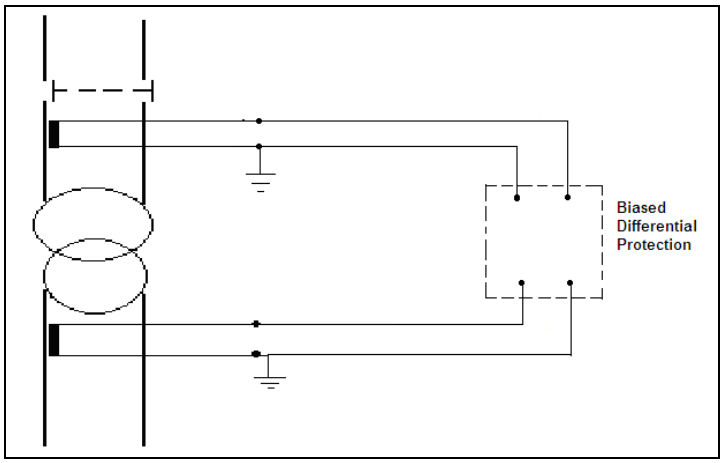


Figure 14.3: AC Substation General Arrangement for Main Transformer Biased Differential protection

8.2 PRINCIPLES OF OPERATION

- Loose standing or bushing current transformers is applied to drive the protection relays. A proportional component of the load or fault current passes through the sensing part of the relay. If the pre-set values are exceeded the trip contact is closed by the operational part to send a trip pulse to the primary circuit breaker.
- For current operations, Instantaneous and Thermal elements are connected in series in electromechanical relays and in modern electronic type relays different elements are programmed to distinguish between fault and load currents.
- For timing operations, magnetic disc and thermal bimetallic principles are used in electro mechanical types with timing elements in electronic relays.
- Restricted Earth Fault protection operates on a balanced current principle where the current flowing into the transformer winding is compared with the current flowing out of the winding. The two currents from the CT secondary windings are so connected that summary of the resultant current amount to zero. If a leakage through failure of insulation occurs the two currents will be different thus current will flow through the relay. A setting of 10% is normally applicable to both Primary and Secondary windings to allow for magnetization and inrush currents.
- Biased Differential Protection operates on a similar balanced current principle where the current flowing into the transformer primary winding is compared with the current flowing out of the secondary winding. A setting of 20% is normally applicable to allow for magnetization and inrush currents.

8.3 BASIC PRECAUTIONS

- All testing must be done under cover of a work permit.
- Never disconnect any relay or current transformer under load.

8.4 TYPES OF TESTS

- Magnetization curves and ratio tests (where possible) on Current Transformers.
- Polarity tests must be done in both AC & DC substations on current transformers when control cables were disconnected or replacements of bushings were done.
- Primary, secondary or test winding injection to test and set overload protection relays at predetermined typical values as below.
- Instantaneous overload relays in AC & DC traction substations are generally tested at 4 and 6 times full load to trip the PCB within 50 milliseconds. Other settings can be applicable depending on the type of substation.
- Thermal overload relays in AC and DC traction substations are generally tested at 2 and 3 times full load to trip the PCB within 30 minutes and 2-3 minutes respectively.
- Restricted Earth Fault relays are tested by applying either a gradually increasing AC voltage (between 40-80 volts) across or current (typical 0.1 amps for a 1 amp secondary) through the relay to pre-set values tripping the PCB.
- Biased Differential Protection relays are tested by applying a gradually increasing AC current through one of the relays (primary and secondary) at one time to pre-set values (typical 0.2 amp for a 1 amp secondary) tripping the PCB

8.5 TEST EQUIPMENT USED

- Variable voltage injection test set.
- Variable current injection test set with timing facility.
- Voltmeter 0-300 v AC
- Ammeters with Lab. current transformers.
- Set of test leads.

8.6 THE TEST CIRCUIT

(For Mag curves and Ratio of Current transformers refer to Section 4)

- **Instantaneous and thermal overload relay**.

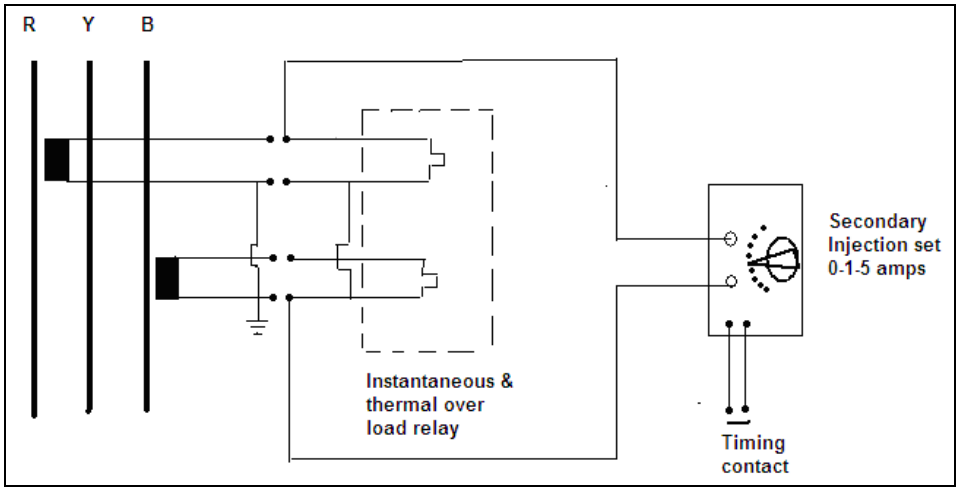


Figure 8.2: Connections for secondary injection test

Figure 8.2 shows the connections for secondary injection to test the relay connected to the red phase as well as a timing contact that can be connected to either a contact on the relay or across the poles of the relevant primary circuit breaker. For testing procedures the links must opened or wires disconnected on the relevant terminals as determined from the applicable circuit diagram.

- **Restricted Earth Fault relay**

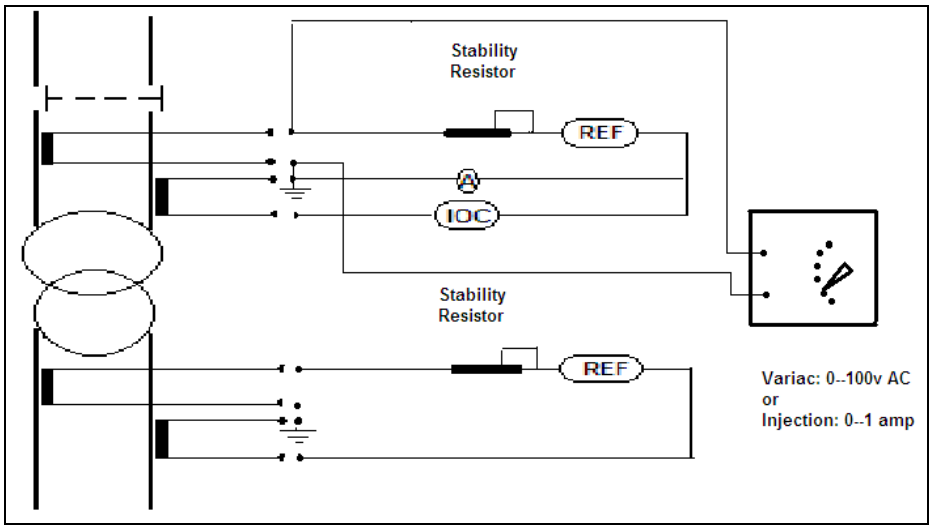


Figure 14.3: Connections for secondary injection

Figure 14.3 shows the connections for secondary injection to test the relay connected to the red phase as well as a timing contact that can be connected to either a contact on the relay or across the poles of the relevant primary circuit breaker The test must be repeated on the secondary side of the transformer to confirm operation from both sides.

- **Biased differential fault relay**

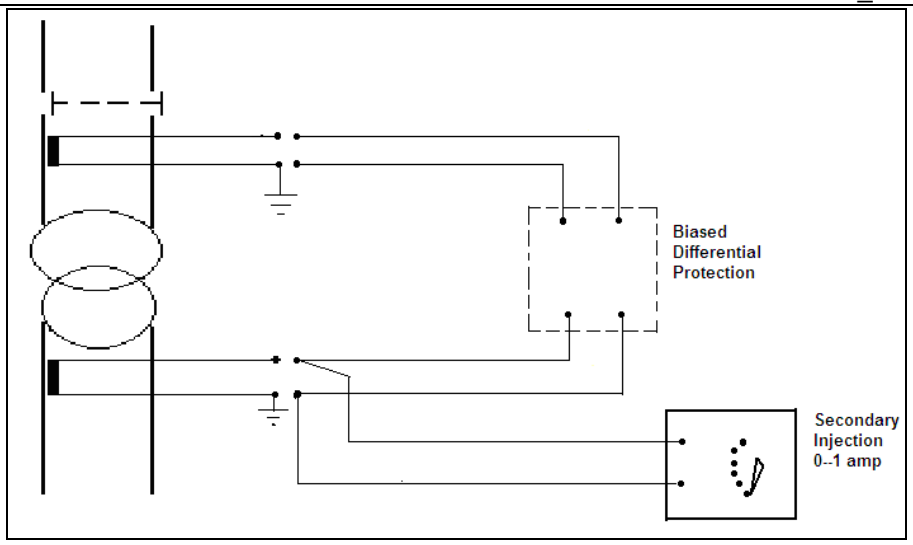


Figure 14.4: ***Connections for secondary injection***

Figure 14.2 shows the connections for secondary injection to test the biased differential protection relay connected to the secondary of the transformer. The test must be repeated on the primary side of the transformer to confirm operation from both sides.

8.7 THE TEST PROCEDURE

- Determine the required settings for the instantaneous and thermal overload relays according to the type of relay and the rated full load current.
- Refer to the substation manuals for information on relays in use. The documents can be referred to for information electronic type relays:
  - BBG5978: Manual for 7SR11 & 7SR12 Argus Over-Current Relay (Siemens)
  - BBG5979: Manual for Fp04-B Combined Over-Current, Earth Fault and Sensitive Earth Fault Protection Relay (Strike Technologies)
- For first time settings e.g. after replacements or refurbishment set the different elements for thermal and instantaneous overloads with the relative Time Minimum Settings (TMS).
- Inject the required current for the different multiples of secondary current recording the respective times on the relevant test sheet.
- Confirm the indications and tripping of the primary circuit breaker.

8.8 DOCUMENTATION

Complete test sheets BBF9000 for 3 kV DC or BBF8995 for 25 kV AC substation.

8.9 THE RANGE OF ACCEPTABLE TEST RESULTS

Tripping values of current and resultant times should fall within 5 % of the specified values for the particular relay allowing for differences in equipment and instruments used.

8.10 SPECIAL PITFALLS

- Care must be taken when setting up the required injecting current at multiples higher than 3 times full load current that the relay is not subjected to these higher currents for more than 5 seconds at any time as the relay is not rated to carry high currents for more than a few seconds.
- Always confirm the injecting current reading the on Lab. instruments to be correct before applying it to the relay under test.

***

SECTION 09

AUXILIARY TRANSFORMER PROTECTION

9.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- The Auxiliary transformer is used to supply a stepped down voltage to the auxiliary equipment in traction substations. In DC substations tertiary connections are tapped from one of the secondary windings and supplied to a three phase step down transformer at ratings of 50 to 150 KVA

  In AC substations a single phase transformer at ratings of 16 to 50 KVA is employed.

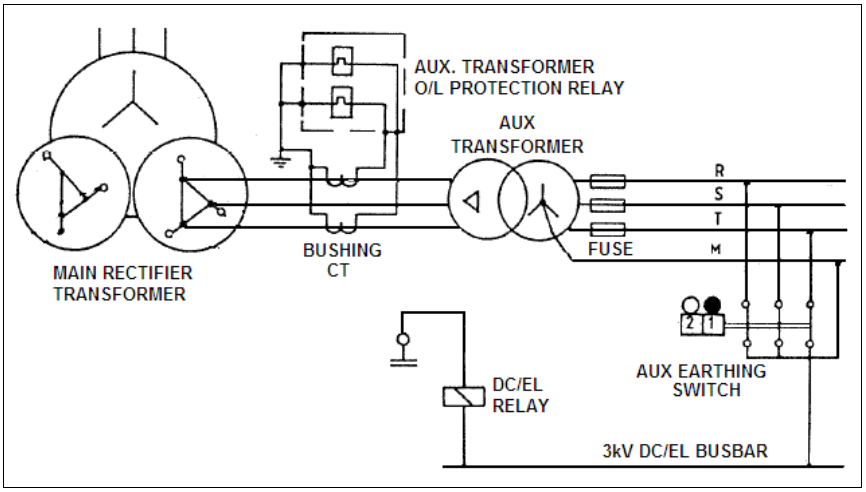


Figure 9.1: Typical connection for Auxiliary Transformer as arranged in Traction substations.

- The Auxiliary transformer in traction substations is protected against overload and fault currents by Instantaneous and Thermal Overload Relay with Buchholz relay protection as discussed in other sections of the Handbook.

9.2 PRINCIPLE OF OPERATION

- Bushing current transformers is applied to drive the protection relays. A proportional component of the load or fault current passes through the sensing part of the relay. If the pre-set values are exceeded the trip contact is closed by the operational part to send a trip pulse to the primary circuit breaker.
- For current operations, Instantaneous and Thermal elements are connected in series in electromechanical relays and in modern electronic type relays different elements are programmed to distinguish between fault and load currents.
- For timing operations, magnetic disc or thermal bimetallic principles are used in electro mechanical types with timing elements in electronic relays. .

9.3 BASIC PRECAUTIONS

- All testing must be done under cover of a work permit.
- Never disconnect any relay or current transformer under load.

9.4 TYPES OF THE TEST

- Magnetization curves and ratio tests (where possible) on Current Transformers.
- Primary, secondary or test winding injection to test and set overload protection relays.

- Instantaneous overload relays in DC substations are generally tested at 4 and 6 times full load to trip the PCB within 500 and 300 milliseconds respectively. Other settings can be applicable depending on the type of substation.
- Thermal overload relays in DC substations are generally tested at 3 times full load to trip the PCB and 2-3 minutes.

9.5 TEST EQUIPMENT USED

- Variable voltage injection test set.
- Variable current injection test set with timing facility.
- Voltmeter 0-300 v AC.
- Ammeters.
- Set of test leads.

9.6 THE TEST CIRCUIT

- Mag curves and Ratio of Current transformer. Refer to Section 4 of the Manual.
- Instantaneous and thermal overload relay.

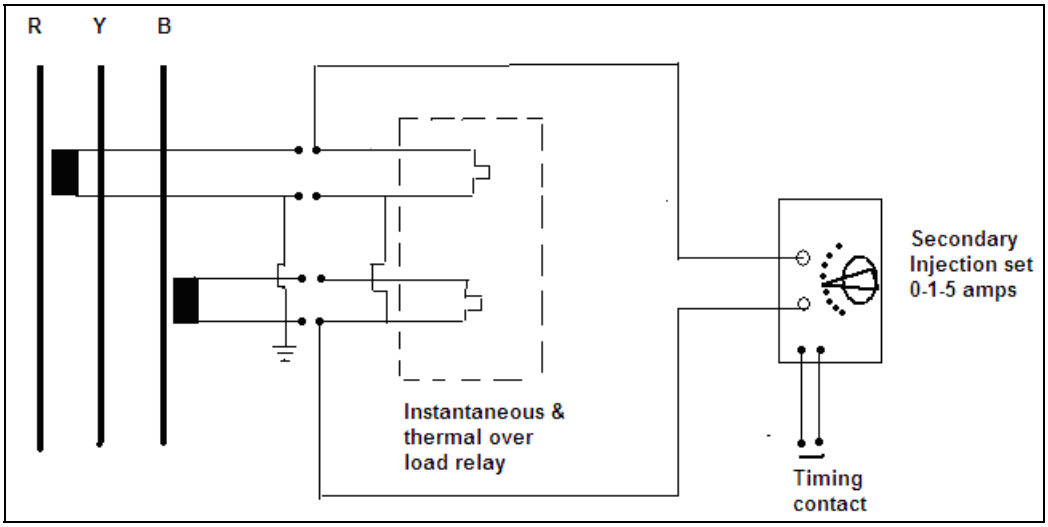


Figure 14.2

- Figure 14.2 shows the connections for secondary injection to test the relay connected to the red phase as well as a timing contact that can be connected to either a contact on the relay or across the poles of the relevant primary circuit breaker. For testing procedures the links must opened or wires disconnected on the relevant terminals as determined from the applicable circuit diagram.

9.7 THE TEST PROCEDURE

- Determine the required settings for the instantaneous and thermal overload relays according to the type of relay and the rated full load current.
- For first time settings e.g. after replacements or refurbishment set the different elements for instantaneous, thermal overloads with the relative Time Minimum Setting (TMS).
- The following documents can be referred to for information on electronic type relays:
    - BBG5978: Manual for 7SR11 & 7SR12 Argus Over-Current Relay (Siemens)

- BBG5979: Manual for Fp04-B Combined Over-Current, Earth Fault and Sensitive Earth Fault Protection Relay (Strike Technologies)

- Inject the required current for the different multiples of secondary current recording the respective times on the relevant test sheet.
- Confirm the indications and tripping of the primary circuit breaker.

9.8 DOCUMENTATION

Complete the relevant test sheet BBF9000 for 3 kV DC substation.

9.9 THE RANGE OF ACCEPTABLE TEST RESULTS

Tripping values of current and resultant times should fall within 10 % of the specified values for the particular relay allowing for differences in equipment and instruments used.

9.10 SPECIAL PITFALLS

- Care must be taken when setting up the required injecting current at multiples higher than 3 times full load current that the relay is not subjected to these higher currents for more than 5 seconds at any time as the relay is not rated to carry high currents for more than a few seconds.
- Always confirm the injecting current reading the on Lab. instruments to be correct before applying it to the relay under test.

***

SECTION 10

AC EARTH LEAKAGE SYSTEM

10.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- An AC earth leakage (E/L) system is provided to protect against flashovers on the HV outdoor yard equipment. Outdoor steelwork of equipment which carries the Eskom supply voltage is insulated from the earth mat and connected in parallel through a current transformer to the earth mat. The CT is connected to an AC Earth Leakage relay.
- Operation of the relay trips and locks out the primary circuit breaker.
- Note that this arrangement can only isolate a fault occurring on the load side of the Primary Circuit Breaker (PCB). A fault on the supply side will still trip the PCB, but the fault must be interrupted by Eskom. If Eskom does not trip the current can cause serious damage at the substation. The same can happen if a fault on the Eskom transmission line earth, which is connected to the substation earth, is not cleared quickly.

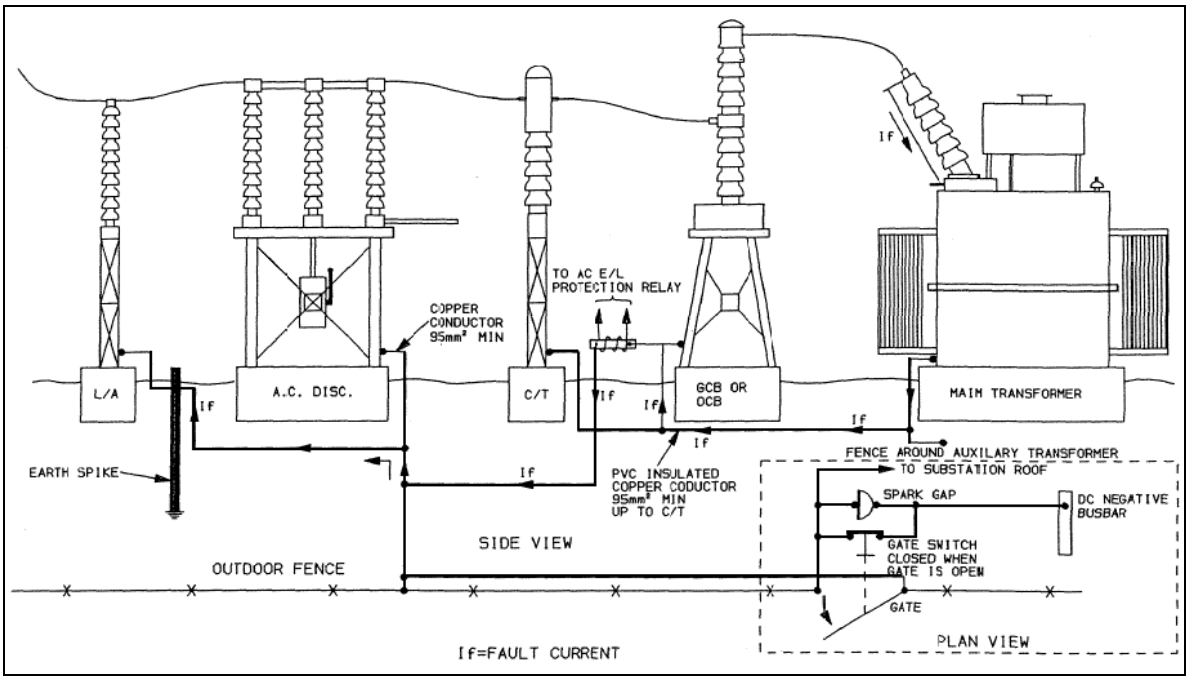


Figure 6.1: Typical layout of the earthing of the equipment in the outdoor yard

- The equipment in the outdoor yard is insulated from substation earth mat and is connected in parallel through a 250-50:5 current transformers to earth mat. The minimum resistance between the parallel connected equipment and earth mat is 10 Ohm.
- The output of the CT (which is mounted on the primary circuit breaker support frame) is fed into an earth leakage relay which is normally set to operate between 50 A and 100 A of primary current.
- Operation of the relay must lock out the primary circuit breaker.

10.2 PRINCIPLE OF OPERATION

- The Current Transformer output (250-50:5) is fed to an AC Earth Leakage Relay which is normally set in the range of 50 to 100A of the primary current.
- Figure 4.1 shows a typical layout of the earthing of the equipment in the outdoor yard including the position of the AC earth Leakage Relay on the primary circuit breaker support frame. The current path of a fault on the main transformer is indicated by means of arrows.

- An AC Earth Leakage operation must trip and lockout the Primary Circuit Breaker.

10.3 BASIC PRECAUTIONS

The CT may under no circumstances be open circuited when the substation is on load.

10.4 TYPES OF THE TEST

- Injection test.
- Trip test to verify the functional operation of the substation.

10.5 TEST EQUIPMENT USED

- Injection set.
- Lab CT at 100/200 amps Lab ammeters to 5 amp scale or clamp on Ammeter.
- Set of Heavy duty leads.

10.6 THE TEST CIRCUIT

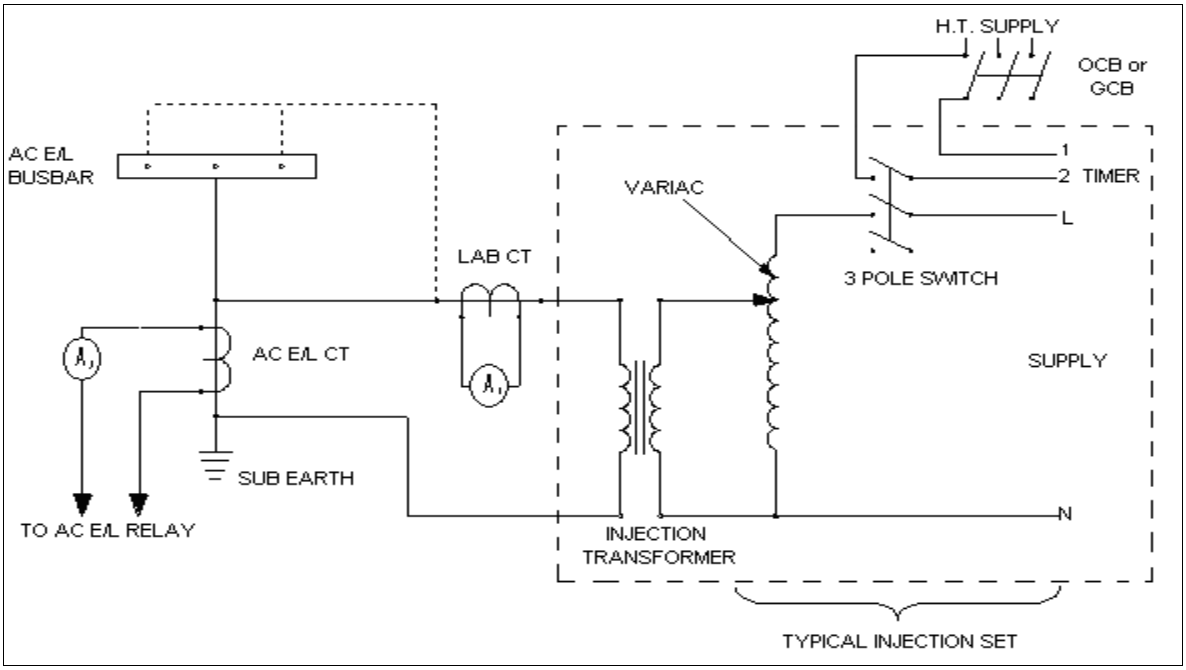


Figure 6.2: Circuit Diagram for Testing AC E/L Protection

10.7 THE TEST PROCEDURE

- Inject alternating current through the AC earth leakage current transformer as shown in Figure 6.2, using a 250 Amp AC Injection Test Set.
- Read the corresponding primary and secondary currents A1 and A2.
- The relay trip setting must correspond with the prescribed primary current A1.
- Check that the primary circuit breaker trips and that the trip & lockout condition is indicated on the AC control panel.
- Remove the primary injection cable from the AC earth leakage busbar side of current transformer and inject (flash test) through the metal parts of the following equipment, one by one, to ensure that all equipment is properly connected to the AC Earth leakage busbar:
  - main current transformer structure.
  - primary circuit breaker structure.
  - main transformer tank.

- auxiliary transformer screen.

- Check that the relay operates in each case.

NOTE: When injecting through the various equipment, the test voltage should be increased to account for the increase in resistance in the circuit to obtain the tripping current.

- Record all measurements on the test sheet BBF9000.

10.8 DOCUMENTATION

Test sheet BBF9000.

10.9 ACCEPTABLE TEST RESULTS

Relay operates at a current of 50-100 A by tripping and locking out the PCB. The minimum resistance between equipment and earth mat is 10 Ohm.

10.10 SPECIAL PITFALLS

Resistance between AC earth Leakage busbar to Earth mat below 10 ohms due to parallel paths formed by insulation failure between transformer and skid rails or control cables exits and entries not block jointed.

***

SECTION 11
TRACTION RECTIFIER

11.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

The function of the rectifier is to convert AC input power to DC input power suitable for 3kV DC traction. Typical connection of transformer/rectifier unit is shown below:

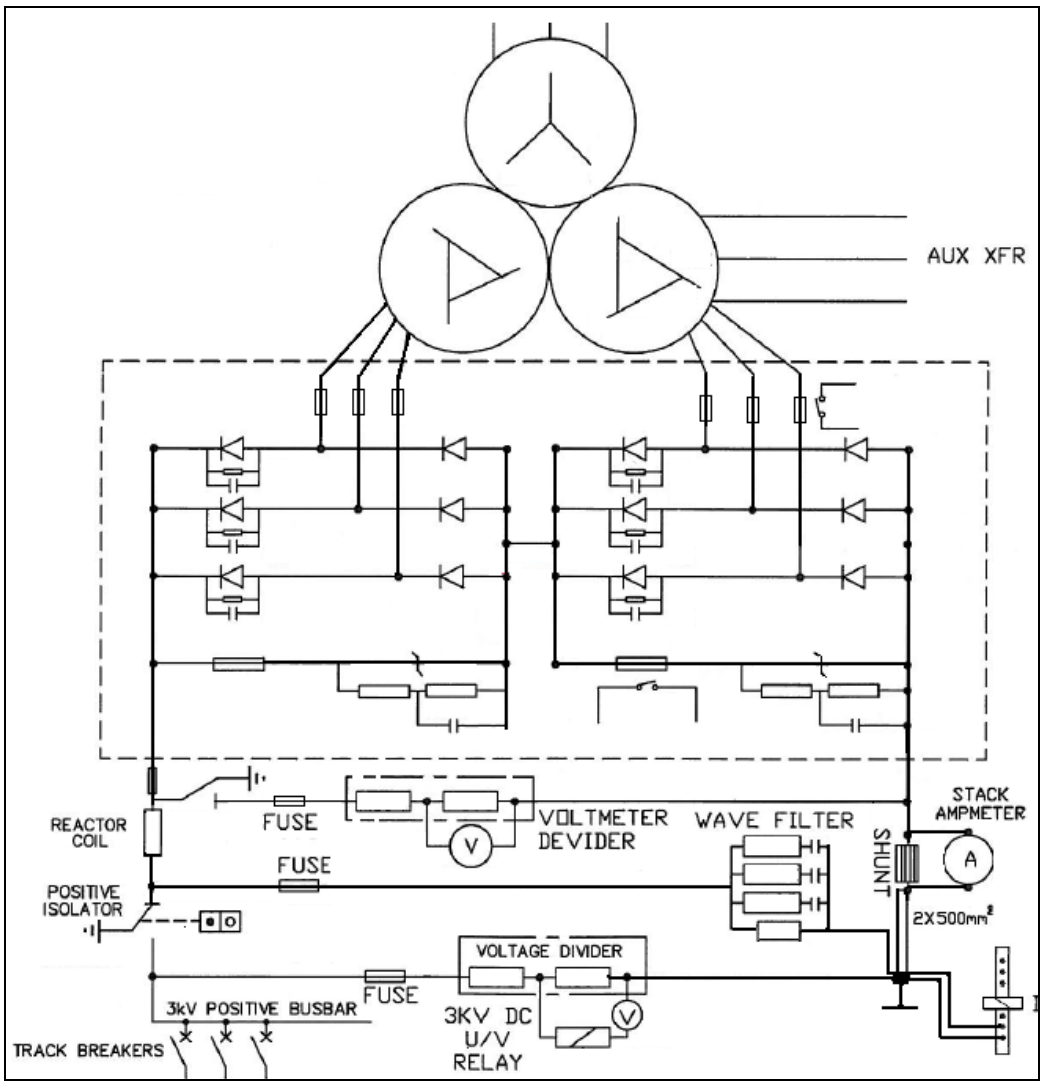


Fig 7.1: General arrangement for traction rectifier connections.

11.2 PRINCIPLE OF OPERATION

- **The Rectifier Unit**

Rectifiers used are either full wave three phase units converting to 3kV 6-pulse DC from a 2450 V three supply, or a 12-pulse rectifier configured as two full wave rectifiers in series, each producing a pulsating 1,5kV DC with 6 pulses per cycle. In this case the two 6-phase components are phase shifted by 30 degrees to produce an overall 3kV DC with 12 pulses per cycle.

The rectifier is connected in series between the traction transformer and the reactor coil and in parallel with a wave filter, which is designed to smooth the 12-pulse harmonic components.

- **Diodes**

The diodes are connected in series and parallel to achieve the current and reverse voltage levels required. The voltage distribution between series connected diodes is controlled statically with RC components. Each diode is monitored with a diode monitoring circuit.

Capacitors ensure that diodes switch on and off more or less simultaneously to prevent any one diode from receiving the full inverse voltage. Resistors ensure an even distribution of voltage across each diode in a series bank.

The loss of one diode failing to short circuit causes:

- The reverse voltage rating or peak inverse voltage (PIV) of series diodes can be exceeded by line surges or over temperatures and cause failure thereof to a short circuit between two of the 3-phases feeding that bridge rectifier (which will result in a high fault current with operation of the overload relay).
- Full 3kV DC from the line side is placed over one half string of the bridge rectifier which can exceed the reverse voltage rating of the string.

The loss of one diode failing to open circuit causes one of the 6 pulses to be absent, which results in pulsating DC with a large harmonic component which the wave filter equipment cannot neutralise.

- **Diode monitoring**

Diode monitoring equipment is installed to monitor the condition of every diode. A LED indication is provided on the display panel. Any diode going faulty must trip and lock out the unit.

Fault finding hint: Defects of the DMS can usually be traced to the power supply which is derived from the 110V of the substation as the 110V supply may contain high switching surges as a result of the reactive load from the contactors on the High Speed Circuit Breakers.

- **Fuse protection**

The latest generation rectifiers are supplied with striker pin fuse protection on the incoming phases, which must lock out the unit in the event of operation.

- **Cooling**

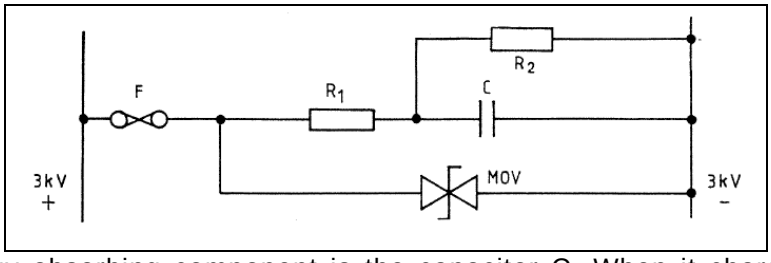
Rectifiers' temperatures are mostly controlled by forced air cooling The cooling fan is activated by a current monitoring relay which detects load current through a shunt resistor or to switch on at 700Amps**.** The rectifier is protected by two over-temperature sensors which is set at 50º for the cooling fan switch on and 80ºC.for the PCB to trip.

Fan failure is detected with a vane which is kept open when the fan blows. At initial power up of the rectifier, a short time delay overrides the fan-fail while the blower gathers speed.

A fan failure must trip and lock out the Primary Circuit Breaker with indication on the Control panel.
A fan test switch is provided on the Control Panel.

- **Attenuation**

An attenuation circuit is installed across the output of the rectifier to suppress and absorb short surge voltages on the load side. The over-voltages should be reduced to around 6kV by the protective devices at the track switch.



The main energy absorbing component is the capacitor C. When it charges via R2 to a level higher than the surge, it will discharge through the resistor. If the surge is of too high magnitude the MOV will trigger. If the MOV cannot discharge the surge, the fuse will operate. A striker pin fuse operation activates a tripping and locks out the PCB and all HSCB's to prevent damage.

11.3 BASIC PRECAUTIONS

Work permit on rectifier unit under test

11.4 TYPES OF THE TEST

- **Factory tests**

A new rectifier must have the following tests performed at the supplier's test facility before delivery to site:

- Insulations tests
- Light load test
- Functional tests on the associated control equipment and circuitry of the rectifier
- Temperature rise test i.e. temperature measurements on diode heat sink temperature rise which must not exceed 75ºC
- Checking of auxiliary and protective devices and control equipment
- Rated output test with measurement of output voltage
- Over-current capacity test
- Power loss determination

- **Commissioning or after Major repair tests**

Insulation Test
Equipment Required: Hi pot test set 0-25-30 kV AC.
Testing Procedure:

- Disconnect all busbar connections to and from the rectifier with adequate insulation inserted where required.
- Short out all diode circuits and busbars by means of binding wire.
- Remove fuse from Attenuation Circuit.
- Connect High tension lead from test set to shorted busbars.
- Connect earth lead from test set to metal frame of rectifier.
- Raise test voltage to 10.5 kV AC for one minute.
- Reduce voltage gradually
- Remove shorting connections and reconnect all busbars.
- Replace fuse in attenuation circuit.

Rectifier temperature control tests
Equipment Required: Optic fibre simulation equipment.
Testing procedure:

- Simulate fan operation at 50º C.
- Simulate Primary Circuit Breaker trip at 80º C. with indication.

Diode monitoring equipment test
Simulate Diode failure on random circuits to trip Primary Circuit Breaker with indication.

Indicating instrument tests:
Equipment Required: Hi pot test set 0-4 kV DC and a Millivolt injection set.
Testing procedure:

- Calibrate DC volt- and ammeters on rectifier and positive isolator.

11.4 TYPES OF THE TEST (cntd)

Load test
Testing procedure

- Energise rectifier with HSCB's open for approx.10 minutes noting no-load voltage.
- Close HSCB's noting On-load voltage to be stable and current to have an even rate of rise.

3 Operation of diodes
With new hitech rectifier designs with diode monitoring systems, faulty diodes can easily be identified. The following procedures below can be applied to confirm any indications or diodes in the process of failing.

Equipment Required: 3 Phase Generator.
Multimeter
Set of light leads.
0-4 kV DC Injection set
Voltdrop test: (*see Figure 11.2*)
Testing procedure

- Disconnect all AC & DC Busbar connections.
- Connect 3 Phase supply to each rectifier bank in turn.
- Measure voltdrop across each diode noting readings.
- If voltage reading is low or zero diode is faulty
- Variation in voltage readings can be caused by RC commutation circuits

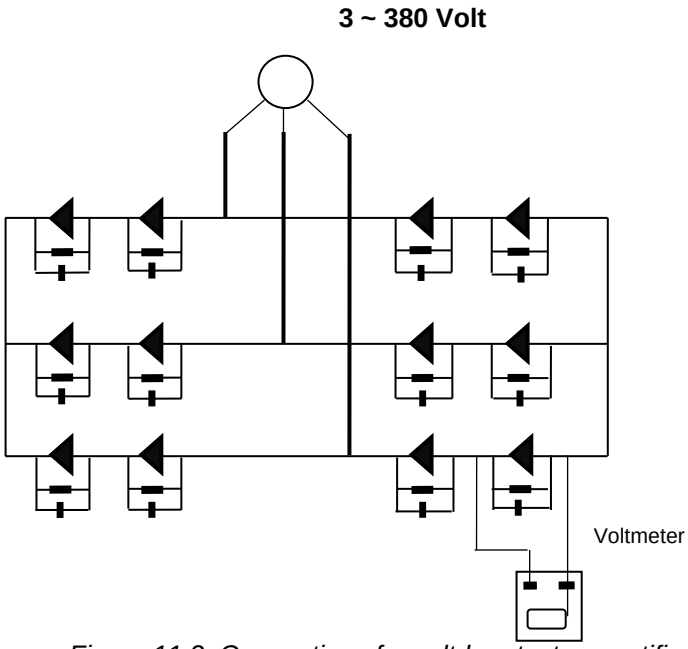


Figure 11.2: *Connections for voltdrop test on rectifier bank*

11.4 TYPES OF THE TEST (cntd)

3. Operation of diodes

Peak Inverse Voltage test:

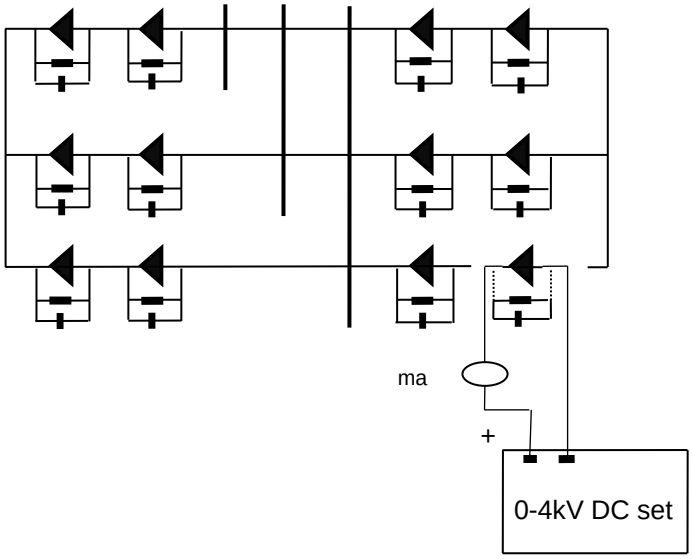


Figure 11.3: Connections for Peak Inverse Voltage test.

Testing procedure

- Disconnect/remove suspect diodes from rectifier bank.
- From the DC Hipot apply a reverse voltage of 50 % of the diode rated PIV across the diode. (Typically in the order of 1500 volts DC)
- The reverse current in micro/milliamps must conform to the diode specified rating curve to identify “soft” diodes.

11.8 DOCUMENTATION

Complete the applicable test sheets.

11.9 THE RANGE OF ACCEPTABLE TEST RESULTS

Insulation test: At 10.5 kV the leakage current should be less than 5 mA

Functional tests:

- All temperature tests shall be within 5 % with required indications.
- All meters within 5 %
- Load tests: No load and full load voltage within 10 % of 3,300 volts.
- Diode Test: Voltdrop across diode to be within 5 % of average value.

11.10 SPECIAL PITFALLS

On testing diodes a faulty diode will only break down at higher voltages.

***

SECTION 12

WAVE FILTER EQUIPMENT

12.1 THE FUNCTION OF THE WAVE FILTER EQUIPMENT IN THE ELECTRICAL SYSTEM

- The rectifier in most DC substations is a 12 pulse rectifier, which generate harmonic frequencies (the 6th, 12th, 18th and 24th harmonics). This can cause interference on communication and train authorisation systems.

  The circuit and output voltage waveform is as follows:

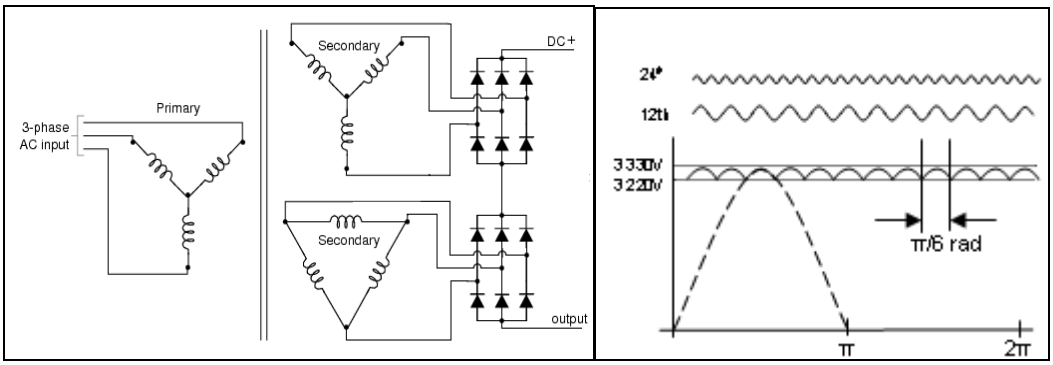


Fig 8.1: 12 pulse rectifier and ripple waveforms

- The Wave filter is connected on the load side of the main reactor. It is protected with a fuse. There are a number of arrangements for this equipment:
- In some substations the wave filter is interlocked with the positive isolator such that the capacitors are earthed / discharged when the rectifier bay needs to be entered.
- Some subs have a separate wave filter room (old mercury arc converted subs), in which case the wave filter has to be earthed by a special mechanism on the access door (ensure it is connected in the capacitor side of the fuse). These access doors should also be mechanically interlocked with the positive isolator.
- Since this equipment must be disconnected to test it, the substation circuit must be studied beforehand. Where automatic earthing is not provided the capacitors must be discharged manually first.

12.2 PRINCIPLE OF OPERATION

The connection in the circuit is as follows:

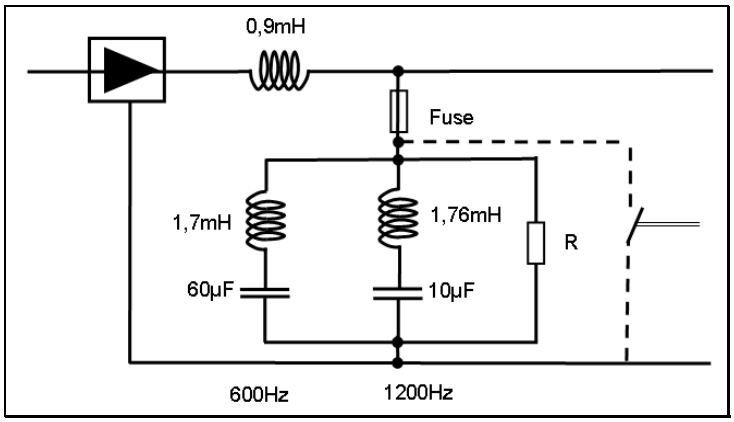


Fig 12.2 12th and 24th harmonic filter for a 12 pulse rectifier

- Wave filters are designed to remove or reduce the ripple resulting from the rectification process. Frequencies in multiples of 300Hz or 600Hz are generated on the output of the rectifier depending on whether 6-pulse or 12-pulse rectification is applicable. The system is installed mainly for no- or light load conditions as it must be born in mind that the harmonic content of the output waveform increases in proportion to the load current.

- The Wave Filter equipment consists of tuning coils and capacitors. The capacitors are normally rated at 100µF, 60µF, 20µF, and 10µF for the 6th, 12th, 18th and 24th harmonics respectively. The tuning coil and capacitor must be in resonance to achieve the best filtration.
- To set the wave filter frequency, the capacitance must be measured and the formula is used to calculate the inductance in milli-Henry for each harmonic frequency:

  X_L: Inductance = $2\pi fL$

  X_C: Capacitance = $\frac{1}{2\pi fC}$

  $X_L = X_C$ for the resonance condition.

  The frequencies for the different harmonics for a 12 pulse rectifier are as follows:

  6th = 300 Hz

  12th = 600 Hz

  18th = 900 Hz

  24th = 1200 Hz.

12.3 BASIC PRECAUTIONS

- In the past some wave filter capacitors used PCB (Poly-Chlorinated Biphenyl) insulating oils. These should all have been exchanged by now, but due care is required. PBC's are very toxic and require special specialist companies to handle such contaminated equipment. (See CEE-0094 & CEE-G_009)
- Testing to be done under a work permit between the AC Disconnects and the Track switches or unit breaker if one is installed as applicable.
- All capacitors must be shorted out before any measurements. Even though there is a resistor connected in parallel with the capacitor when the fuse is drawn, the discharge rate may be slow. Damage will occur to the measuring instrument if connected to a capacitor that has not been discharged.
- Verify first the earthing arrangement as stated above. In a multiple unit substation, all the units must be de-energised.

12.4 TYPES OF THE TESTING

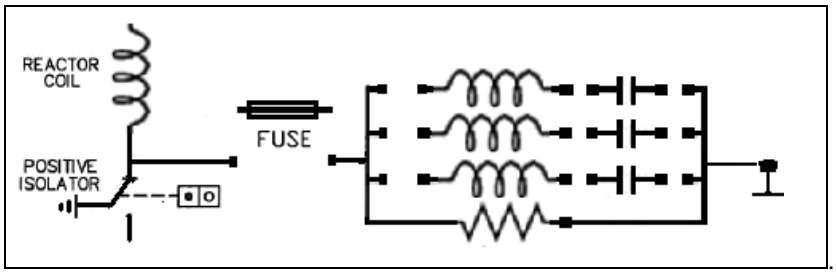
Value test

Capacitors and inductors are individually tested by establishing the values with an LCR-meter, with each component removed form the circuit. The values are recorded and compared to the design values.

12.5 TEST EQUIPMENT USED

The test equipment required for this test is a LCR Meter.

12.6 THE TEST CIRCUIT



12.7 THE TEST PROCEDURE

- Disconnect Caps and Coils. Short out capacitors prior to measuring capacitance. Measure the capacitance of each capacitor and record the values.

- Measure the inductance of each coil (the wave filter coils must be disconnected when conducting this test).
- Adjust the tuning coils if necessary by moving it closer or further apart to set the coils to the correct value of inductance. (calculated milli-Henry)
- Check the 100amp HRC fuse that protects the Wave Filter equipment in the event of capacitor failure, or in the event of the filters passing excessive current
- Measure the resistance of the discharge resistor (75k Ohm) connected in parallel with the resonant shunts, to discharge the capacitors when the rectifier is switched off for maintenance purposes.
- Measure the resistance of the series resistor, if provided. (± 0.68 ohm.)
- Record all measured values and reconnect all leads to wave filter equipment

12.8 DOCUMENTATION,

Complete the relevant test sheet BBB0342

12.9 ACCEPTABLE TEST RESULTS

6 pulse:

Harmonic	L	C
6th = 300 Hz		
12th = 600 Hz	1,173	60µF
18th = 900 Hz		
24th = 1200 Hz	1.759	10µF

12 pulse

Harmonic	L	C
6th = 300 Hz	2.814 mh	100µF
12th = 600 Hz	1.173 mh	60µF
18th = 900 Hz	1.564 mh	20µF
24th = 1200 Hz	1.759 mh	10µF

12.10 SPECIAL PITFALLS.

Ensure that the inductor coils are properly fastened on the mounting frames as surge currents caused by lightning and switches through the capacitors will cause movement due the magnetic fields present and thereby causing the set values to be out of specifications.

12.11 REFERENCES.

CEE-0186: Traction Power Supplies Handbook (CF Scheckle)

Specification CEE-0094 Retro-filling PCB filled transformers and disposal of (Poly-Chlorinated Biphenyl)

Engineering Instruction CEE-G_009: Electrical Equipment containing Askarels (Poly-Chlorinated Biphenyl)

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SECTION 13

DC EARTH LEAKAGE PROTECTION

13.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM;

1 A DC earth leakage system is provided in order to detect 3kV insulation failure and flash-over in the substation. All steelwork, control panels and the auxiliary supply neutral installed in a DC substation are bonded to a DC Earth Leakage busbar, which is insulated from earth mat (minimum resistance 25 Ohm). This busbar is connected to the substation negative busbar through the DC earth Leakage relay.

2 Each item in the earth leakage circuit is connected in a ring and each ring is connected the DC earth leakage busbar via two cables to ensure continuity in the even of a break in the circuit.

3 When this relay operates as a result of a current flowing through the relay, it ensures that all incoming 3kV supplies from the line are interrupted by opening the HSCB's, and that the supply/supplies to the rectifier is interrupted by isolating and locking out the primary circuit breaker(s).

4 The equipment connected to the DC earth Leakage busbar system is shown in Figure 9.1 below:

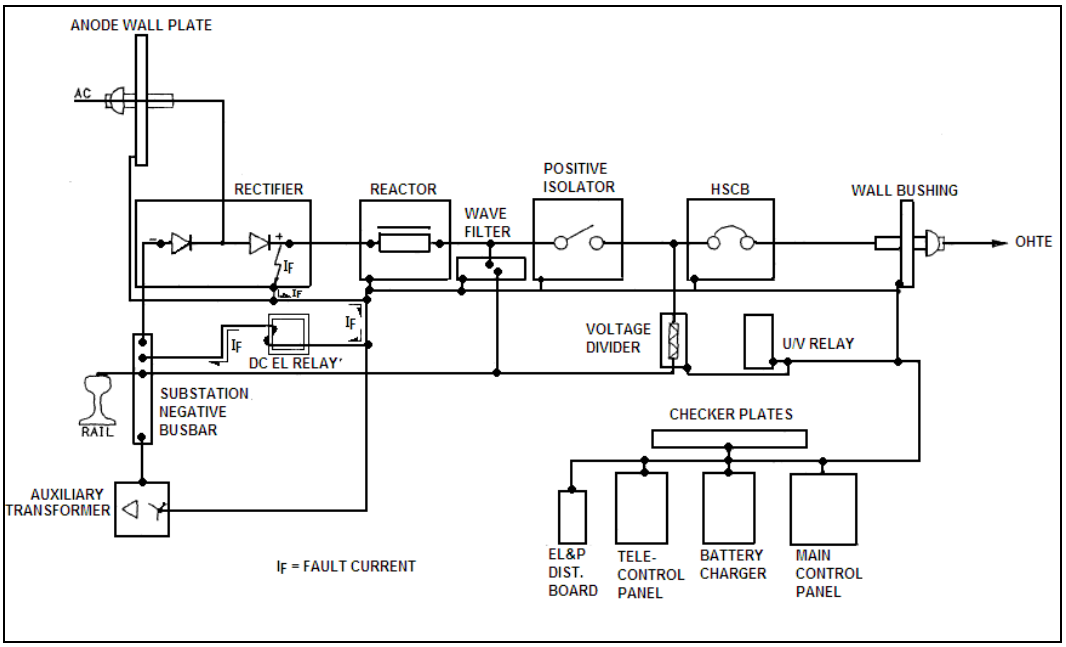


Figure 9.1

13.2 PRINCIPLE OF OPERATION;

1 In the event of a failure of the 3kV insulation, the fault current flows to the negative busbar via the DC Earth Leakage relay and the thereby causes the operation of the relay. The relay is normally of the attracted armature type, operating on the magnetic field set up by the fault current passing through the busbar or cable through the relay..

2 The DC Earth Leakage relay is generally calibrated to trip at a value as low as possible but not higher than 250 Ampere.

3 Operation of the DC Earth Leakage relay must isolate the complete substation from all sources of supply and must lock out the Primary Circuit Breaker and all 3kV high speed circuit breakers

13.3 BASIC PRECAUTIONS

1 Testing requires a work permit across the complete substation.

13.4 TYPES OF THE TEST

1 DC Injecting test to establish operation of the DC Earth Leakage relay

2 "Flash" test: Confirming that all connected equipment operates the relay.

13.5 TEST EQUIPMENT USED

1 Injection Set

2 DC metering equipment

3 Set of heavy test leads.

13.6 THE TEST CIRCUIT

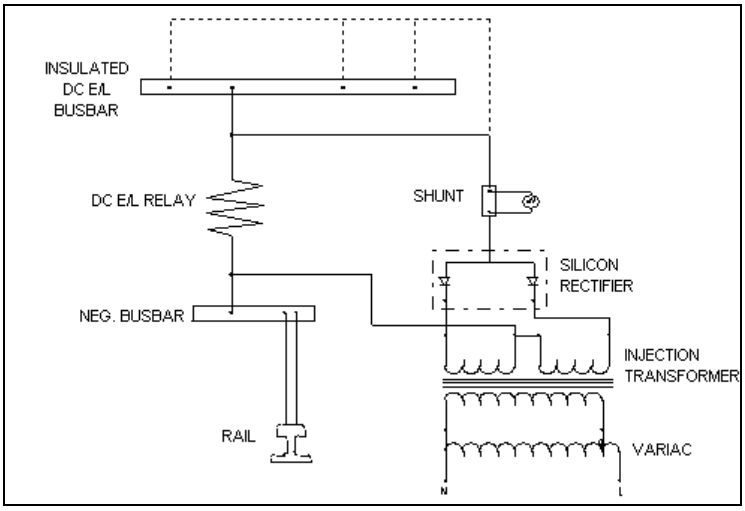


Figure 9.2: Circuit Diagram for Testing DC E/L Protection

13.7 THE TEST PROCEDURE

1 Inject DC current through the DC earth leakage relay as shown in Figure 9.2 by using a 250 Volt AC / DC Injection Test Set and slowly increasing the current from zero. Note the setting and trip current.

2 The relay should be set to trip at the value as per the previous test, but not higher than the rating of the relay, or 200 Amps (Traction Substations Technical Assistant Handbook EP.001 Issues 1 indicates 250 A), whichever is the highest.

4 Remove the injection cable from earth leakage busbar side of the relay and inject ("flash" test) through the metal parts of all the equipment that is connected to the DC earth leakage busbar as indicated in Engineering Instruction S.013. The relay must operate in each case.

5 When injecting through the various equipment, the test voltage should be increased to account for the increase in resistance in the circuit to obtain the tripping current.

6 Confirm that Primary Circuit Breaker as well as all 3 kV High Speed Circuit Breakers trips, and that the trip & lockout condition is indicated on the A/C control panel. (The DC/EL operation should isolate the substation from all sources of supply)

13.8 DOCUMENTATION

1 Record results on the relevant test sheet; documentation to be completed: BBB0343

13.9 ACCEPTABLE TEST RESULTS

1 DC/EL relay should trip at currents of values of lower than 250 A.

2 DC/EL relay operation must isolate the substation from all sources of supply and lock out the Primary Circuit Breaker as well as all 3 kV High Speed Circuit Breakers.

13.10 SPECIAL PITFALLS

1 Parallel paths can be formed by modifications to control cables and leakage paths formed in the low voltage power and lighting systems in substation.

References Substations Electricians Handbook BBF8190

Engineering Instruction CEE-S_013.

***

SECTION 14

CONDUCTIVITY (EARTH) MEASUREMENTS

14.1 THE FUNCTION OF CONDUCTIVITY SYSTEMS

- **The conductivity systems of any electrical installation are required to:**
  - provide a return circuit for normal power transfer.
  - complete the electrical circuit for all high voltage components to provide an conductivity/earth return path in the event of electrical insulation failure.
  - to provide a safe step voltage for normal access in railway electrified areas such as substations and the permanent way.
  - for surge protection a good earth is required to discharge the large currents associated with lightning and other surges.
- **Conductivity installations are arranged in the railway electrification systems as follows:**

Note**:** The rail return circuit is insulated from “mass earth”. The insulation must be of such a value to prevent or limit DC stray currents from flowing through any other services such as pipelines, fences, steel structures or power supply systems. The resistance value from the rail return to earth is normally in the order of more than 5 ohms.

3 kV DC Traction Substations:

The following 5 distinctive "Earth" systems are in place:

- The outdoor Earth system consisting of the bare copper earth mat or spike to which the steel structures before the Primary Circuit breaker is connected i.e. AC disconnects, HV lightning arrestors, Current transformers (where installed) and substation fencing.
- The AC Earth Leakage system consisting of all outdoor equipment support structures i.e. Current transformers (where installed), Primary Circuit Breakers, Main transformer (being insulated from the substation earth) and Auxiliary Transformer barrier fencing.
- The DC Earth Leakage system consisting of all indoor equipment subjected to possible HV DC flashover structures i.e. Anode wall plates, Rectifier frames, Reactor base, Wave filter equipment, Positive isolator, 3kv DC under-voltage relay and potential divider support frame, High Speed Circuit Breakers, Auxiliary transformer star point, Main control panel, Battery charger, Telecontrol equipment and Low voltage distribution board.
- The Substation Negative Busbar to which the following is connected: the DC Earth leakage system is coupled via the DC EL Relay, the gate earth switch, the 3 kV under-voltage relay negative, wave filter equipment negative, auxiliary transformer tank and the rail return connections.
- The Rail return Connections which is connected to the negative return rail via the rail connection cubicle next to the rail.

25 and 50 kV AC Traction:

- For 25kV and 50kV the return is common with mass earth. A good earthing installation has less than 5 Ohm resistance between the return circuits and substation “earth” which comprises of bare copper conductors buried in the outdoor yard of the substation with one or more spikes.

11 and 6,6 kV Signal and distribution:

- For Distribution and Signal power supplies, a return leg is required to complete the circuit to its source. In the case of a star connected transformer the star point serves as the neutral being earthed at the transformer. The substation has the associated protection to react to a phase/earth fault. Distribution substations require a good earth mat, and mini-subs, H-masts and transformer step-downs require a star point connection to an earth electrode which can be an earth Spike or Trench Earths. The Earth reading must be below 5 ohms.

14.2 PRINCIPLE OF OPERATION

- **DC Traction Substations**

The principle of the distinctive separate earth systems is to ensure that fault currents during insulation failures are forced to flow to its source via a dedicated shortest route to operate dedicated protective devices effectively in the shortest possible time.

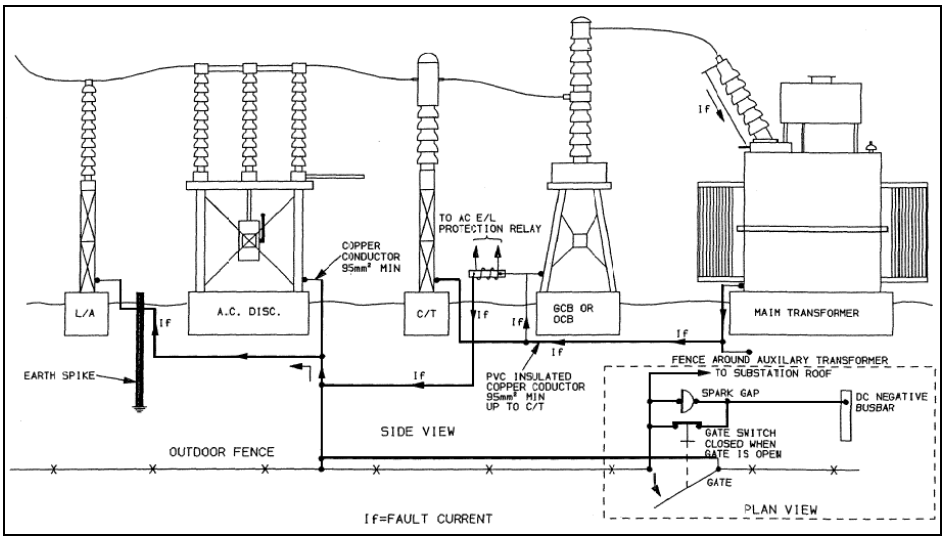


Figure 9.1: Typical AC Earth leakage protection systems.

Figure 9.1 shows the typical AC connections where fault current flows from the transformer HV side to earth via the AC earth Leakage system operating the required protection to isolate the supply. Note that the lightning arrestors and AC disconnects are connected directly to earth.

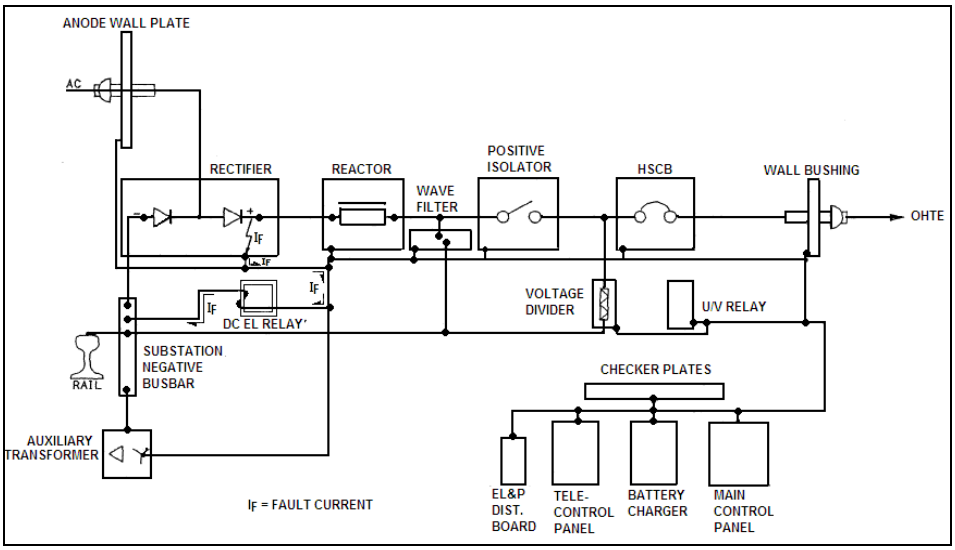


Figure 14.2 Typical AC Earth leakage protection systems.

Figure 14.2 shows the typical DC connections where fault current flows from the rectifier to negative via the DC earth Leakage system operating the required protection to isolate the supply.

- **AC traction Substations**

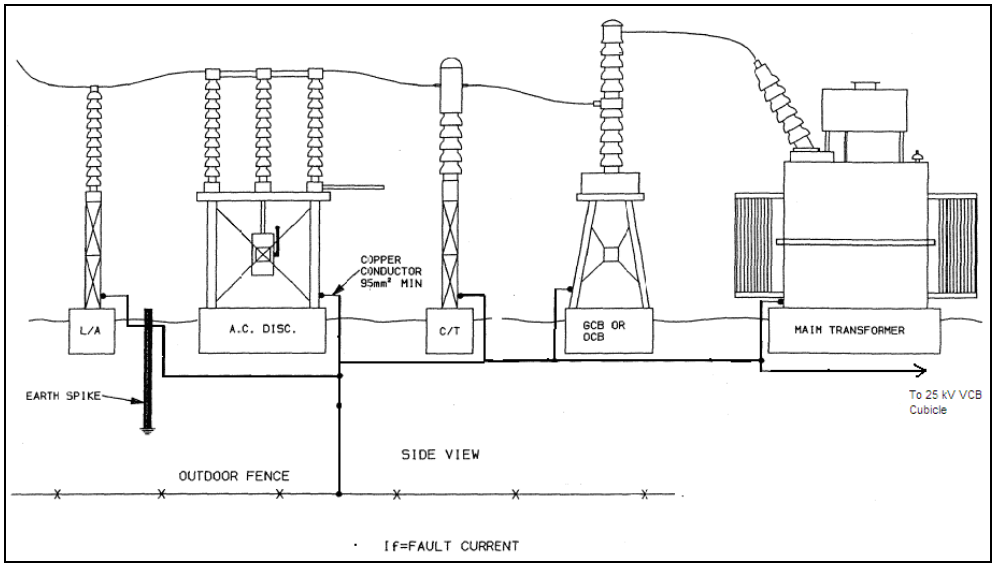


Figure 14.3

Figure 9.3 shows a typical AC traction substation earth layout where all primary fault currents will flow to common mass earth to which all equipment is connected relying on Eskom protection for equipment before the PCB and the transformer protection for equipment after the PCB.

- **11 kV and 6,6 kV Signal and Distribution**

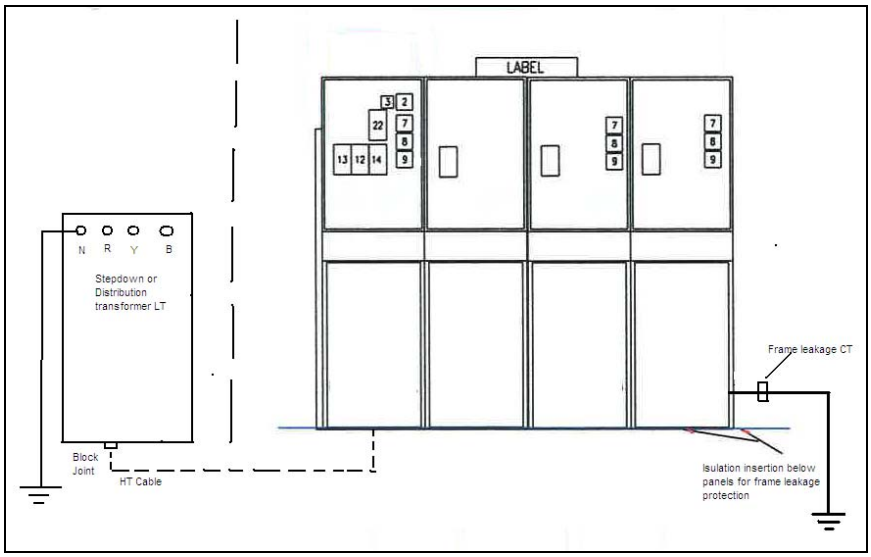
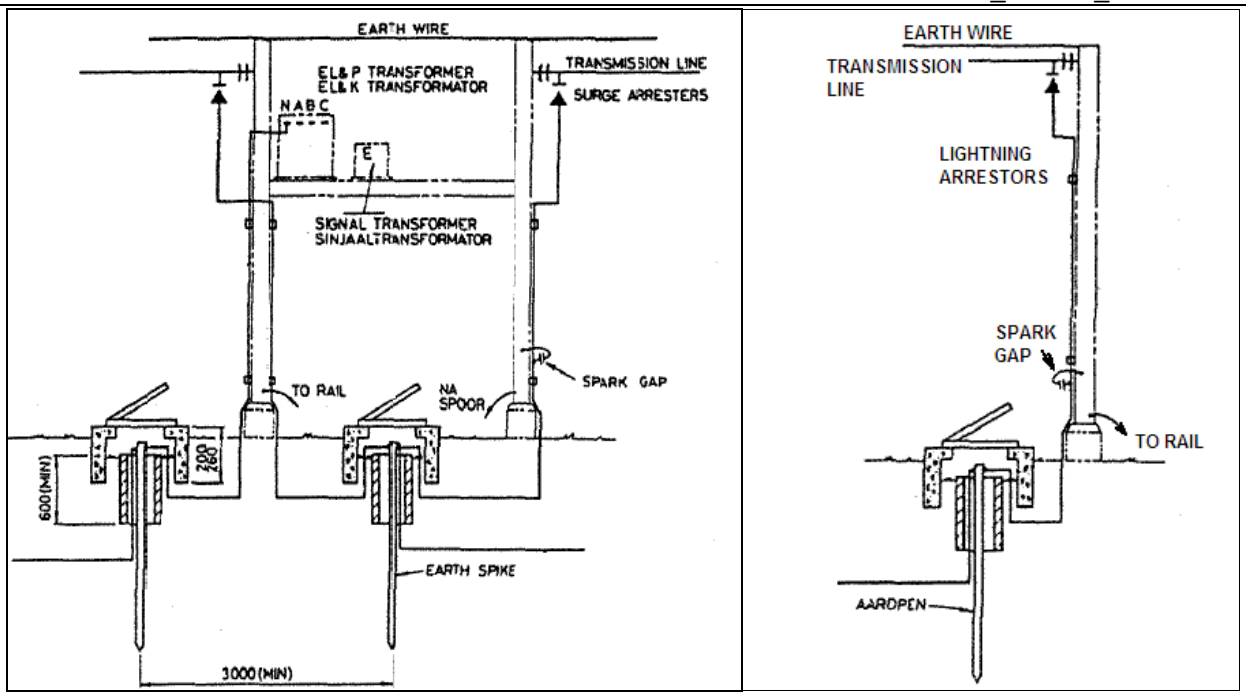


Figure 14.4: Typical distribution earth system

Figure 14.4 shows a typical distribution substation earth system where all equipment is earthed to a common earth mat or spike. Where frame leakage protection is installed, the HV panels are insulated from the floor and the earth fault current will flow from the panels through the frame leakage current transformer to operate the applicable protection.



H-Frame Power Line to Cable transition

Figure 14.5: Typical H Frame stepdown point earthing arrangement

Figure 9.5 shows typical transmission line stepdown point earth arrangement. Note the separation distance of 3m between the earth spike for the transformer neutral point and the spike for the surge arrestor earth connections. This ensures that high surge currents from lightning strikes do not affect the neutral point of the transformer

14.3 BASIC PRECAUTIONS

- Trace all underground cable routes before hitting in an earth test spike.
- When testing an earth electrode the equipment that it protects must be is temporarily taken out of service.
- Be aware of lightning activity in the area (up to 10km).

14.4 TYPES OF THE TESTS

- Earth resistance test.
- Insulation resistance test.
- Test for deterioration of earth mat at DC substations.
- Earth Resistivity test (See Code of practice).

14.5 EARTH RESISTANCE TEST

Test equipment used

- Null balance megger with four terminals.
- Two metal test earth spikes.
- Three insulated light leads.
  - Current Lead 1(+/- 50m long)
  - Potential Lead 2 (+/- 25m long)
  - Test Lead 3 to connect the Megger to the spike under test ((max 2 m long)

14.6 THE TEST CIRCUIT

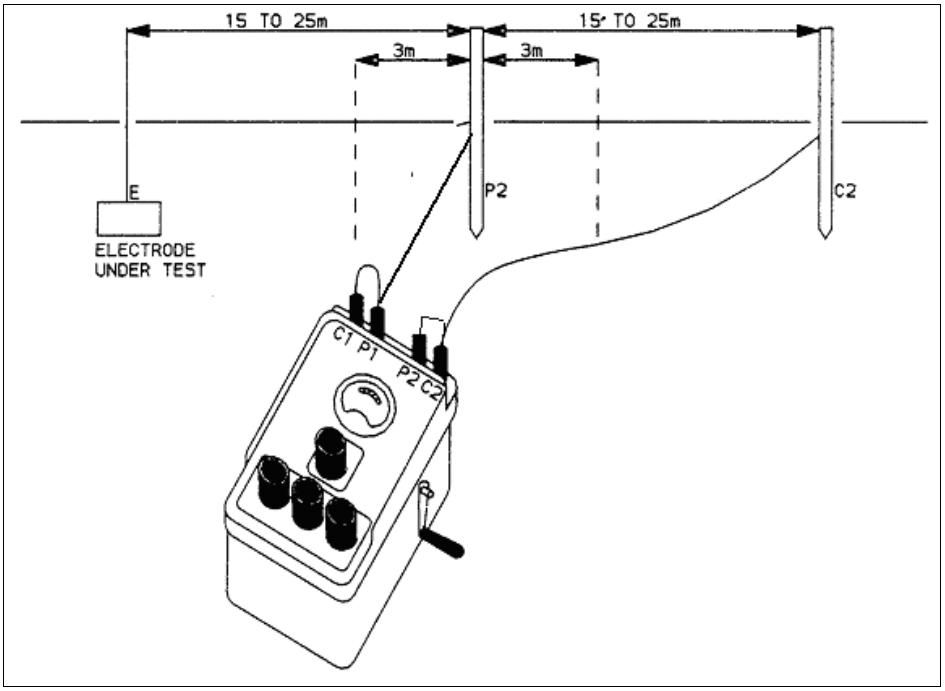


Figure 14.6: Connections for testing resistance between the current and potential spikes

14.6 THE TEST PROCEDURE

- Set up the two spikes (current spike, C2 and potential spike, P2), in a straight line and as far as possible from the earth electrode under test / test spike. Connect the earth megger as shown in figure 9.6
- Follow the test procedure given in the instruction handbook for the earth megger to determine the true soil resistivity between the potential, P2 and current, C2 spikes. This value should be in the order of 500-1000 ohm.

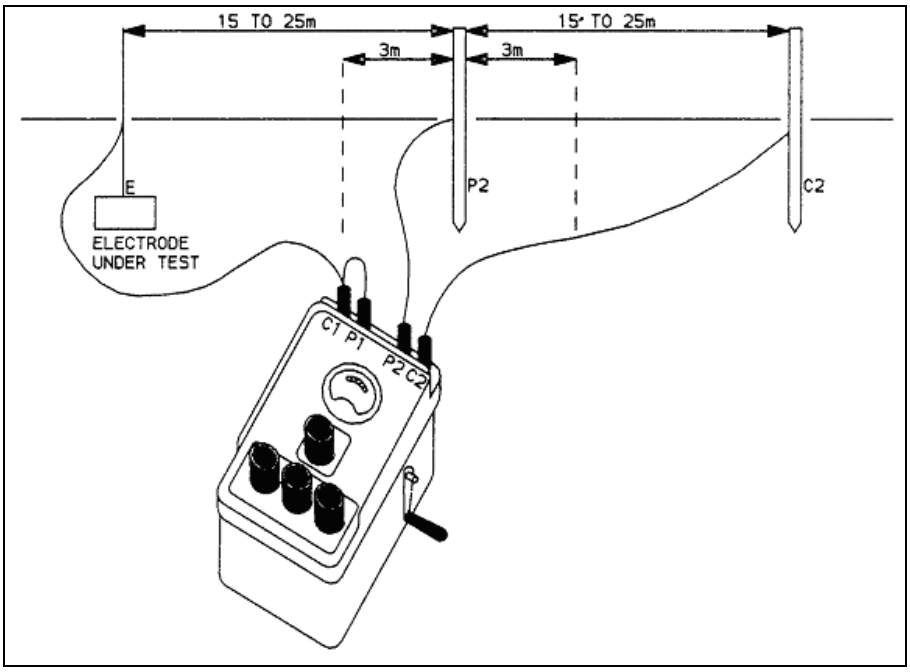


Figure 14.7: Connections for testing resistance between spikes under test the current and potential spikes.

- Follow the test procedure given in the instruction handbook for the earth megger to determine the true resistance of the earth spike/mat to earth. The value is to be below 5 ohms.

Equivalent circuit of earth test procedure.

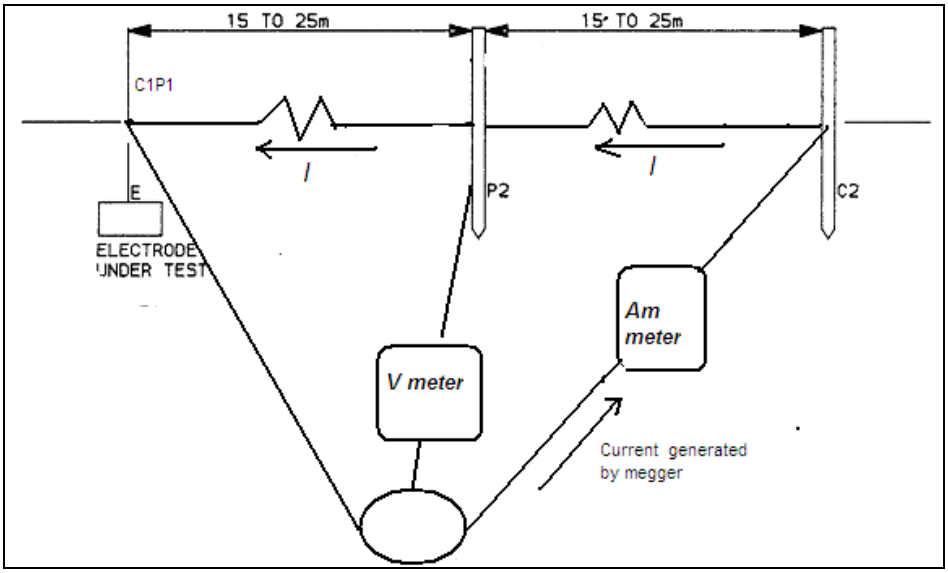


Figure 14.8: Equivalent circuit of earth test procedure.

- Figure 14.8 shows the equivalent circuit for the test: The earth megger generates an alternating voltage which sets up a current **(*I*)** flowing from the C2 spike through earth mass to spike C1. The volt drop **(*V*)** across the earth resistance from spike P1 to spike P2 is measured by the internal voltmeter and integrated with the current (***I***) by the principle of Ohm's Law internally by the instrument as demonstrated below.
- Resistance of the earth spike = V/I where:
  - V = voltmeter reading in Volts.
  - I = current injected in Amps.
- In the case where more detail readings are required the test must be repeated by moving the spikes in a straight line to 5 meters from the original positions
- Take repeat readings to obtain a mean or average value.

14.7 INSULATION RESISTANCE TESTS

For DC Traction Substations it is required to test the resistance values between the separate “earth” systems for reasons mentioned above. Use the earth megger as an insulation tester with terminals P1-C1 and P2-C2 shorted respectively and follow process is laid down below:

- Disconnect the DC earth leakage relay and the rail connections from the negative busbar (Rail) in the outdoor yard.
- Disconnect the spark-gap at the yard gate switch or place a wedge between the contacts.
- For convenience run three leads from the negative busbar, the DC earth leakage shunt and the rail connection to a suitable position in the outdoor yard.
- Disconnect the earth lead from the AC earth leakage CT and run a lead from the CT to the same position as the other leads.
- Run a lead from the substation earth spike to the same position as above.

- With the leads from spikes, rail, DC earth leakage bar, negative busbar, AC earth leakage CT and substation earth spike carefully marked, measure all earth and insulation measurements according to test sheet BBF9295 and record the results.
- On completion replace all connections that were removed from equipment.

14.8 DOCUMENTATION

Record all measurements on the test sheet BBF9295.

14.9 RANGE OF ACCEPTABLE RESULTS

The acceptable values are indicated on the relevant test sheet (BBF9295).

14.10 SPECIAL PITFALLS

- Earth mat: A high reading above 5 ohms. Possible causes include: 1) Dry soil condition 2) High resistance connections due to corrosion. 3) Underground bare connecting conductors corroded away due to electrolysis and acidic soil conditions.
- AC earth leakage: Low reading to substation earth mat. Possible causes include: (1) Low Resistivity of concrete bases for main transformer, CT or PCB structure; (2) Waterlogged ground condition (3) The insulation on the skid-rails under main transformer and skid-rails is not installed or has deteriorated.
- AC earth leakage: Zero reading to substation earth mat. Possible causes include: (1) Faulty or no block-joint between cables and equipment (2) “Double-starring” of metering current transformers by ESKOM.
- DC earth leakage: Very low or zero reading to substation earth mat. (1) A possible cause is a faulty or no block-joint between control cables and equipment. (2) Substation lighting circuit conduit passing through walls making contact with reinforcing or metal in contact with roof structure, which is bonded to earth. 3) Control cables not block jointed
- DC negative busbar: Very low reading to substation earth mat. (1) Auxiliary transformer standing on low resistivity concrete base or very wet concrete base. (2) Punctured dielectric in yard gate spark-gap if the spark gap has not been isolated for this test**.**
- Rail: Technically insulated from earth, the resistance value may be low due to ballast fouling. The ballast is therefore a “leaky insulation”.
- Magnetic metals which fully surround the earth conductor. Such metallic path form a CT around the earth conductor which will block lightning and other high currents, thus making the earth electrode ineffective. A typical example is a cable cleat. Report such installations as a defect.

14.9 EARTH MAT INTEGRITY TEST: AC AND DC SUBSTATIONS

- **Test equipment used**
  - Welder with secondary current rating 100 to 150 Ampere.
  - Clamp on type ammeter with suitable range.

- **The test circuit**

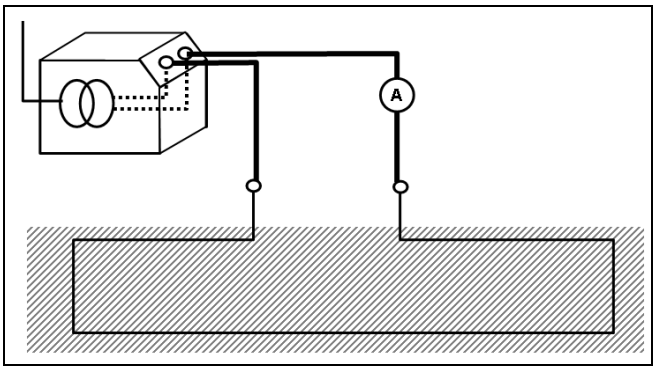


Figure 14:9 Earth connection tests

- **The test procedure**
  - Inject a current into the wires by means of a 100 to 150 ampere portable welding set connected to both ends of each conductor in turn. An ammeter is to be connected in series.
  - The test current shall be allowed to flow for a minimum of five minutes where after the test is completed.
- **Documentation, i.e. test sheet(s) used**
  - The information must be entered in the substation report for routine maintenance.
- **The range of acceptable test results**
  - An unstable (varying) current indicates that the earth conductor may be open circuit underground due to corrosion or electrolysis and the soil itself is part of the circuit. A steady current is indicative of a good electrical circuit.
  - Provided that the current injected reaches a value in the order of the rating of the machine and can be maintained at that value during the full test period the conductor may be considered to be in a sound condition.

14.10 REFERENCES

- Code of Practice: Earthing Practice for Electrical Light and Power and Traction installations CEE-0177.
- Engineering Instruction CEE-T_004: Testing of Outdoor Yard Earthing Systems for Corrosion: 3kV DC Traction Substations.

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SECTION 15

PANEL METERS

15.1 THE FUNCTION OF PANEL METERS IN THE ELECTRICAL SYSTEM

Meters are the window to the electrical system, which cannot be safely sensed in any other way to monitor the system performance. Meters used are:

- Voltmeters: Indicates voltage at the connection point of the voltmeter or its transducer;
- Ammeters: Indicates the current at the connection point of the CT or transducer;
- KW-h meters: Energy Meters are used for billing purposes and for energy management purposes where they are connected.

15 2 PRINCIPLE OF OPERATION

- Voltmeters
  - DC Traction Substations: Voltmeters are connected from a potential divider on the rectifier or the 3kV Under voltage relay depending on the substation situation
  - AC Traction Substations: Directly onto a VT supply, either indoor or outdoor.
  - Signal supply and Distribution substations: The incoming feeder may be provided with a VT or a VT by be connected onto the busbar.
  - Battery voltmeters are connected onto the output of the battery supply.
- Ammeters
  - DC Traction Substations: Derived from high current DC shunts supplying millivolts to a DC ammeter calibrated to read 4 kA.
  - AC Traction Substations: Directly from a CT supply, either indoor or outdoor.
  - Signal supply and Distribution substations: From a CT supply normally in series with other equipment.

15.3 BASIC PRECAUTIONS

- All testing or calibrations to be done under work permit conditions.
- Remove voltage transformer LV fuses and open test links for Ammeters.

15.4 TYPES OF THE TEST

- Comparison tests

15.5 TEST EQUIPMENT USED

- Voltage, current and millivolt injection sets.

15.6 THE TEST CIRCUIT

- DC Traction Substations:
  - Voltmeters: Refer to Section 16 for the connections for primary injection onto the potential divider or inject the required voltage as per nameplate data directly onto the meter.

- Ammeter:

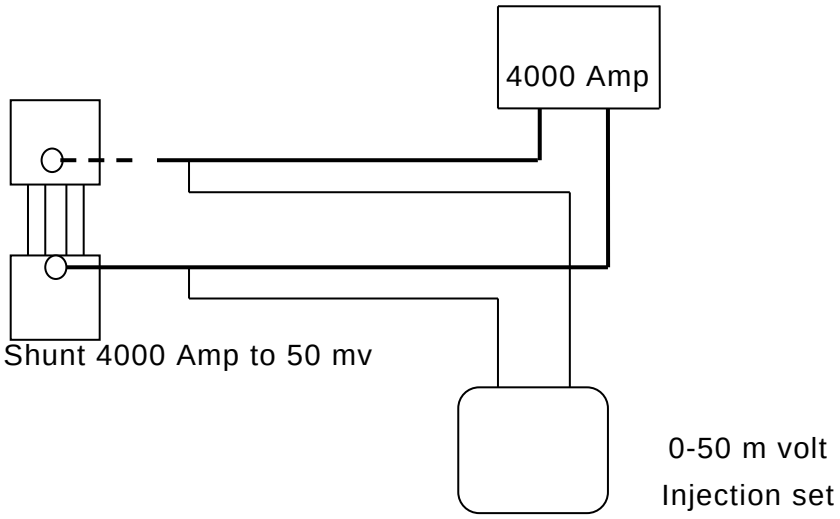


Figure 15:1 Connections for testing DC Kilo Ammeter.

- AC Traction substations and Signal supply and Distribution substations
  - Voltmeters: The nominal voltage normally stepped down by the Voltage transformer is at 110 volts usually supplied through 1/ 2 Amp HRC fuses or MCB's.

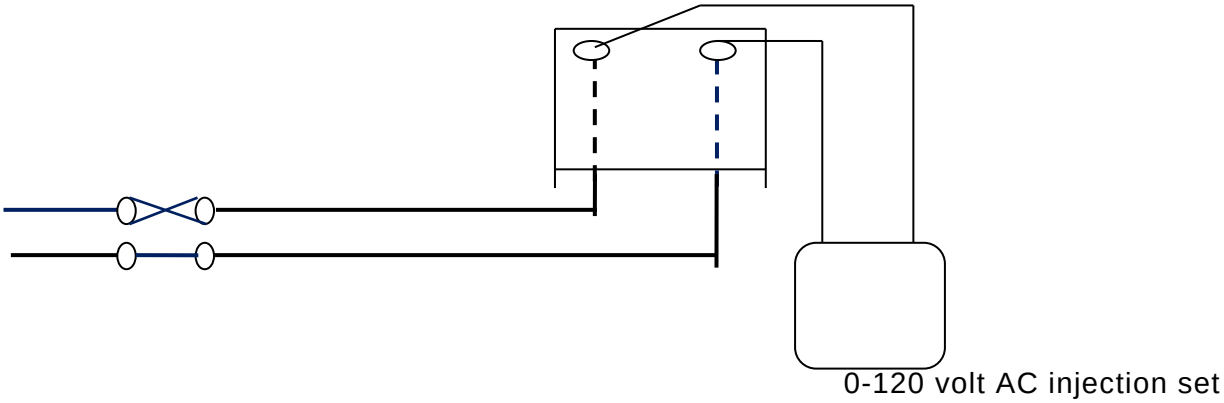


Figure 15:2 Connections for testing AC Voltmeter.

  - Ammeter: The nominal current normally stepped down by the current transformer is at 1or 5 amps usually supplied through the test block

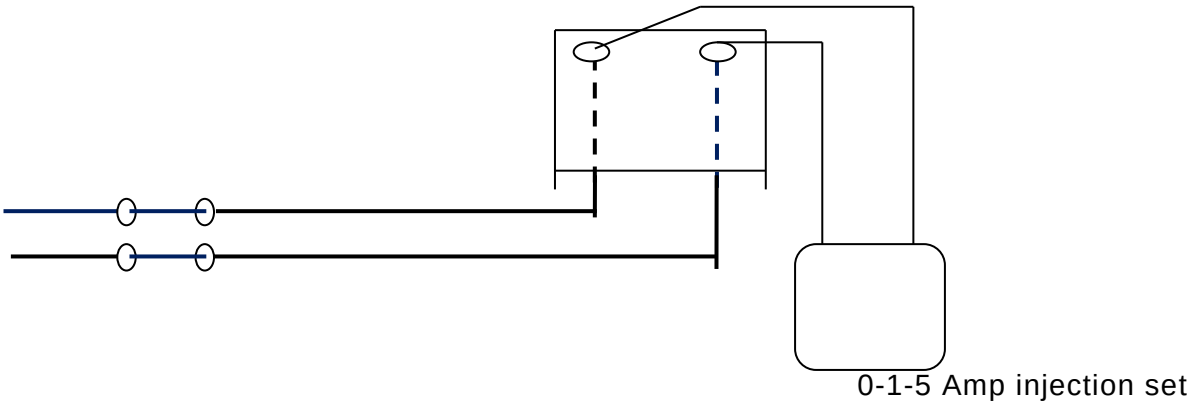


Figure 15:3 Connections for testing AC Ammeter.

15.7 THE TEST PROCEDURE

- DC Traction Substations:
  - Voltmeters: Refer to Section 16 for the connections for primary injection onto the potential divider or inject the required voltage as per nameplate data directly onto the meter.
  - Ammeter: Inject the required millivolts onto the shunt connections the latter being disconnected.
- AC Traction substations and Signal supply and Distribution substations:
  - Voltmeters: Inject the required voltage as per nameplate data directly onto the meter being disconnected as per *Figure 15:2.*
  - Ammeter: Inject the required current onto the ammeter being disconnected or via the test block terminals as per nameplate data as per *Figure 15:2.*

15.8 DOCUMENTATION

- Complete relevant test sheet BBF9001**.**

15.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- All the measurements must be accurate to within 5% error.

***

SECTION 16

3KV DC UNDER-VOLTAGE PROTECTION

16.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- DC traction systems supplies power to locomotives at high current values, typical current values according to HSCB setting can be in the order of 4000 amps. Applying Ohms Law in it is evident that the inherent resistance of the OHTE, (which increases with distance), causes the supply voltage to drop to a value which will bring about a "stale" condition. Referring to CEE-S_004 in this "stale" condition the train can be at an “offload substation” at a distance of e.g. 11 km from the next substation attempting to get moving drawing a high value of current from this next substation causing a large volt drop. The high current being drawn for a considerable time can then cause high temperature rises in the OHTE.

  Annealing of the copper wires can take place which then have to be replaced at very high costs. The Under-voltage relay is installed to detect the volt drop at the busbar of the “off load” substation or the Tie station protecting OHTE the system against high currents at low voltages in case where a substation is off load or HSCB's has tripped. Since the DC busbar is the connection point of various supplies, the detection of under-voltage at the busbar must trip the all supplies associated with the relay.

- The under-voltage setting is the highest voltage (that means the lowest voltage drop) which can occur on the busbar under the crippled network conditions; i.e. with the substation off load, while taking a safety factor into consideration.

16.2 PRINCIPLE OF OPERATION

- The Under-voltage relay monitors the 3 kV DC busbar voltage by comparing a portion of the voltage stepped down by the potential divider to a pre-set minimum “Drop-out” value within the relay and interrupts the holding coil supply of all HSCB’s. The setting is normally in the order 2250 Volt.

- For calculation purposes of the “Drop-out” value, it is normally assumed that the relevant substation is off load, with the HSCB’s and all power routes are available.

- To enable the 3kV busbar to be re-energised from the “line” side after all the HSCB’s have tripped, and to test whether the line voltage is greater than the “Pick-up” voltage of the relay, a set of by-pass timed contacts are provided in the relay which allows the relay to “read” the busbar voltage with one HSCB reclosing. If the voltage exceeds the “Pick-up” voltage the HSCB will stay closed and allow the reclosing of the remaining HSCB’s.

- The relay is made inoperative with the substation on load by a set of “by pass” normally closed contacts which will open when the substation is off load.

The relay is connected in the circuit as follows:

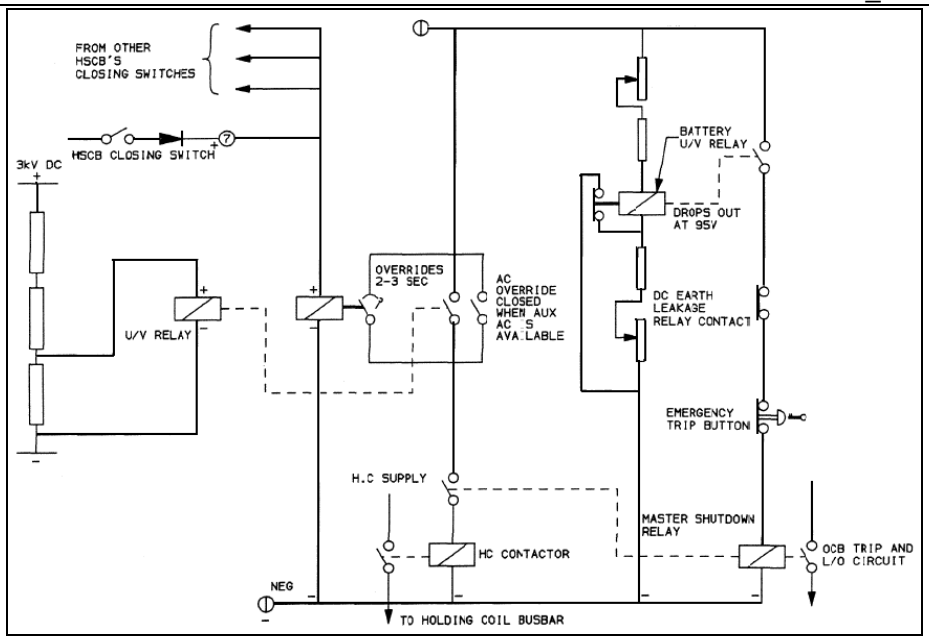


Figure 16.1: Schematic layout of 3 kV DC Under voltage relay

16.3 BASIC PRECAUTIONS

- All tests do be done under cover of a work permit
- The 3 kV DC Under-voltage relay must be tested in accordance with clause 609.0; Conditions Governing High Voltage Power Testing of the Electrical Safety Instructions (BBF3690).

16.4 TYPES OF THE TEST

- The Relay is tested by applying a variable HV DC test voltage across the potential divider.

16.5 TEST EQUIPMENT USED

- The main instrument or test equipment required for this test is a 4 kV DC Hi Pot set or calibration set.

16.6 THE TEST CIRCUIT

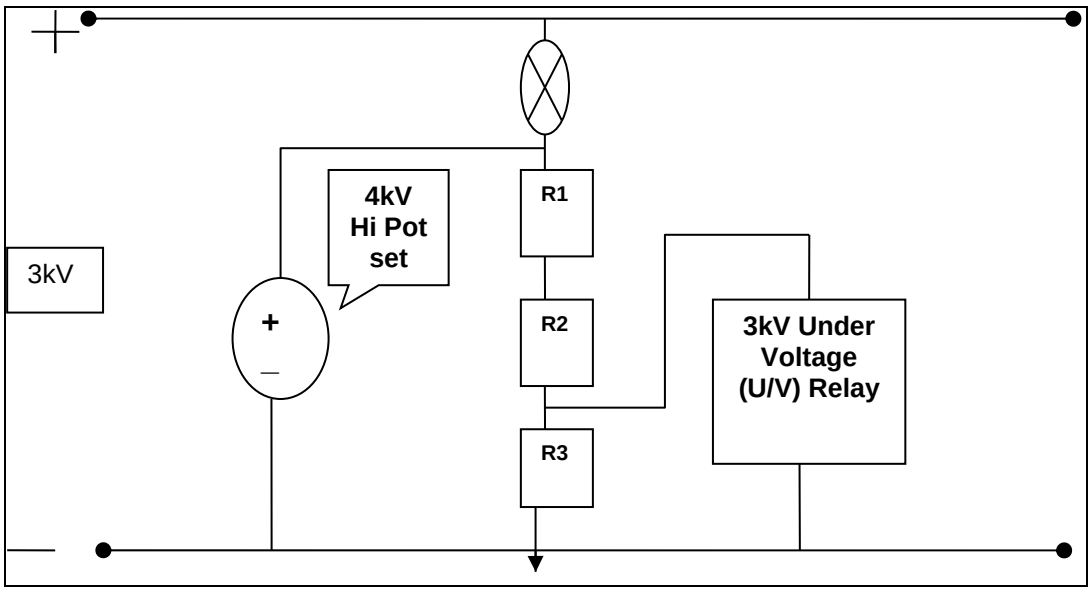


Figure 16.2: Test connections for testing 3kV DC Under voltage relay

16.7 THE TEST PROCEDURE

- Remove the fuse from the potential divider.
- Connect the 4kV DC Hi Pot set on the potential divider, the Positive (+) lead to the bottom of the fuse holder and the Negative (-) lead to the Negative Busbar.
- Adjust the test voltage upwards from zero.
- When the pick-up voltage (as prescribed for the specific substation) is reached, the Under-voltage relay will be activated and the HSCB holding coil contactor will close.
- Close all HSCB's manually.
- Slowly decrease the voltage until the dropout voltage is reached and all HSCB's will open.
- The pick-up and dropout voltages should correspond to the values prescribed (obtained in most recent test sheet).
- If necessary, adjusted the values with the variable potentiometers on the Under-voltage relay, and the final values recorded on the test sheet. Check that when the relay operates on the dropout value that all track breakers trip after ±2 seconds, giving a counter operation and a fault indication on the control panel.
- Should the Under-voltage relay not operate correctly, the resistors on the potential divider, or the relay must be checked and report the faulty component to the technician.
- Test the fuse before being replaced into the holder.

16.8 DOCUMENTATION

- The following documentation must be completed: BBF9001.

16.9 ACCEPTABLE TEST RESULTS

- The relay operates on the "Dropout" value so that all track breakers trip after ±2 seconds, giving a counter operation and a fault indication on the control panel.
- With the relay in the Dropout state, close one of the HSCB's the latter must stay closed for approximately 3 seconds and then fall out again to confirm the overriding facility of the relay.
- The relay operates on the "Pickup" value in the order of 200 volts above the "Dropout" value reclosing the holding coil contactor and resetting the indication on the control panel.

16.10 COMPLICATIONS AND PITFALLS

- Ensure that the negative connection of the voltage divider is connected to rail The U/V relay may still test correctly or erratically if this connection is interrupted (loose, stolen, etc.)
- Should the Under-voltage relay not operate correctly, the resistors on the potential divider, or the relay must be checked, the faulty component must be reported to the electrician and recorded on the test report form.
- The fuse must be tested before being replaced into the holder.

16.11 REFERENCES

- CEE-S_004: Calculations of Under-Voltage Relay Settings for 3 kV DC Traction Substations and Tie-Stations.
- BBF3690: Electrical Safety Instructions.

***

SECTION 17

BATTERY UNDER-VOLTAGE PROTECTION

17.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- The battery under-voltage relay monitors the battery output voltage. The battery is used to as a source of DC power for protection and control equipment in the substation. It is also used for emergency lighting. When the battery supply is faulty or run down it cannot fulfil the function.

17.2 PRINCIPLE OF OPERATION

- Control equipment such as relays, spring wind motors; contactors etc. are not designed to operate at voltages lower than approximately 70 % of the design value and will be damaged by overheating at a too low control voltage.
- The battery under-voltage device is set to a predetermined “Dropout” level. Under-voltage can be caused by charger failure, supply MCB trip or blown fuses. At the “Dropout” value the device initiates the shutdown of the substation by tripping all Primary and Secondary/HSC Breakers. The “Pickup” value is determined to be at a safe operating level for all equipment. In some AC substation designs individual control panels are equipped with separate under-voltage relays.

17.3 BASIC PRECAUTIONS

- Since the battery supply is the power backbone of protection in the substation, the substation must be off load (primary and secondary breakers) before the battery supply is interrupted for tests.

Note: Never attempt to close any circuit breakers under low control voltage conditions.

17.4 TYPES OF THE TEST

- With the DC Supply switched off a variable voltage is applied across positive and negative supply to the control and indication circuit in the control panel.

17.5 TEST EQUIPMENT USED

- Variable DC voltage test set 0 to 120 volts.

17.6 THE TEST CIRCUIT

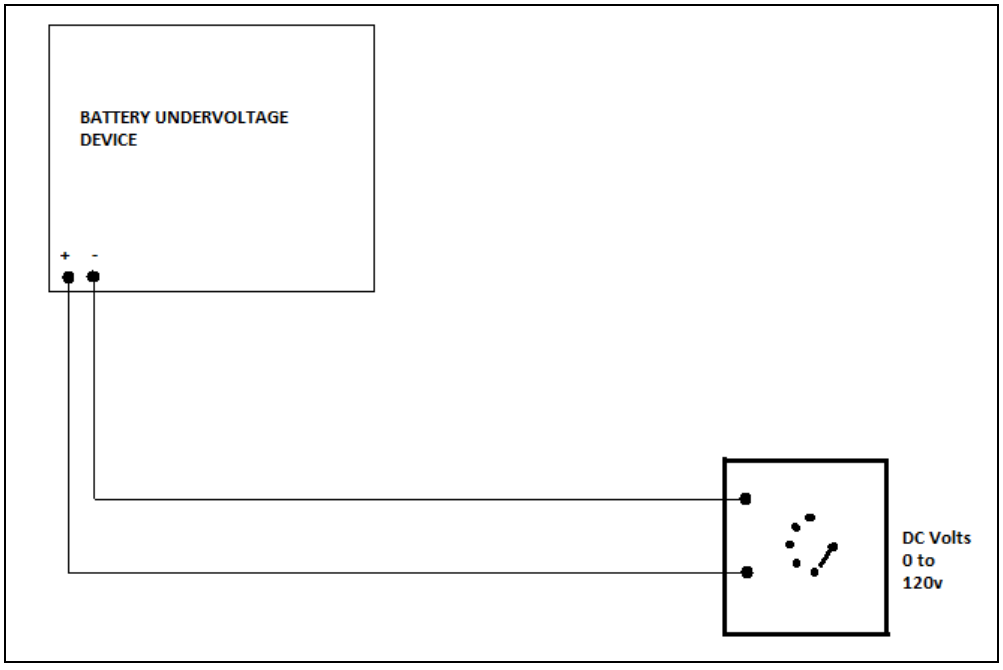


Figure 17.1

17.7 THE TEST PROCEDURE

- The battery supply to the 110V battery under-voltage relay coil must be disconnected to test the battery under-voltage. Connect the output of the 110 Volt DC injection set to the relay and adjust the voltage of the injection set until the pick-up and dropout voltages are reached. The pick-up and dropout voltages should correspond to the values obtained in previous tests.
- Ensure that when the relay operates on the dropout value, the primary circuit breaker trips, and that the trip & lockout condition is indicated on the A/C control panel.
- The leakage between the battery positive to earth is to be measured by measuring the DC voltage between the battery positive and the earth terminal in AC subs and D/C earth leakage busbar in DC subs. Similarly the battery negative-to-earth voltage is to be measured between the battery negative and the earth terminal in AC subs and D/C earth leakage busbar in DC subs. These readings should be zero.

17.8 DOCUMENTATION

- Complete the relevant test sheet.

17.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- Typical values are in the order of 95 volts for “Pickup” and 85 volts for “Dropout” respectively with an allowable tolerance of 5 %.

17.10 SPECIAL PITFALLS

- Confirm proper test connections as high resistance connections will result in erratic operations.

***

SECTION 18

SECONDARY BREAKERS

3 kV HIGH SPEED CIRCUIT BREAKERS

18.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- The HSCB is installed primarily to protect the OHTE against overloads and to isolate the substation from supplies from adjacent substations in case of flashover faults as well as in the case of or 3 kV DC under-voltage operations. Additionally HSCB's are utilised to isolate switching sections during occupations for work permits on the OHTE.

18.2 PRINCIPLE OF OPERATION

- Magnetic principles are employed to detect the rate of rise of the load current supplied through the breaker. A moderate rate of rise will permit the passage of large load currents but a rapid rate of rise of fault current will cause the breaker to trip in a time relative to the rate of rise. The arc chute serves to dissipate the energy resulting from the breaker action to trip high fault or load over-currents.
- Modern HSCB's are equipped with FPR (Feeder Protection Relays) which prevents the closing on to short circuited locomotives or OHTE. Refer to instruction manuals

18.3 BASIC PRECAUTIONS

- HSCB must be racked out of the breaker cell for testing purposes.

18.4 TYPES OF THE TEST

- Insulation tests: In the case of major repairs on a HSCB a High Potential test must be done to prove the insulation.
- Calibration tests: After major repairs as well as on a routine basis HSCB's must be calibrated to the calculated value of tripping current.

18.5 TEST EQUIPMENT USED

- High Potential test set rated at 0 to 20 kV AC at 20 milliamps.
- DC Current injection set rated at 5000 amps.

18.6 THE TEST CIRCUIT

- **Insulation tests**

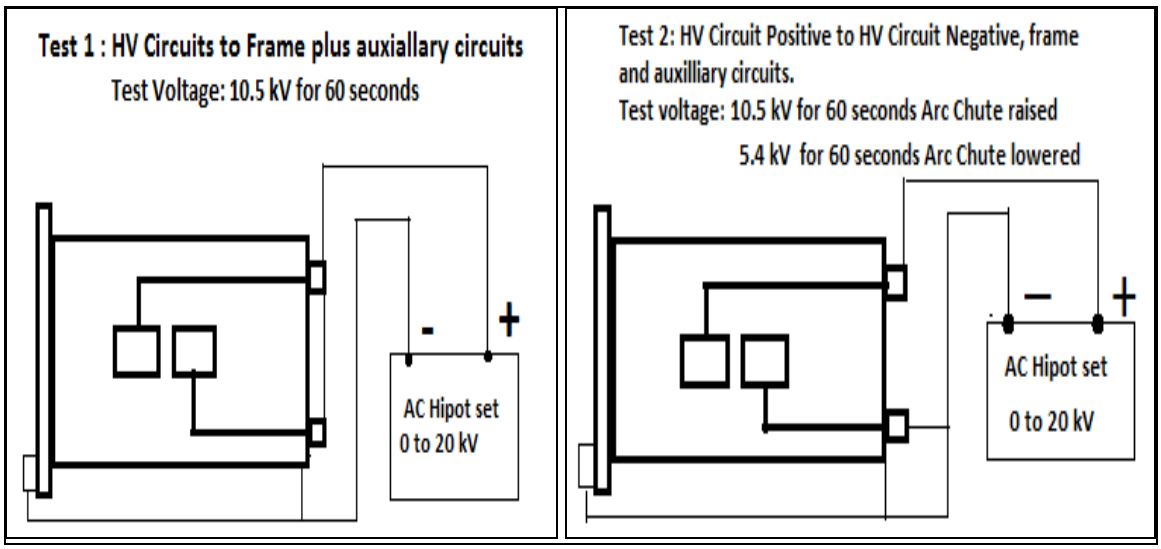


Figure 18.1 Hi-pot insulation tests

- **Calibration Test**

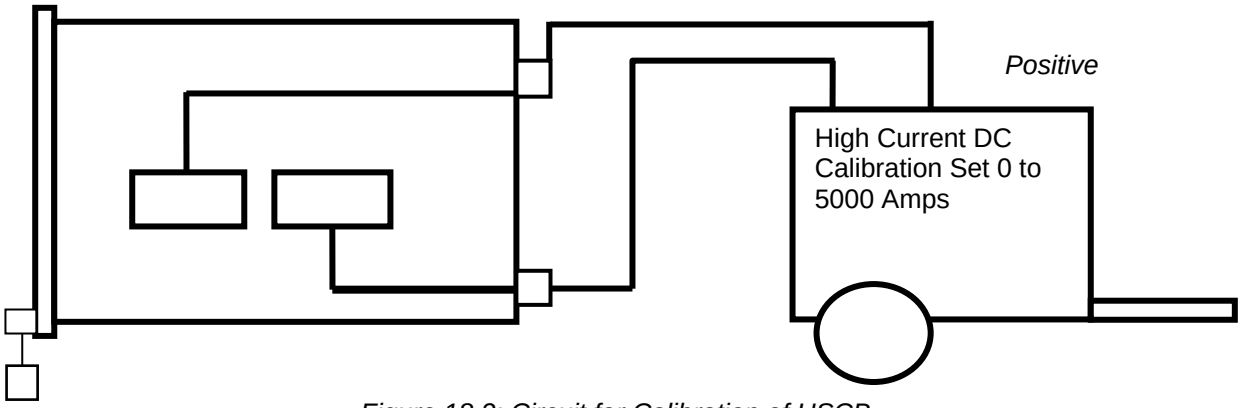


Figure 18.2: Circuit for Calibration of HSCB

18.7 THE TEST PROCEDURE

- **Insulation Test**
  - Connect the Hi-pot test set as shown in figure 18.1 Test 1 for testing the insulation of the power circuits.
  - All auxiliary cell-side contacts to be bridged out with binding wire and connected to the frame of the HSCB.
  - Switch on the AC supply to the test set and gradually increase the test voltage to the required value.
  - Apply the test voltage for the 60 seconds required.
  - Decrease the test voltage to zero and discharge the parts under test.
  - Connect the Hipot test set as shown in figure 18.1 Test 2 for testing the insulation between the power circuits at the voltages shown with the arc chute raised and lowered for 60 seconds respectively.
  - Decrease the test voltage to zero and discharge the parts under test in each test.
  - Remove all binding wires.
- **Calibration Test**
  - Connect the heavy positive and negative cables to the HSCB with the correct polarity. Polarity is not applicable HSCB's fitted with the later Secheron type of breakers.
  - Connect the breaker to the cell-side contacts via the test rig and close.
  - Switching on the power, gradually increase the current to the calculated value.
  - Note the tripping value for either over- or under calibration.
  - Do the required adjustments as per HSCB type.
  - Repeat the procedure till correct setting is achieved.

18.8 DOCUMENTATION

- Complete the applicable test sheets

18.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- Insulation test: The HV circuits must withstand the pressure test for the specified time
- Calibration test: The HSCB must trip within 10 % of the calculated value.

18.10 REFERENCES

- Substation manual for Electricians.
- CEE-S_005: Test Voltages For High Speed Circuit Breakers
- CEE-S_007: Trip Value and Calibration of 3 kV DC High Speed Circuit Breakers
- Instruction manuals on HSCB's and the Feeder Protection Relay.

***

SECTION 19

SECONDARY BREAKERS

25/50 KV AC VACUUM CIRCUIT BREAKERS

19.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- Vacuum Circuit Breakers (VCB's) in 25 and 50 kV AC Substations are installed to provide switching and protection functions in AC Electrification systems. VCB's are equipped with instantaneous, thermal and distance protection relays to protect the substation busbars and the OHTE against high load and fault currents. The first generation VCB's was of the indoor type housed in a steel cubicle construction with the new generation VCB's being of the outdoor pedestal type.

19.2 PRINCIPLE OF OPERATION

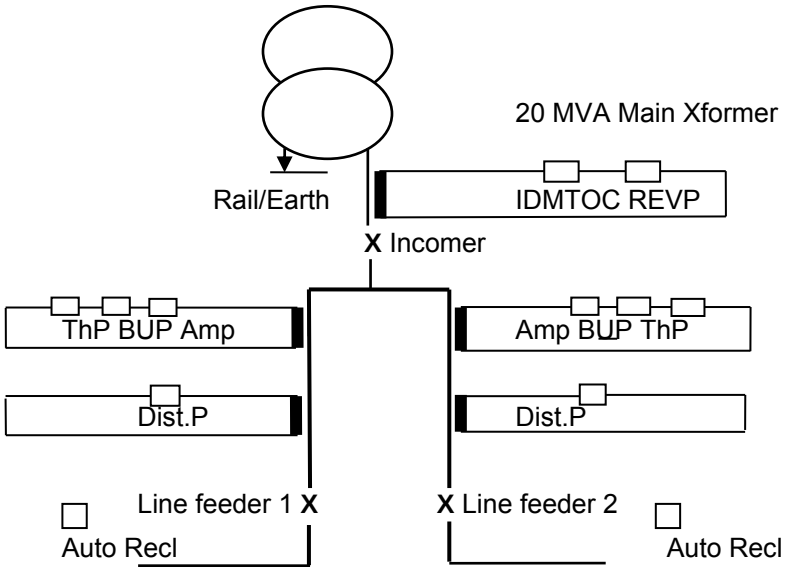


Figure 19.1: Typical layout of secondary breakers (VCB's) in single unit AC Traction substations indicating protection equipment layout.

- Typical AC traction configuration consists of an incoming VCB supplied from secondary winding of the 20 MVA traction transformer feeding on to the busbar from which line feeder VCB's supplies the OHTE, the number depending on single or double line sections.
- In double unit substations a bus-coupler is installed to separate or combine the two busbar sections with instantaneous overload protection in certain designs.
- The incomer VCB is fitted with an IDMT overload relay in the older subs and in later designs programmable hi-tech relays to detect any busbar flashover faults and serve as backup protection for the Line VCB's.
- Reverse power protection is fitted in later designs as well to prevent or limit "backfeed" supplies to Eskom through the main transformer.
- The line feeder VCB's.
- Older type substations are fitted with the following protection: Thermal overload relay: The P & B Golds type relay is generally in use to protect the system in terms of overheating of the transformer and OHTE conductors and operates on a thermal element which is heated by the secondary current from the current transformer to operate in specific time at a pre-set setting. Backup instantaneous protection: This is in the form of an attracted armature type relay (CAG14 relay from GEC being typically installed), to serve as additional protection in the case of severe high currents caused by short circuits or lightning surges. Distance protection relays: The YTG 14 from GEC.

- In AC electrification the OHTE line has resistance and reactance which depends on the length of the line and construction type. Under fault conditions the “distance” relay compares the phase angle (which is relative to the “impedance” between the supply substation and the fault) between the voltage and current to a pre-set relay value. Under certain conditions, a fault current being of the same magnitude as a load current (with a fault at the end of the section) can exist and a normal over-current relay will not see this fault whereas the distance impedance relay will interpret the fault to be in different Zones by calculating and comparing the phase angle relative to the impedance of the section. This will ensure minimum tripping time not relative to the fault distance. Please refer to annexure 1 for further detail.
- In later designs the following protection is installed:
- Thermal overload relay: The KCCG type relays are used as a wide range of settings is available to protect the system against load currents overheating the transformer or the OHTE.
- Backup instantaneous protection: The KCCG type relays allows for an element to be programmed for this function.
- Distance protection relays: The Optimho and Protecta relays.
- The principle of distance protection as mentioned above is well catered for in these type of programmable type relays with improved characteristics regarding current sensing and reaction (tripping) times. Additionally the system has adequate facilities to download history of tripping values and times when required.
- Auto Re-closer Relays: The VAR 22 from GEC and the MTVR 51 from Alstom The auto re-closer relay is “started” by a trip action caused by an instantaneous or distance protection relay. It allows one reclosing action for the VCB after a preset time in the order of 30 seconds. If the fault or overload still is not cleared the VCB will then trip to Lockout and after inspection of the line or fault repairs will it be able to close the VCB.

19.3 BASIC PRECAUTIONS

- All testing to be done under cover of a work permit**.**
- Ensure that the potential transformer fuses are removed to prevent back-feed

19.4 TYPES OF THE TEST

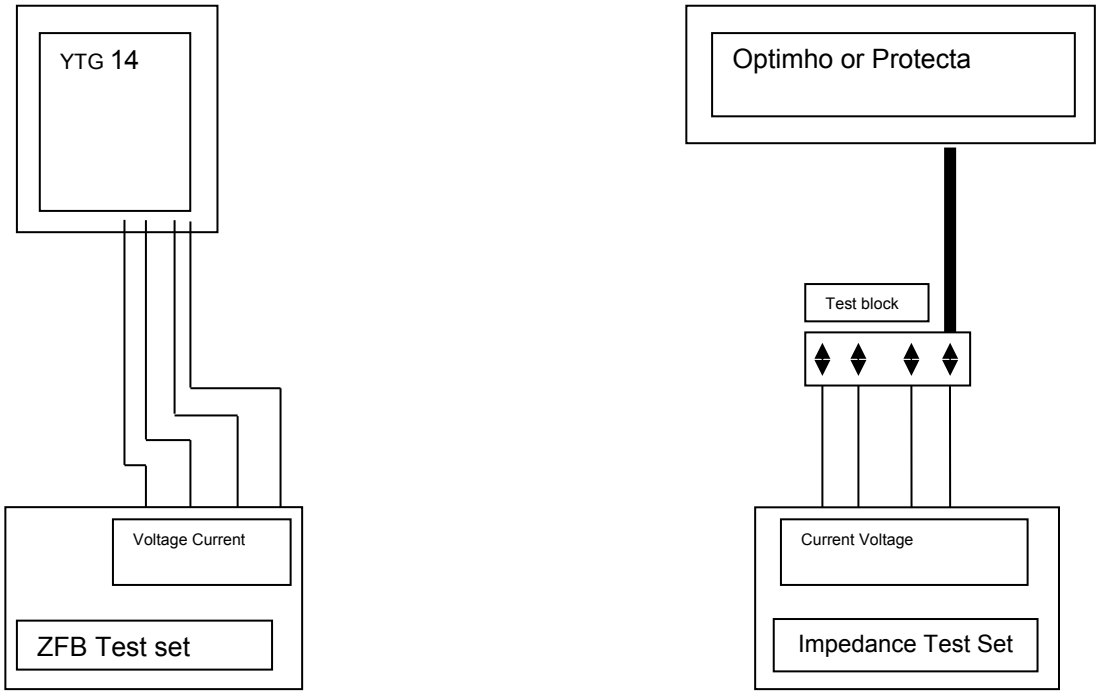
- Magnetization curves and ratio (where possible) on current transformers
- Secondary current injection to test Instantaneous and thermal overload relays.
- Simulation test by impedance test set applying voltage, current at different phase angle values on distance protection equipment.
- Auto Reclosing Relay action.

19.5 TEST EQUIPMENT USED

- Secondary injection test set.
- Distance Protection YTG 14 relay: ZFB test set
- Optimho and Protecta relays: Distance Impedance Test Set.

19.6 THE TEST CIRCUIT

- For current transformers and overload relays refer to section 08 of this manual.
- Distance protection relays.



15.7 THE TEST PROCEDURE

- For Thermal and Instantaneous Overload relay connections, identify the relevant test blocks from the schematic control diagrams referring to section 08 of this manual for secondary injection testing at the prescribed values.
- For Reverse power relays on the incomer VCB's, apply both voltage (110volt AC) and secondary current at the relay setting to the test block connections, firstly in a forward direction and then in a reverse direction by swapping the polarity of the voltage connection to obtain the tripping value of the current.
- For Distance Protection on the line feeder VCB's, connect the voltage and current connections to the relevant test terminals and follow the prescribed procedure to confirm the trip values at which the relay is set.
- Auto Reclosing Relay: After an overload tripping action confirm that the auto recloser recloses the VCB in approximately 25-30 seconds. After initiating a second tripping action immediately after the reclosure the VCB must be tripped to lockout.

15.8 DOCUMENTATION

- Complete the relevant test sheets.

15.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- All values should be within a tolerance of 10 %.

15.10 SPECIAL PITFALLS

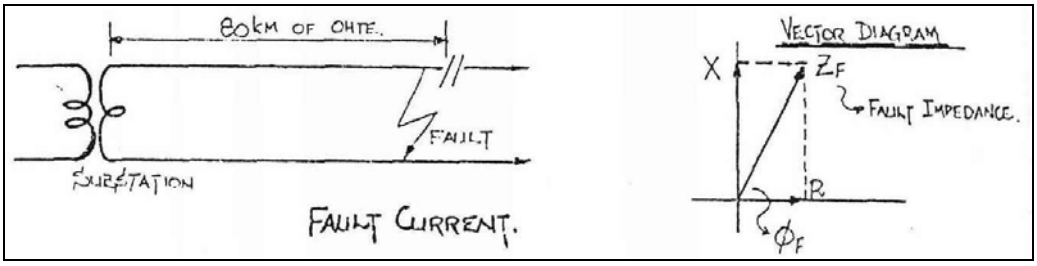
- Polarities must be correct where voltage is applied in testing reverse power and distance protection relays.

15.11 REFERENCES

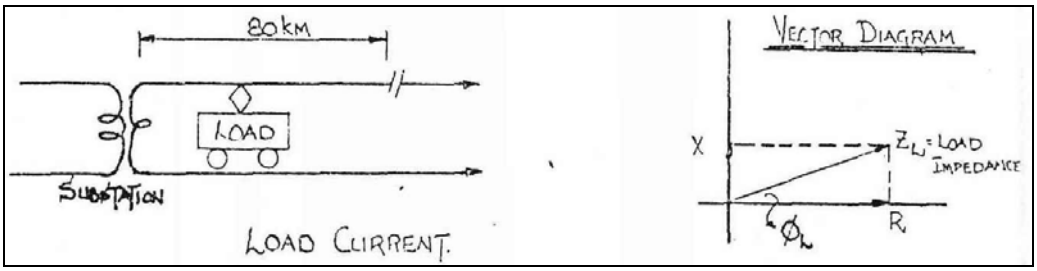
- PSP Training: Electrical Power Protection, pp 14.6-14.22
- Annexure 1: PROTECTION OF OHTE DISTANCE IMPEDANCE PROTECTION (YTG 14 RELAY), Transnet Publication.

Annexure 1: PROTECTION OF OHTE DISTANCE IMPEDANCE PROTECTION (YTG 14 RELAY)

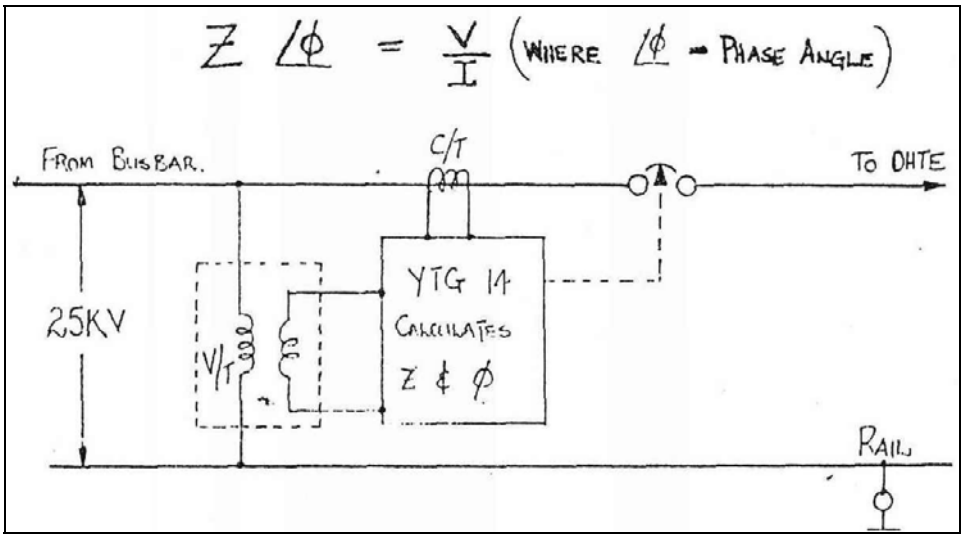
- An impedance relay is used instead of the normal over-current, as under certain conditions, a load current of the same magnitude as the fault current (with a fault at the end of the section) can be drawn. The distance impedance relay can permit this, by calculating the phase angle and Impedance of the section.



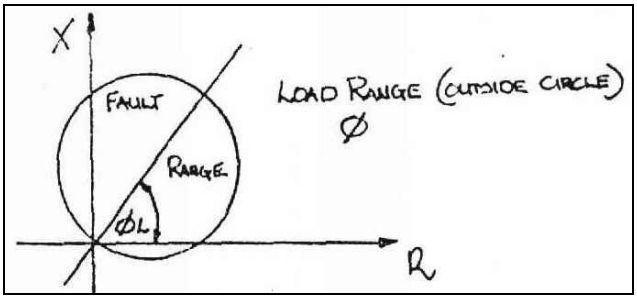
- The impedance of the OHTE is highly reactive on a short circuit while the load drawn by a locomotive is mainly resistive (or closer to unity power factor).



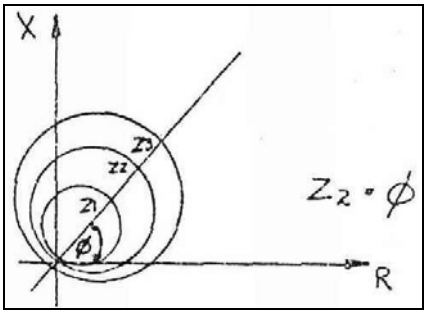
- It can be seen that although $Z_L \cong Z_F$, the phase angles Φ_F and Φ_L are not equal: $\Phi_F > \Phi_L$. The YTG relay uses this difference to distinguish whether the current fed into the section is load current or fault current.
- The YTG 14 relay calculates the impedance and phase angle from inputs from both the CT and VT.



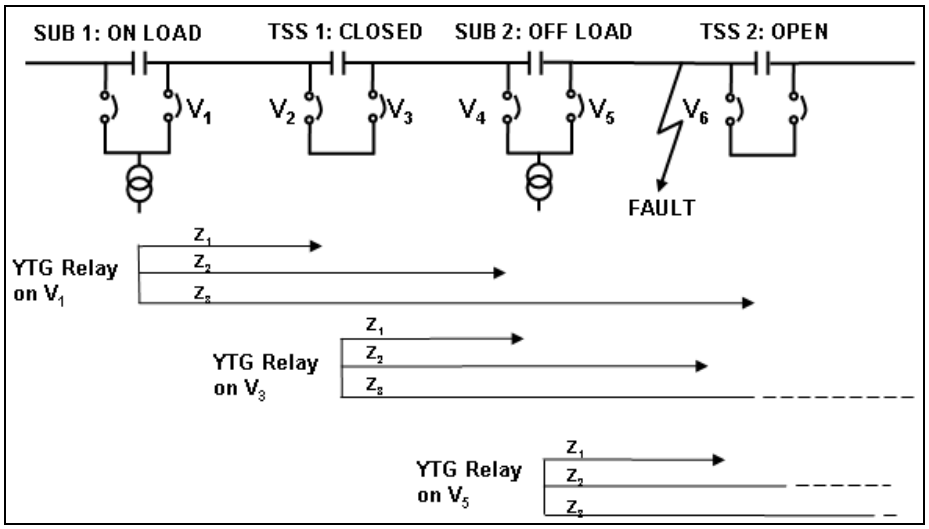
- The relay will prevent operation in the whole range of impedances, represented by o circle.



- Changing the settings of the relay will change the size of the circle, the position of the mid-point of the circle (as determined by the phase angle Φ) and also the time delay before tripping the VCB.
- The relay distinguishes between three levels of fault currents (i.e. zones 1, 2 and 3) represented by 3 circles, each with its own time delay (Zone I delay being 0).



- Each zone can then be used to protect up to the next VCB (although the relays are not normally set like this).



- With a fault as shown, the YTG relay at V_5 will see the fault as a Z_1 fault, and trip immediately. If it fails to trip, the YTG relay at V_3 will see it as a Z_2 fault, and trip V_3 after a time delay. The V_3 relay will therefore act as back up protection for the V_5 relay, the V_1 relay as back up for the V_3 and the V_5 relay, etc.
- A special feature of the YTG14 is the “instant trip” facility. This is a circuit arrangement by which the Zone 3 timer is bypassed for a short period after the line becomes ”live” so that immediate tripping takes place if the line is energized on to a zero-voltage fault.
- Another feature of the YTG 14 is the memory action which enables the measuring unit to operate for faults which collapse the voltage to zero. This consists of an LC circuit tuned to the system frequency which stores the pre-fault voltage for a short time.
- Track Feeder VCB’s have one auto reclose operation approximately 5 seconds after a trip. This operates when the Track Feeder is selected to remote control only. On manual selection the auto-reclose circuit is bypassed and only one trip will take place, with no auto-reclose operation.

PROTECTION OF OHTE OVERLOAD PROTECTION

- The YTG relay will not protect the OHTE against sustained overloads.
- The OHTE is protected against sustained overloads by a thermal overload relay, which is basically a bi-metal relay fed by a CT. A "P & B Golds" relay is used as this relay's characteristics closely matches the OHTE thermal characteristics.
- Operation of this relay will trip the VCB.

***

SECTION 20

SIGNAL SUPPLY & DISTRIBUTION SUBSTATIONS

20.1 THE FUNCTION IN THE ELECTRICAL SYSTEM

1 Signal supply substations are situated along the main line sections to supply power to signal relay room stepdown points by means of three phase transmission lines at either 6.6 or 11 kV. Substation outdoor yard layouts are similar to Traction substations as seen from Figure 20.1 below with the HV supply stepped down to the above voltages.

See Figure 20.2 for a typical switching diagram used in a T-supply configuration

A distribution substation distributes power supplied by local authorities or Eskom to Transnet stations, yards, workshops and other complexes in towns and cities. Either 6.6 or 11 kV equipment are installed in ring-feed systems with overhead transmission line or underground cable systems. See Figure 20.3 for a diagram of a typical system.

In some installations Signal transmission lines is supplied from Distribution systems depending on the layout.

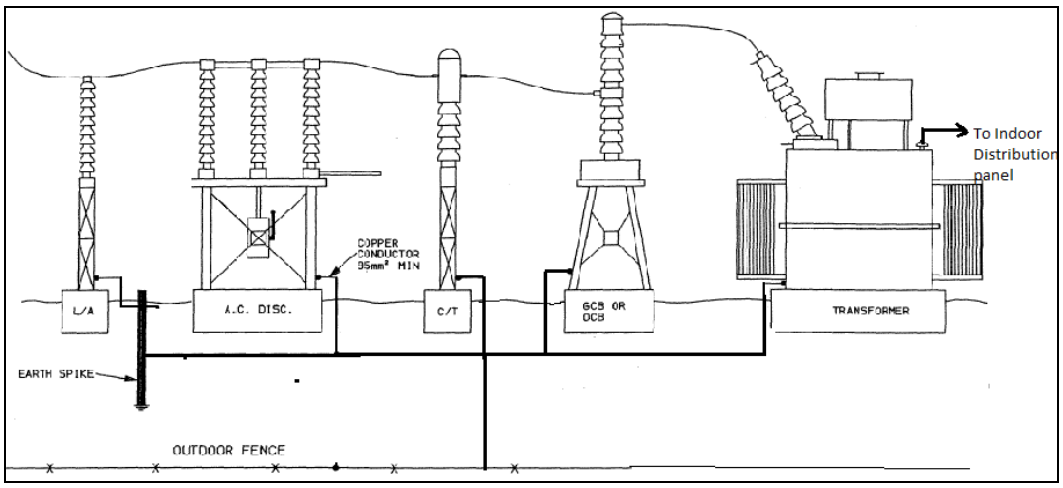


Figure 20.1: Signal Supply Substation outdoor yard layout

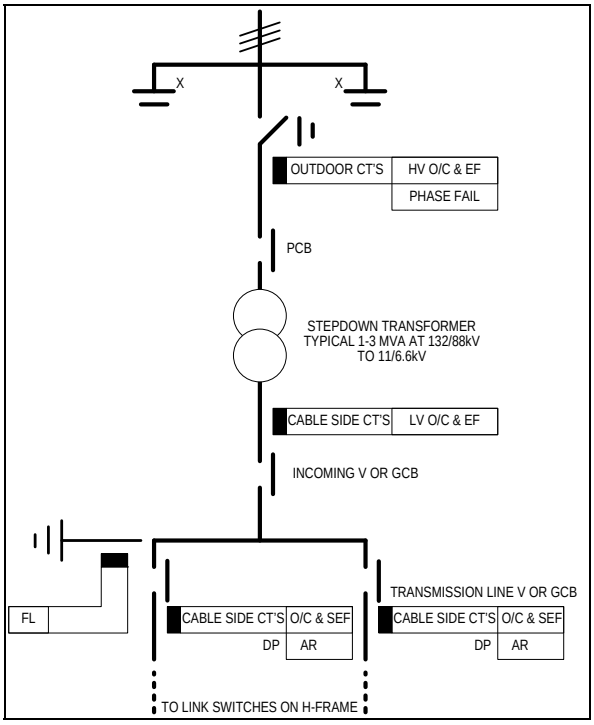


Figure 20.2: Typical Signal Supply Substation Diagram

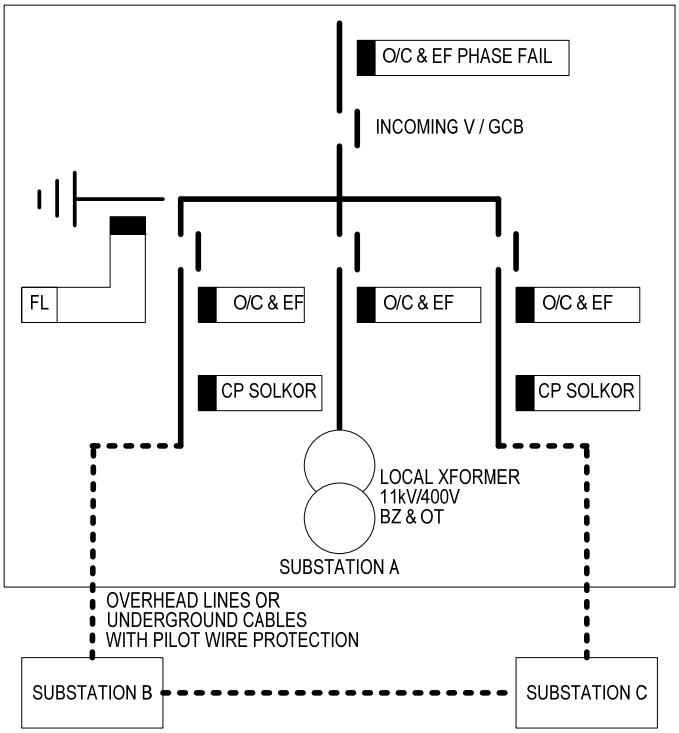


Figure 20.3: Typical Diagram of Distribution Supply Substations in a Ring-feed Configuration

20.2 PRINCIPLES OF OPERATION

Different elements of protection are applied in Signal and Distribution substations.

- General overcurrent, earth fault protection are provided by various relay makes and types operating on the magnetic disc for IDMT (Inverse Definite Minimum Time) curves and attracted armature types for instantaneous operation. Most common in the older substations is the GEC CDG type but in upgraded or new installations new generation programmable relays are installed such as the Siemens Argus and Strike Technology FP04 with different elements available for overcurrent and earth fault (normal or sensitive) functions.
- The IDMT (Inverse Definite Minimum Time) principle is demonstrated below in an extract from *Electrical Power Protection by Les Hewitson*:

Co-ordination by Time Grading

10.1 Protection Design Parameters on Medium & Low Voltage Networks

- Although not appreciated by many engineers, the widespread use of Inverse Definite Minimum Time Overcurrent and Earth Fault (IDMT OCEF) Relays as the virtual sole protection on medium and low voltage networks requires as much detailed study and applications knowledge as does the more sophisticated protection systems used on higher voltage networks.

10.1.1 Introduction

- Traditionally, design engineers have regarded medium arid low voltage networks to be of lower importance from a protection view, requiring only the so-called simpler type of IDMT Overcurrent and Earth fault relays on every circuit. In many instances, current transformer ratios were chosen mainly on the basis of load requirements, whilst relay settings were invariably left to the commissioning engineer to determine. However, experience has shown that there has been a total lack of appreciation of the fundamentals applicable to these devices as numerous incidents have been reported where breakers have tripped in an uncoordinated manner leading to extensive network disruption or failed to trip causing excessive damage, extended production downtime and in some cases loss of life.
- This chapter reviews some of the fundamental points for the design engineer to watch for in planning the application of IDMTL OCEF protection to Medium Voltage switchboards and networks.

10.1.2 Why 1DM]?

- To achieve selectivity and co-ordination by time grading two philosophies are available, namely:
  - Definite Time Lag (DTL), or
  - Inverse Definite Minimum Time (IDMT)
- For the first option, the relays are graded using a definite time interval of approximately 0.5 seconds. The relay A at the extremity of the network is set to operate in the fastest possible time, whilst its upstream relay B is set 0.5 seconds higher. Relay operating times increase sequentially at 0.5 second intervals on each section moving back towards the source as shown in Figure 10.1.

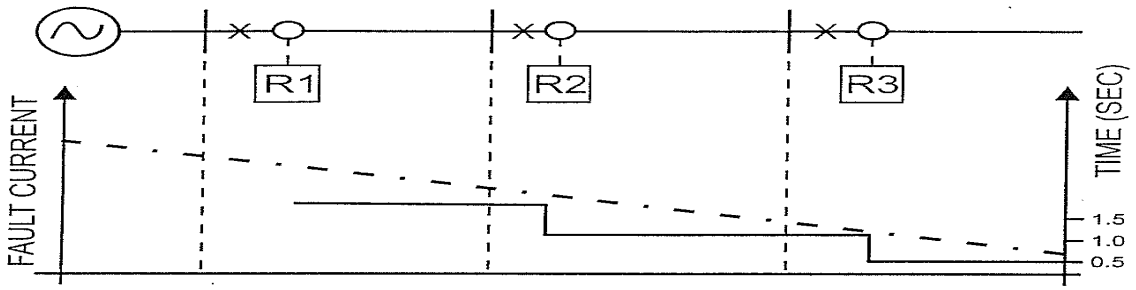


Figure 10.1
Definite Time Philosophy.

The problem with this philosophy is the closer the fault to the source, the higher the fault current, the slower the clearing time – exactly the opposite to what we should be trying to achieve!

On the other hand, inverse curves as shown in Figure 10.2 operate faster at higher fault currents and slower at the lower fault currents, thereby offering us the features that we desire.

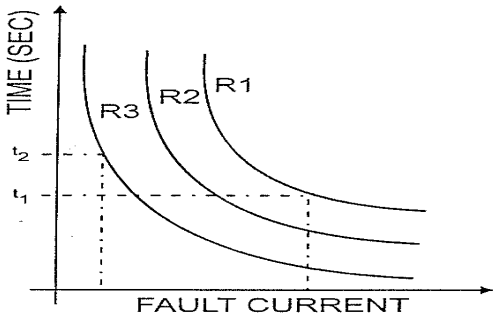


Figure 10.2
Inverse Definite Minimum Time.

- With modern programmable relays IDMT Curves applicable to electromechanical relays can easily be obtained from the wide range of curves available.
- Typical connections for overcurrent and earth fault protection are shown below in figure 20.4.

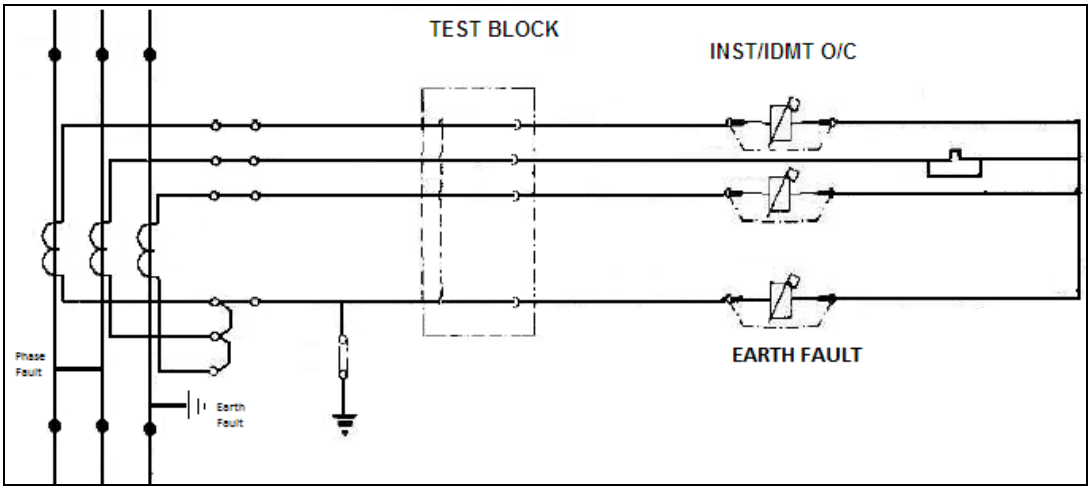


Fig 20.4 Typical connections for general O/C and E/F protection

- A phase to phase fault will circulate current through the high set overcurrent elements and trip on instantaneous and with a large overcurrent the IDMT element will trip after a preset time .Overcurrent settings ranges from 50 to 200% with timing elements from 0.05 to 1 second. A phase to earth fault will circulate current from the CT through the high set element which will not react at low current values, and to earth through the low set element tripping the earth fault element. Earth fault settings ranges from 10 to 40% with timing elements from 0.05 to 1 second.
- Sensitive Earth Fault is installed on circuit breakers supplying Transmission lines to ensure protection in case of short circuit faults at long distances from the supply point. Due to the available lowest setting of 10% on the normal earth fault element and relatively high load current transformer ratio's a distant fault will not trip the relay due to the impedance limiting the fault current. The Sensitive Earth Fault relay facilitates current settings from 0.4 to 40% and time settings from 0.1 to 99 seconds. A typical setting is at 2% for current at a time of 10 seconds.
- Cable protection is mostly provided by SOLKOR relay systems which belong to the circulating current class of differential protections which can be recognised by two main features. Firstly, the current-transformer secondaries are arranged to produce a current circulating around the pilot loop under external fault conditions balanced wire principles. Secondly, the protective relay operating coils are connected in shunt with the pilots across points which have the same potential when the current circulates around the pilot loop.

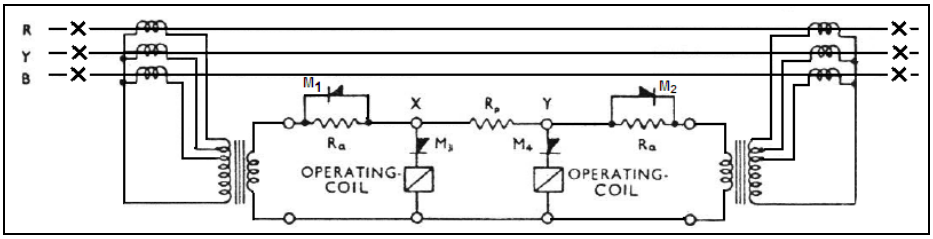


Fig 20.4 Connection of SOLKOR cable protection equipment.

- Normal 3 phase load currents flows through the cable from point A to B. The resulting secondary currents flowing in the summation transformers in a

balanced system. In the case of a phase or earth fault the currents at point A and B will not be equal causing the summation winding of the faulty phase to be out of balance allowing current to flow from the secondary winding of the summation transformer to the operating coil tripping the relay. Padding resistors are installed to compensate for differences in pilot wire resistance which should be in the order of 1000 ohms. Refer to Solkor annexure for further study.

- Transformer protection: Signal supply and Distribution transformers may have Buchholz relays, and Oil and/or Winding temperature protection depending on the rated KVA.
- Phase fail protection: This provides a trip facility to the incoming breaker in case of failure of the Supply Authority supply. The “AC Fail/Available” indication to Electrical Control” is obtained from this relay as well. Modern relays provides for phase rotation checks as well.

20.3 BASIC PRECAUTIONS

- All testing to be done under the cover of a work or test permit.
- Safety measures to be in place during primary current injection tests on Solkor equipment as high voltages may be generated on the pilot cable connections.

20.4 TYPES OF THE TEST

- **Overcurrent and earth fault protection (Normal and Sensitive)**
  - Current transformers: Ratio and Magnetization curves. (Refer Section 4)
  - Relays: Primary or Secondary Current injection and timing tests**.**
- **Sensitive Earth fault**:
  - Current transformers: Ratio and Magnetization curves. (Refer Section 4)
  - Relays: Primary or Secondary Current injection and timing tests**.**
- **SOLKOR Cable Protection**
  - Current transformers: Ratio and Magnetization curves. (Refer Section 4)
  - Relays: Current injection and stability tests**.**
- **Transformers**
  - Buchholz Relay: Air injection (Refer Section 6)
  - Oil or Winding Over-temperature: Simulation tests (Refer Section 7)
- **Phase fail Protection.**

20.5 TEST EQUIPMENT REQUIRED

- Primary/Secondary Injection Test Set
- Multi-meters
- Set of Light and Heavy test leads.
- Megger 500v (for SOLKOR pilots cables)

20.6 THE TEST CIRCUITS

- **Overcurrent and Earth Fault (incl. Sensitive Earth Fault) protection**

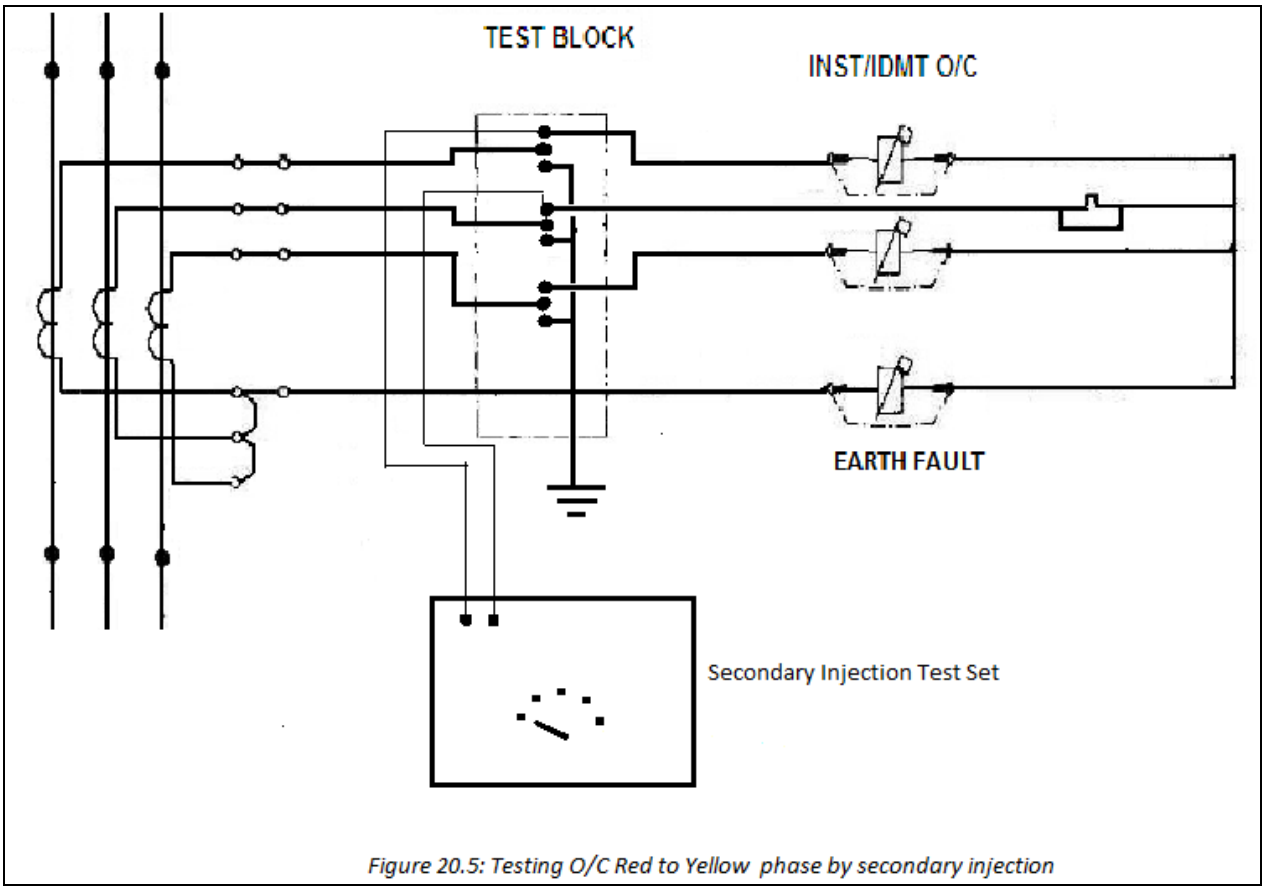


Figure 20.5: Testing O/C Red to Yellow phase by secondary injection

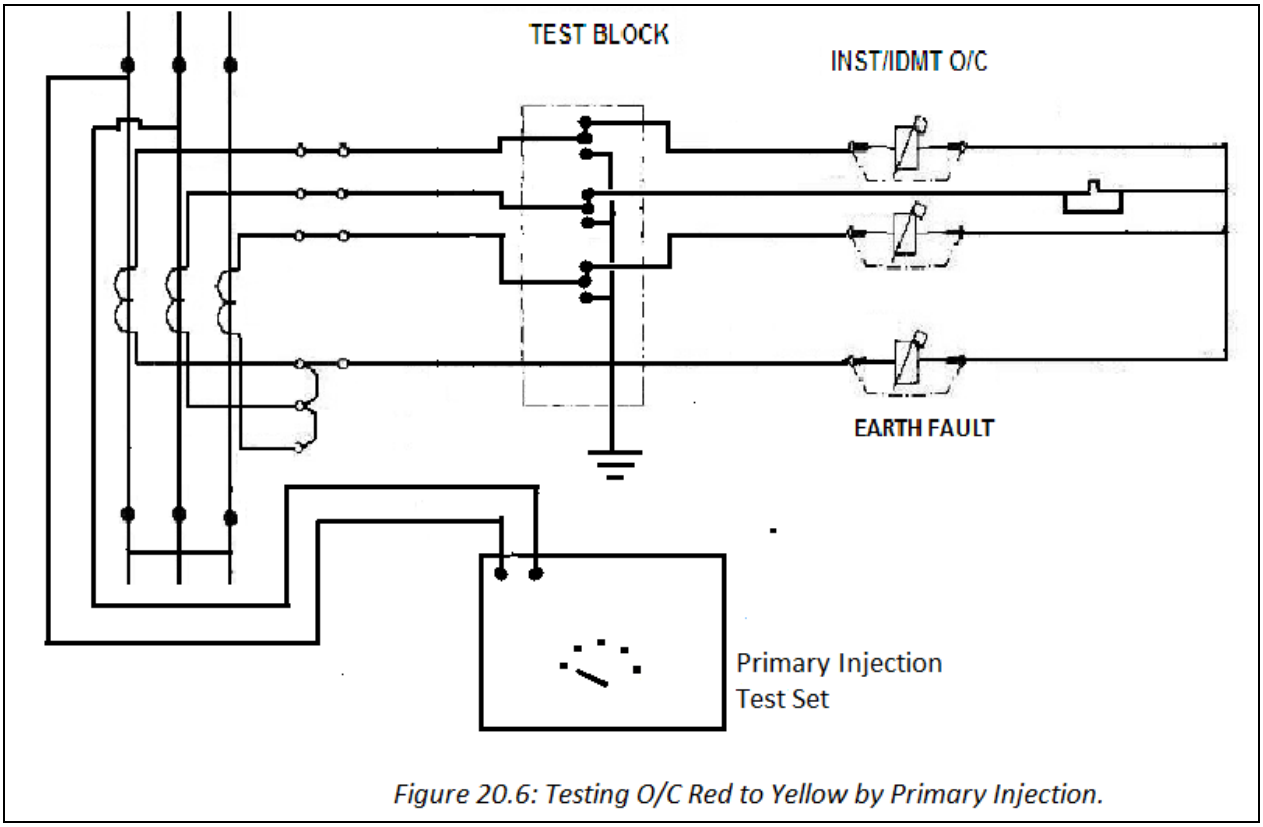


Figure 20.6: Testing O/C Red to Yellow by Primary Injection.

20.6 THE TEST CIRCUITS (ctnd)

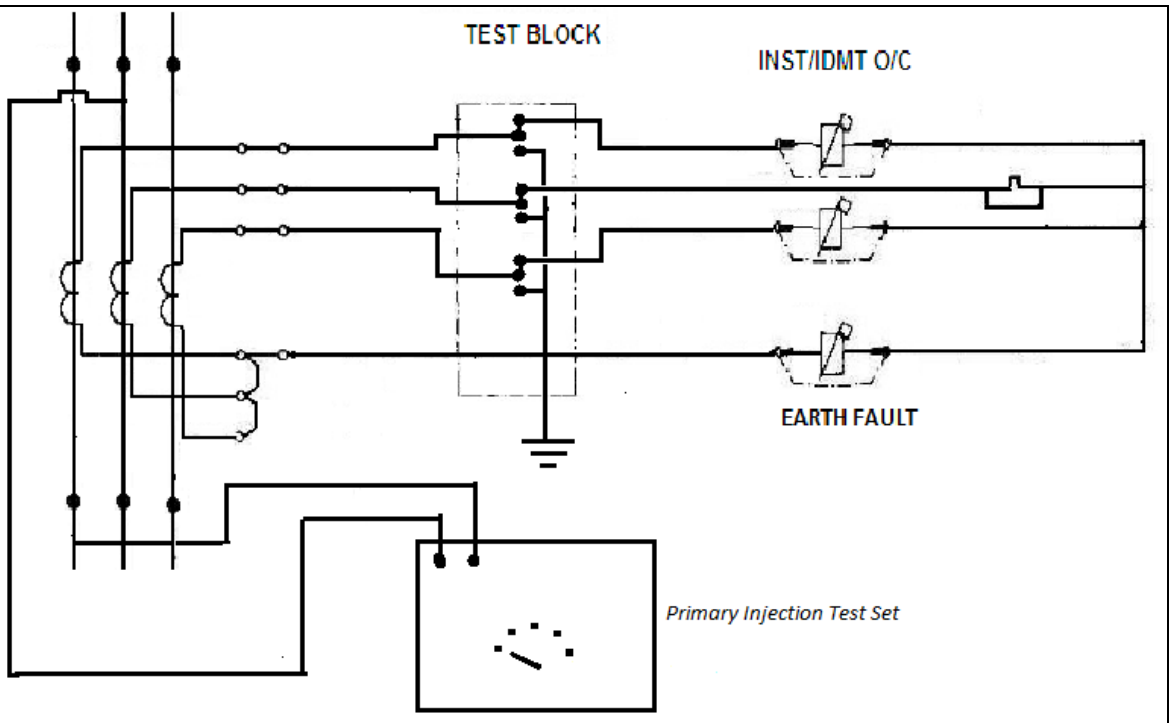


Figure 20.8: Testing E/F Yellow phase by primary Injection.

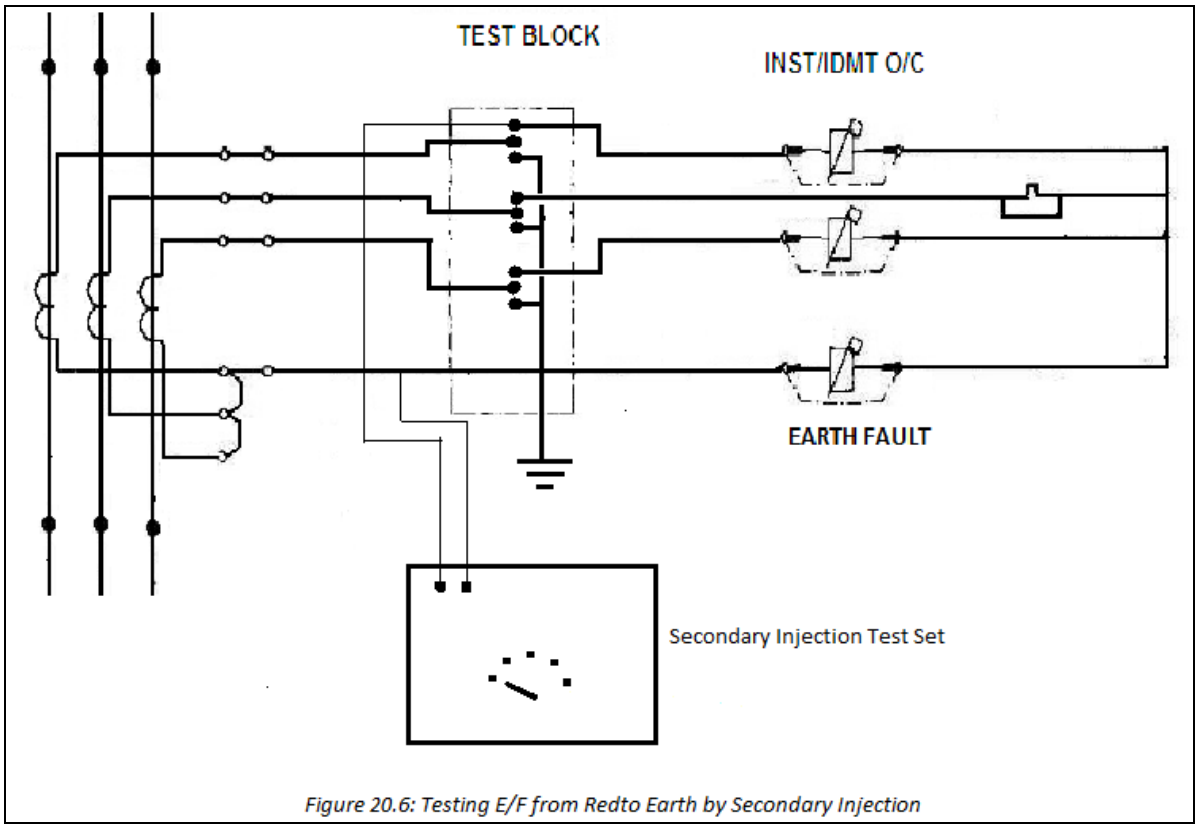


Figure 20.6: Testing E/F from Redto Earth by Secondary Injection

20.7 THE TEST PROCEDURE

- **Overcurrent protection**
  - IDMT (Instantaneous) Overcurrent elements are tested by injection of either primary, secondary or test winding current at multiples of the relay setting. Refer to *Figure 20.5 and 6* for connections for secondary and primary injection respectively. Relay trip times are recorded at 2, 4 and 6 times the full load current by setting the current at the required value and switching on the test set controls for current and timing circuits. For primary and secondary injection test leads are connected across a pair of phases in turn, i.e. Red to Yellow, Red to Blue and Yellow to Blue.
- **Earth fault and sensitive earth fault protection**
  - Earth fault elements are tested by similar injection with leads connected from Red, Yellow and Blue phase individually to Earth at similar Time Multiplier Settings recording the trip times as above. Refer to *Figure 20.7 and 8* for connections for secondary and primary injection respectively.
  - During factory tests the relay is tested at a number of plug and time multiplier settings. With field commissioning and routine tests it is only tested at the prescribed settings as calculated according to the conditions of application.
- **Current and Time Multiplier Settings**
  - Older type relays e.g. CDG: IDMT setting for current is selected on the plug setting face-board with the time selected by adjusting the magnetic disc travel on the time setting disc. High speed elements are adjusted by spring tension mechanisms.
  - On modern programmable relays different elements are selected for time delayed and instantaneous protection with a wide range of tripping curves available. A range of output relays are available for tripping, lockout and alarm functions. The history of fault tripping is obtainable as well as continuous load current displays.
  - Typical makes installed in new and refurbished substations are: MiCom from Alstom, Argus from Siemens Reyrolle and FP1000 or FP04 from Strike Technologies.

20.6 THE TEST CIRCUITS (ctnd)

SOLKOR Cable protection

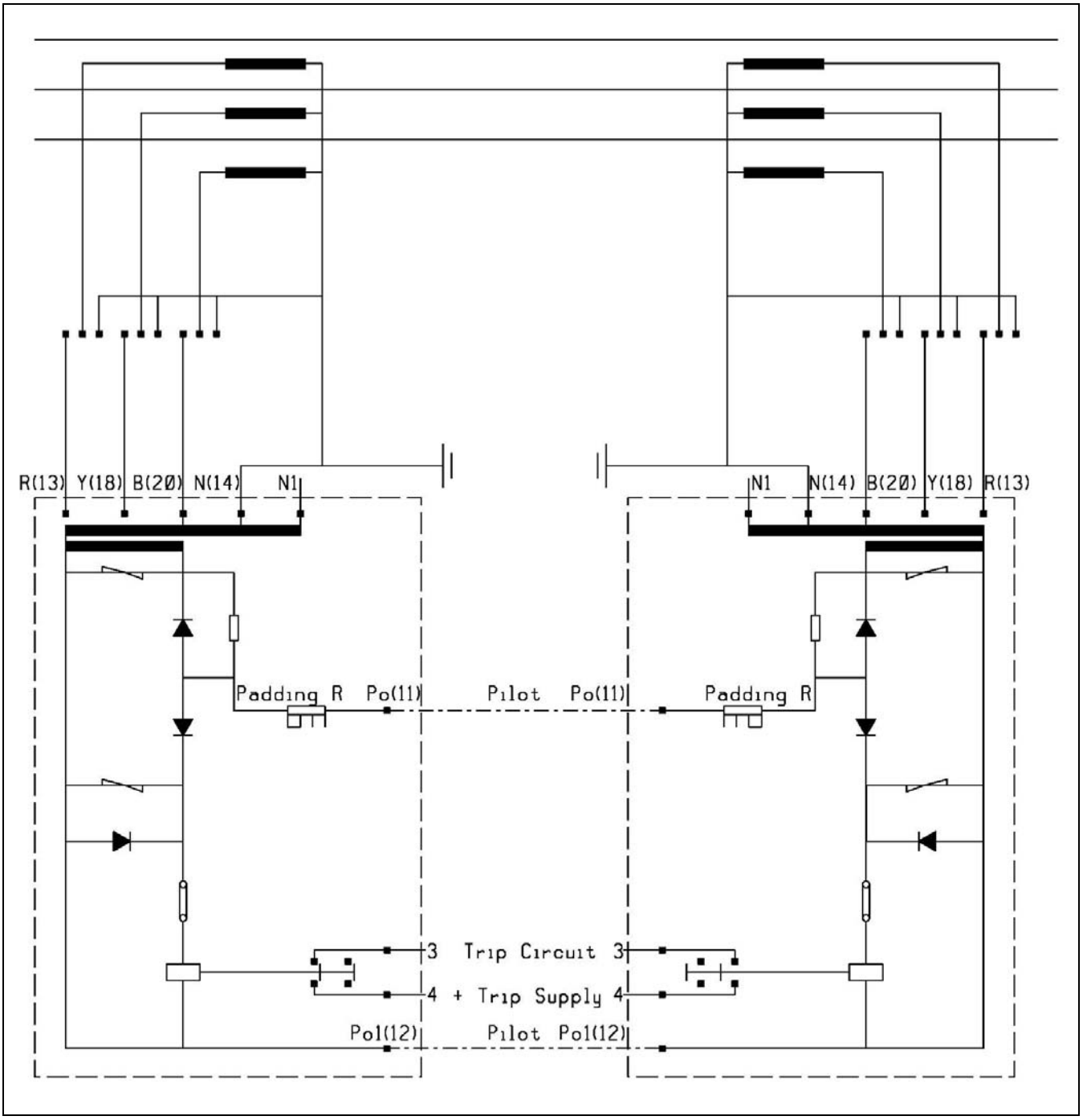


Figure 20:9: Typical schematic diagram for a SOLKOR feeder protection system.

20.7 THE TEST PROCEDURE

- **General Connection check.**
  - Visually inspect and confirm relay and connections to be as shown in *Figure 20:9*. Confirm starpoint of current transformers to be on cable side at both ends of cable. The N(14) tap terminal is normally connected to earth with the N1 used where extreme low settings are required.
- **Insulation of secondary wiring**

- With all fuses, earthing connections and -links removed test the insulation of the secondary wiring to earth by applying the 500v megger to be 5 Meg-ohm minimum.

- **Pilot wire tests**
  - **Insulation tests:** With the pilot wires disconnected at both ends, test the insulation by applying the 500 volt megger to the individual cores to earth to be at 5 Meg-ohm minimum during commissioning and 1 Meg-ohm with routine tests.
  - **Loop resistance test:** With the pilot cores shorted at one end measure the loop resistance to be more than 1000 ohms. Add padding resistors with the same value at both ends determining the value by applying the calculation standard of 0.5(1000-Rp) where Rp is the total loop resistance of the pilot cores.

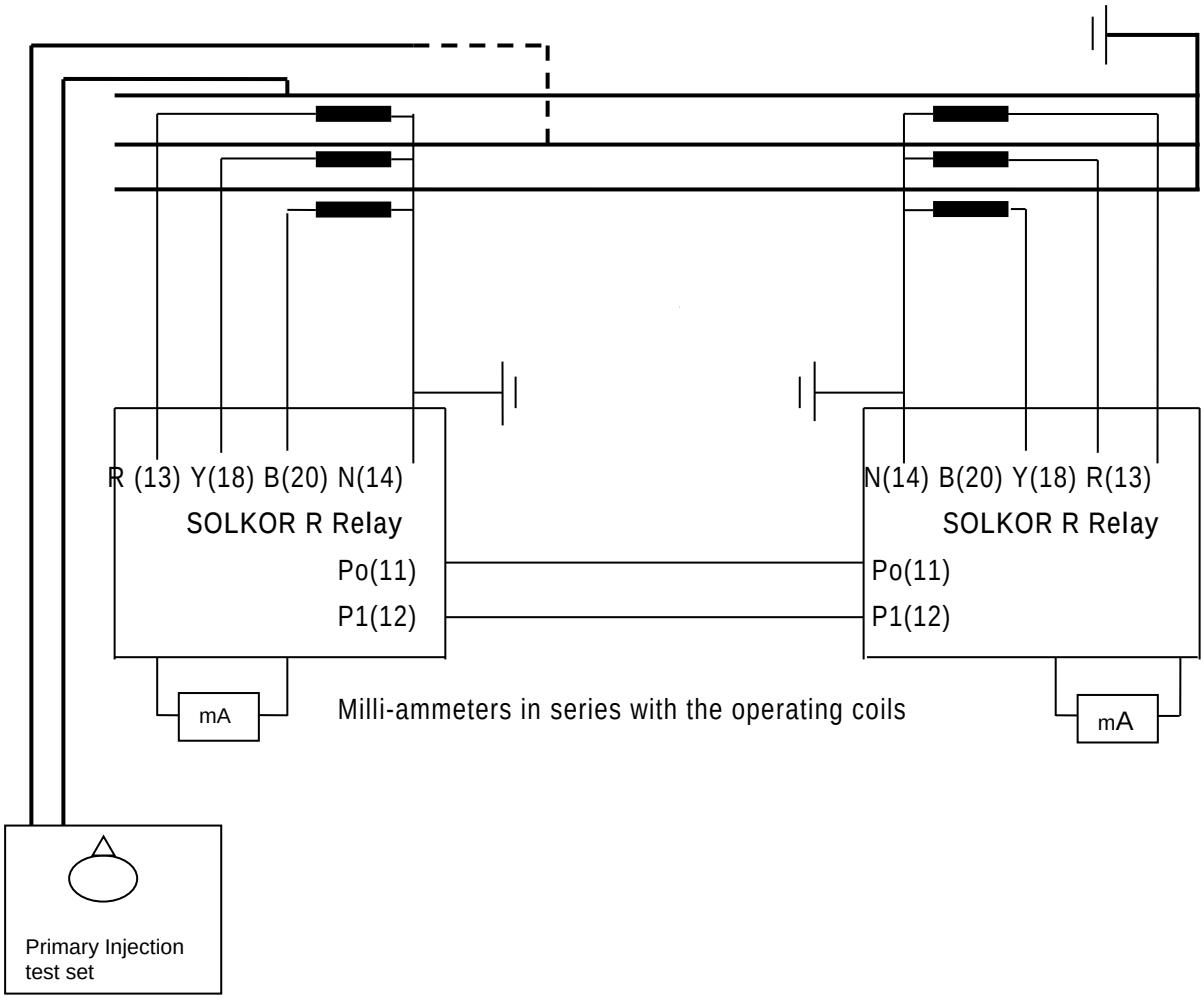


Figure 20:10: Typical test connections for primary injection for an earth fault and phase fault (in dotted lines) setting tests.

- **Fault setting test**
  - The primary injection test with connections as shown in *Figure 20.10* is done to confirm that the overall fault settings are in order with the pilot cores correctly connected. This will prove that the secondary wiring from the current transformers to the summation transformers are connected as required at each end as well.
  - Gradually increase the primary current until the local relay operates recording the current value in table 1 confirming it to be as shown in

column 3. If the system is operating correctly the current in the operating coil of the remote relay should be half of the current in the operating coil of the local relay. With an open circuit in the pilot cores the local relay will operate at approximately half of the percentage listed in column 3 of Table 1. Repeat the test for the yellow and red phase to earth, confirming the required percentages.

- Similarly the test is done for phase to phase fault with connections as per dotted lines for red to yellow phase in above test connection diagram.
- Repeat the primary injection test from the remote substation and confirm that the most sensitive earth fault setting at both ends refer to the same phase.

- **Phase fail Protection**
  - Tested by disconnecting connections or removing fuses depending on wiring and VT supply arrangements. Phase rotation is tested by changing two phase connections at the bottom end of fuses or MCB's

20.8 DOCUMENTATION

- Complete the relevant test sheet BBB0346 for over-current and earth-fault.
- Complete the relevant test sheet for SOLKOR cable protection.

20.9 THE RANGE OF ACCEPTABLE TEST RESULTS

- In general a tolerance of 10% for current values and 5% for Minimum time values are applicable.

20.10 SPECIAL PITFALLS.

- Confirm proper test connections at all times as high resistance connections can lead to difficulties in reaching required current values.

THEORY AND PRACTICE OF PILOT WIRE PROTECTION

- **Principle of a Solkor feeder protection relay [1]**
  - Solkor R belongs to the circulating current class of differential protections which can be recognised by two main features. Firstly, the current-transformer secondaries are arranged to produce a current circulating around the pilot loop under external fault conditions. Secondly, the protective relay operating coils are connected in shunt with the pilots across points which have the same potential when the current circulates around the pilot loop. In this particular scheme equipotential relaying points during external fault conditions exist at one end during one half cycle of fault current, and at the other end during the next half cycle. During half cycles when the relay at either end is not at the electrical midpoint of the pilot system the voltage appearing across the relay is in the reverse direction to that required for operation.
  - At each end of the feeder the secondaries of the current transformers are connected to the primary of the **summation transformer**. For various types of current distribution in the three current transformers, a single phase quantity appears in the summation transformer secondary winding and is applied to the pilot circuit. By this means a comparison between the currents at each end of a three phase line is affected over a single pair of pilot wires on an equivalent single phase basis. The tappings on the summation transformer primary have been selected to give an optimum balance between the demands of fault setting and stability.
- **Principle of a summation transformer [2]**
  - The main purpose of the summation transformer is to enable either balanced or unbalanced three phase currents to be re-produced as a single phase quantity. This makes it possible in a feeder protection to compare the various fault currents on a single phase basis over only two pilot cores. As this device is essentially a transformer it can also be used to reduce the burden imposed by the pilot circuit on the current transformers by changing the impedance levels. In addition, it provides isolation between the current transformers and the pilot circuit and makes it possible to have the current transformers earthed and the pilots unearthed.

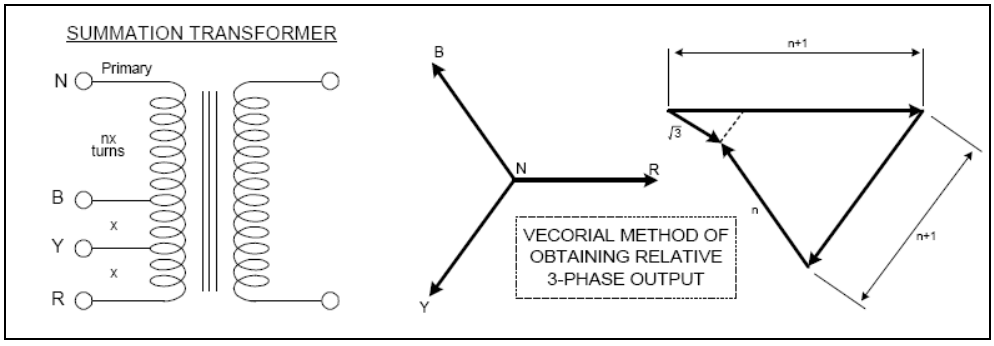


Fig X.1

Fault Type	Effective Primary Ampere-turns	Relative Output
R-E	I(nx + x + x) = Ix. (n+2)	n+2
Y-E	I(nx + x) = Ix. (n+1)	n+1
B-E	I(nx) = Ix. (n)	n
R-Y	I(x) = Ix. (1)	1
Y-B	I(x) = Ix. (1)	1
B-R	I(2x) = Ix. (2)	2
3P	I(√3x) = Ix. (√3)	√3

Table X.1

- **Circuitry**
  - The basic Solkor-R protective circuit is that shown in Fig. X2. The protective relay operating coils are connected in shunt with the pilots, across points which have the same potential when current circulates round the loop. In this scheme, equipotential relaying points during external faults exist at one end during one half-cycle of fault current and at the other end during the next half-cycle. During the half-cycles when the relay at either end is not at the electrical mid-point of the pilot system, the voltage appearing across the relay is in the reverse direction to that required for operation.
  - At each feeder end, the secondaries of the line current transformers are connected to the primary of a summation transformer. For various types of current distribution in the three current transformers, a single phase quantity appears in the summation transformer secondary and is applied to the pilot circuit. Thus the comparison of currents entering and leaving the feeder is on a single phase basis. In the basic diagram the resistance of the pilot cable is represented by R_p, the rest of the loop comprising the resistors R_a and the rectifiers M_1 and M_2. The operating elements which are made unidirectional by rectifiers M_3 and M_4, are connected in shunt with the pilots at points X and Y.
  - When a fault occurs external to the protected zone, an alternating current circulates around the pilot loop. On alternate half-cycles one or other of the resistors R_a at the two ends of the pilot is short-circuited by its associated rectifier M_1 or M_2, and the total resistance in the pilot loop at any instant is therefore substantially constant and equal to R_a+R_p. The effective position of R_a however, alternates between the two ends being dependent on the direction of current. This change in position of R_a makes the voltage distribution between the pilot cores different for successive half-cycles of the pilot current, the effective circuits on successive half-cycles being shown in Fig. X.2 at (a) and (b).

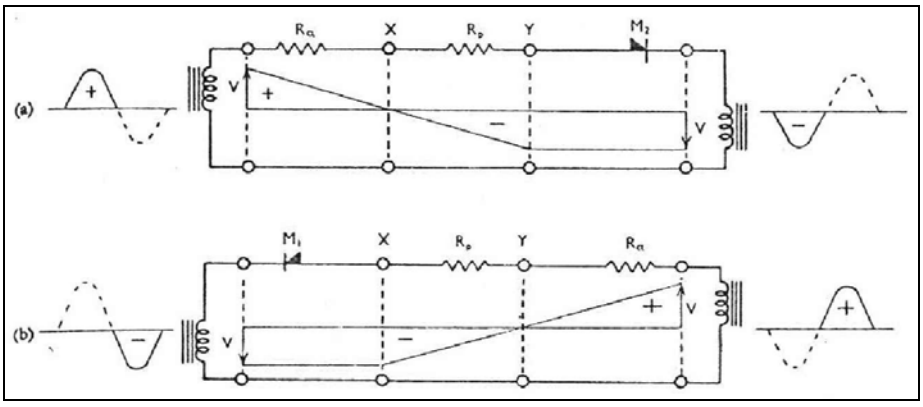


Fig.X.2.-Behaviour of basic circuit under external fault conditions.(a) and (b) show effective circuits during alternate half-cycle.

  - These diagrams indicate also the resulting potential-gradient between pilot cores when R_a is equal to R_p and it will be seen that the voltage across the relays at points X and Y is either zero (because the relay is at an electrical mid-point) or in the reverse direction for conduction of current through rectifier M_3. Therefore, when $R_a=R_p$, a reverse voltage appears across the relay circuit during one half-cycle and zero voltage during the next. The voltage across each relaying point X and Y during a complete cycle is shown in Fig. X.3 at (a).

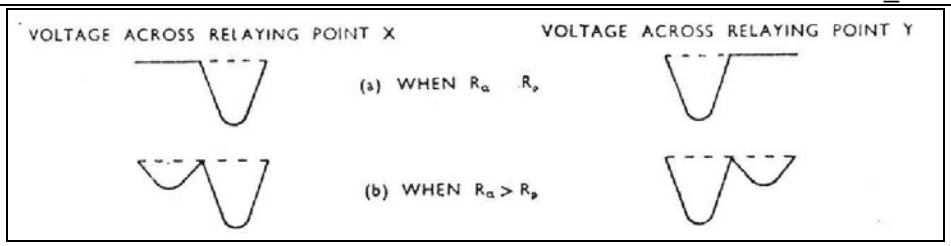


FIG X.3.-Voltage across relaying points X and Y during one cycle of external fault current

- In practice, resistors R_a are made greater than the pilot loop resistance R_p and this causes the point of zero potential to occur within resistors R_a as shown in Fig. X.4 and the voltage across X and Y throughout a complete cycle is now that shown at (b) in Fig. X.3.

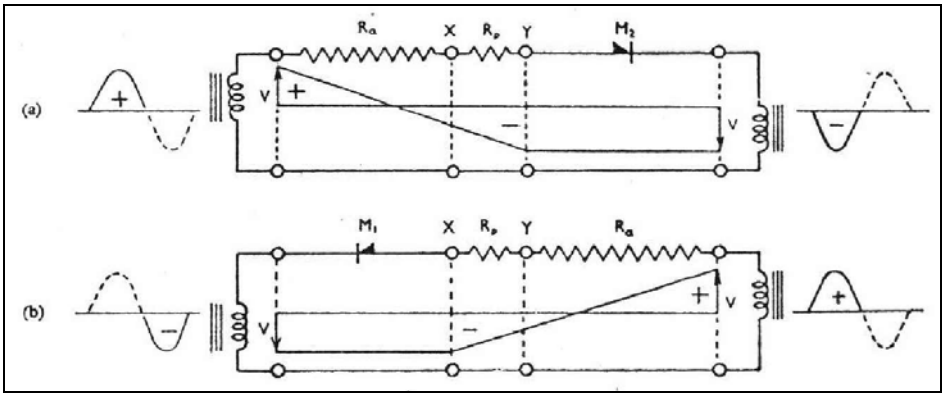


Fig.X.4: Behaviour of basic circuit under external fault conditions when R_a is greater than R_p. (a) and (b) show effective circuits during alternate half-cycles

- Thus, instead of having zero voltage across each relay on alternate half-cycles, there is on both half-cycles a voltage in the reverse direction to that required for operation and as this voltage must be overcome before operation can take place the effect is to enhance the stability on through faults.

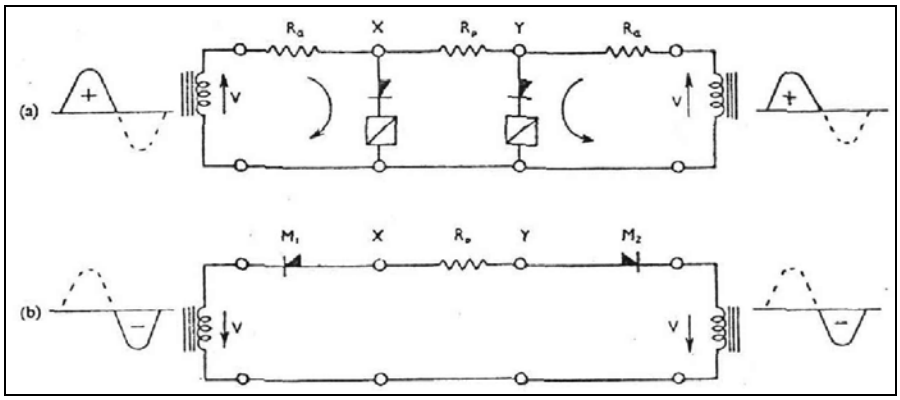


Fig. X.5: Behaviour of basic circuit under internal fault conditions fed from both ends, (a) and (b) show the effective circuits during alternate half- cycles.

- When a fault occurs within the protected zone and with current fed equally from both ends, the effective circuits during successive half-cycles are those shown at (a) and (b) in Fig. X.5. From this it is seen that pulses of current pass through each relay on alternate half-cycles and the relays at both ends will operate. If the current is fed from one end only, the relay at the remote end (in series with the pilot loop resistance R_p) is energised in shunt with the relay at the feeding end.

The relay at the feeding end operates at the setting current and the relay at the remote end at approximately 23 times the setting current. Providing therefore, that the fault current is not less than 23 times the fault setting, the relays at both ends operate to completely isolate the circuit.

- Fig. X.6 is a schematic diagram of the complete protective system. All schemes of differential protection for feeders so far described have required the use of pilot cables. When a feeder is of any length this can be costly and is rarely economical when the line is greater than 15 to 20 miles in length.

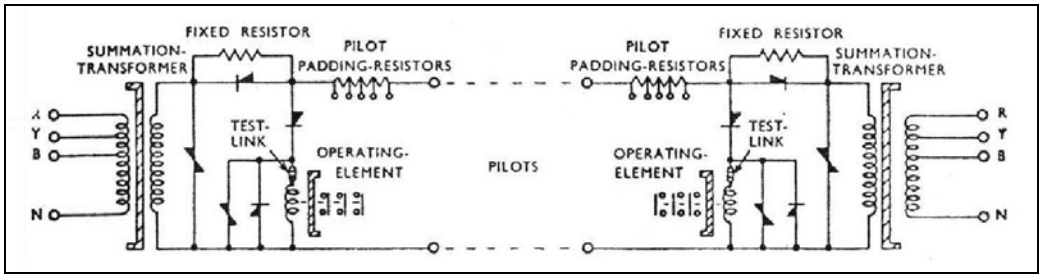


Fig.X.6.-Schematic diagram of complete "Solkor-R" protective system

- It is natural, therefore, that a scheme or schemes should be sought in which discriminating protection is obtained without the use of pilot cables and two such schemes which have been available for a number of years are those known as "Distance" (or "Impedance") and "Carrier Current". The complexity of the modern versions of both is such as to make it impossible to give other than a brief indication of the basic principles.

- **Current Transformer Requirements**
  - The main requisite is that the saturation voltage of the current transformers should not be less than that given by the formula:

$$V_k = \frac{50}{I_n} + \frac{I_F}{N}\left(R_{CT} + 2R_L\right)$$

Where;

I_n = Rated current of Solkor Rf relay.

I_F = Primary current under maximum steady state THROUGH FAULT conditions.

N = Current Transformer ratio.

R_{CT} = Secondary resistance of the current transformer

R_L = Lead resistance between the current transformers and the Solkor R/Rf, per phase.

  - For the above purpose the saturation voltage i.e. the knee point of the magnetising curve, may be taken as that point on the curve at which a 10% increase in output voltage requires 50% increase in magnetising current.
  - To ensure good balance of the protection the current transformers at the two ends should have identical turn ratios. Close balance of the ratio is provided by current transformers to IEC60044: pt1, class px, whose ratio error is limited to ±0.25% and these CT's are recommended to meet the above requirements.
  - It is recommended that no other burdens should be included in the current transformer circuit, but where this cannot be avoided the

additional burden should be added to those listed when determining the current transformer output voltage required.

- In addition to the above, the secondary magnetising currents of the current transformers at different ends of the feeder should normally not differ by more than $I_N/20$ amperes for output voltages up to 50/I Volt where I = rated current of Solkor Rf relay. This criteria is applied to quantify matching of the transient response of the two CT's so that relay operations do not occur due to differing responses of the CT's to normal load switching or the incidence and clearance of out of zone faults. This condition is usually easily satisfied by modern CT's of similar size since the magnetising current is usually a lower value. Care should be taken when applying a new CT to be paired with existing CT and also when interposing CT's are required to match CT ratios.
- The fault current used for the above calculation should be the THROUGH FAULT level. This condition must be considered to ensure that the relay will not be caused to operate for through faults due to secondary differential current being created by the failure of the CT to measure correctly due to core saturation. During a high level internal fault the relay will operate before the saturation effect becomes significant. The THROUGH fault level is often not readily available and may be significantly different to the source Busbar fault level which is commonly quoted incorrectly based on switchgear rating rather than on the actual current level which is limited by system impedances. The remote end fault level will be distorted by any parallel infeed or back-feed and is only equivalent to the through fault level for truly radial systems.

REFERENCES

- Siemens 7PG21 Solkor Rf product technical manual.
- J&P Switchgear book. R.T. Lythall. Newes-Butterworths.

***

SECTION 21

VOLTAGE TRANSFORMERS

21.1 THE FUNCTION OF THE DEVICE IN THE ELECTRICAL SYSTEM

- Voltage transformers are used in the electrification systems as follows:
  - DC substations: Loose standing Voltage transformers is normally installed in the Eskom Yard to provide a supply is received from Eskom for metering as well as ”AC Fail/Available” indication to “Control”.

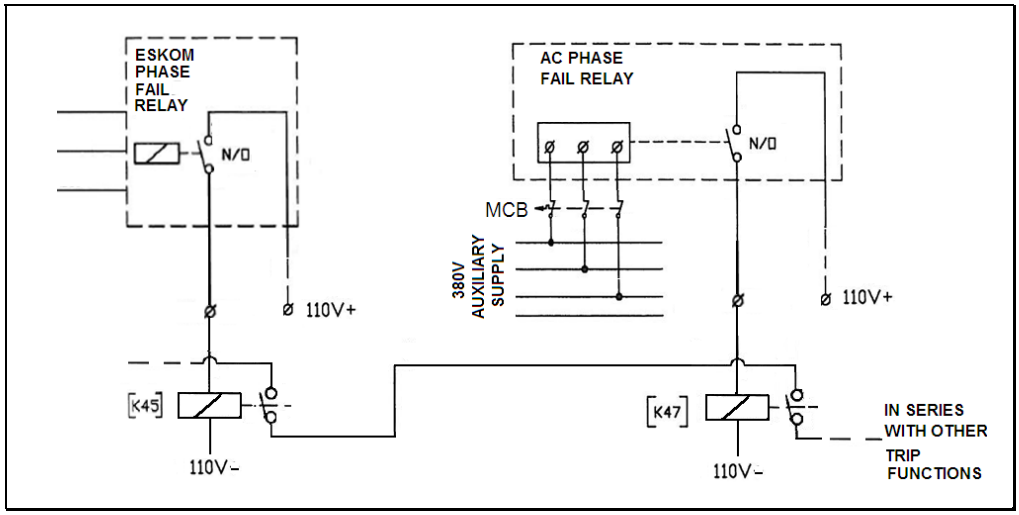
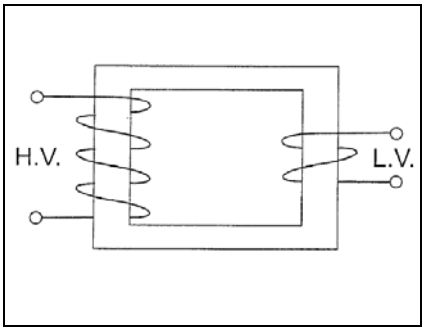


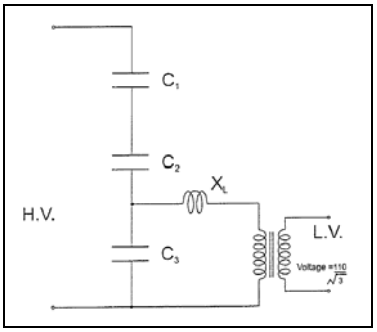
Figure 21.1: VT supply from Eskom VT utilised for “AC Fail/Available” with alternative from auxiliary supply.

  - AC Traction Substations: Loose standing Voltage transformers is normally installed in the Eskom Yard to provide a supply is received from Eskom for metering
  - A VT supply from the secondary LV busbar is used to provide the reference voltage for distance protection as well as ”AC Fail/Available” indication to “Control”.
  - Signal and Distribution Supply Substations: VT’s are used for indicating instruments and phase fail/rotation protection as well as ”AC Fail/Available” indication to “Control”.

21.2 PRINCIPLE OF OPERATION

- Voltage transformers are either of the transformer type or the capacitive type (CVT):





  - Primary voltages can range from 132, 88, 66, 33, 22, 11 and 6.6 kV with secondary normally at 110v. Protection of VT’s is normally HV and LV fuses.

- In distribution substations VT's are normally of the retractable type with the HV fuses located in the HV bushings. Refer to annexure for further study.

21.3 BASIC PRECAUTIONS

- The Eskom VT supply is likely to be earthed, hence this must be considered if this VT supply is used in equipment which is installed in the substation's earthing scheme. An isolation transformer would be required if the earth needs to be connected to an earth leakage circuit in any way.
- All testing to be done under cover of a work-permit.

21.4 TYPES OF THE TEST

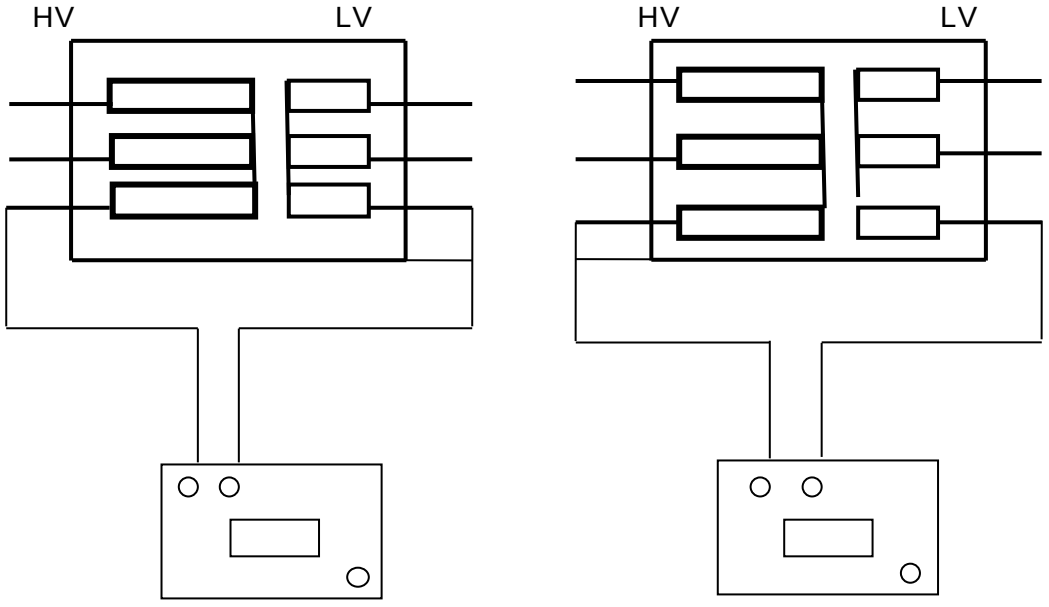
- Insulation test
- Ratio Test
- The above tests are normally done at commissioning and after repairs. During routine tests only operational checks and meter calibrations are required

21.5 TEST EQUIPMENT USED

- Megger 2.5 kV
- Three or single phase supply set
- AC Voltage injection set 0 -150 volts
- Multi-meters
- Set of light leads

21.6 THE TEST CIRCUIT

- **Insulation test**



Megger 2.5 kV

Test HV to LV+E

Megger 2.5 kV

Test LV to HV+E

Figure 21.3: Connections for Insulation test on a 3 phase VT typical in distribution substations

- **Ratio test**

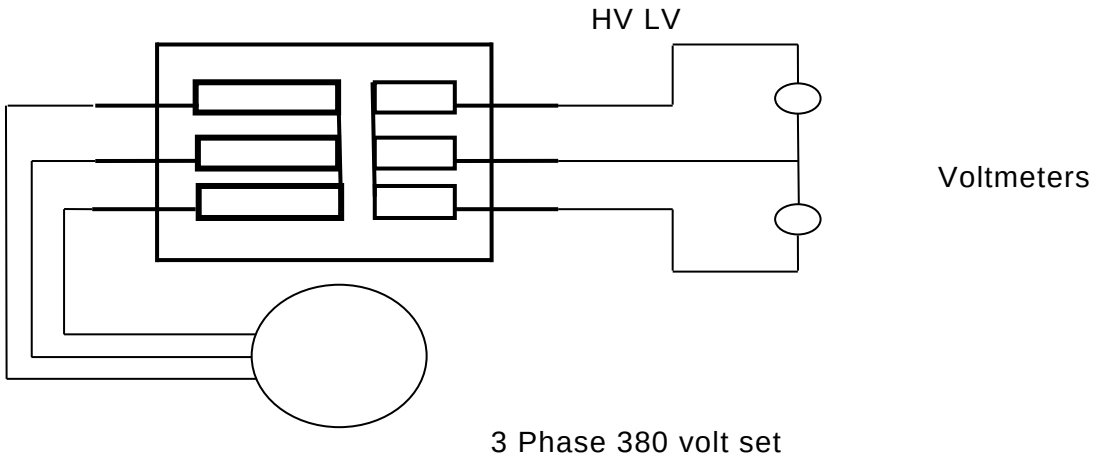


Figure 21.4: Connections for Ratio test on a 3 phase VT typical in distribution substations

21.7 THE TEST PROCEDURE

- **Insulation Test**
  - Connect megger as shown in Figure 21.3
- **Ratio Test**
  - Connect 3 phase supply to HV winding with fuses removed as shown in Figure 21.4 and measure the voltage on the LV between phases and compare with calculated values.

21.8 DOCUMENTATION

- Complete the relevant test sheet

21.9 ACCEPTABLE TEST RESULTS

- Insulation values must conform to 2Mohm per KV standard.
- Ratio: Measured voltages must be within 5 % of calculated values.

21.10 SPECIAL PITFALLS

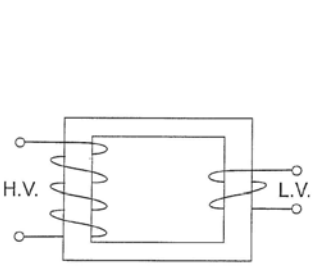
- Short circuits in the LV winding will not rupture the HV fuses in some instance. This will cause low or no readings between phases when operating the selector switch. A ratio test must then be done.

21.11 REFERENCES

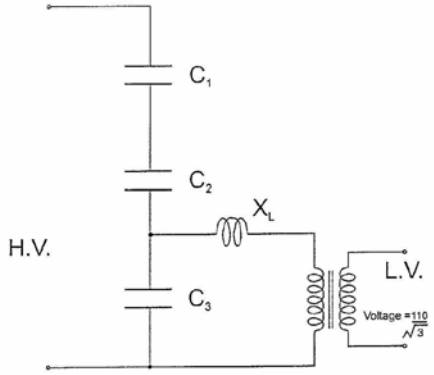
- IEC 60186 voltage transformers

ANNEXURE ON VOLTAGE TRANSFORMERS

- There are two types of voltage transformer used for protection equipment, the purely electro-magnetic type (commonly referred to as a VT) and the Capacitor type (referred to as a CVT). These two types are illustrated schematically as follows:



Electro-Magnetic Type



Capacitor Type VT

- The magnetic voltage transformer is similar to a power transformer and differs only in so far as a different emphasis is placed on cooling, insulating and mechanical aspects.
- The primary winding has a large number of turns and is connected across the line voltage either phase-to-phase or phase-to-neutral.
- The secondary has less turns, consequently as the volts per turn remains constant then less voltage and higher currents are obtained.
- Output burdens of 500 VA per phase are common.
- The capacitor VT is more commonly used on high voltage networks. The capacitor allows the injection of a high frequency signal onto the power line conductors to provide end-to-end communications between substations for distance relays, telemetry/supervisory and voice communications.

Accuracy of Voltage Transformers

- Voltage transformers for protection are required to maintain reasonably accuracy over a large range of voltage from 0 - 173% of nominal. Extreme accuracy, such as would be required for metering, is not necessary for protection. Typical permissible errors as laid down by the IEC 186 are as follows:

Accuracy class, voltage transformers

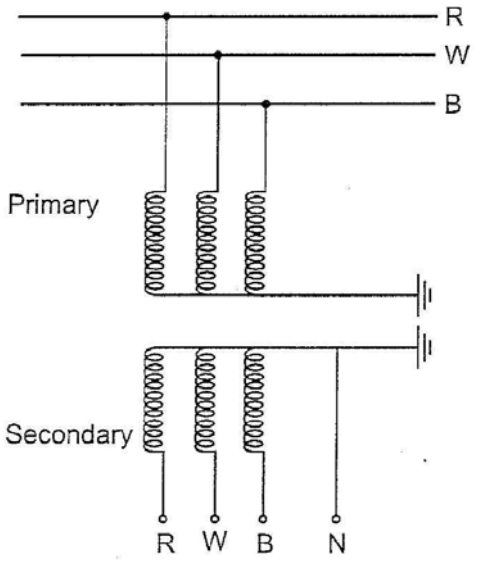
		Range		Limits of errors		
		Burden	Voltage	Ratio	Phase displacement	
Standard	Class	%	%	%	min	Application
IEC 186	0.1	25-100	80-120	0.1	5	Laboratory
	0.2	25-100	80-120	0.2	10	Precision metering, Revenue metering
	0.5	25-100	80-120	0.5	20	Standard revenue metering
	1.0	25-100	80-120	1.0	40	Industrial grade meters
	3.0	25-100	80-120	3.0	-	Instruments
	3P	25-100	5- V_f*)	3.0	120	Protection
	6P	25-100	5- V_f*)	6.0	240	Protection

*) V_f= Voltage factor

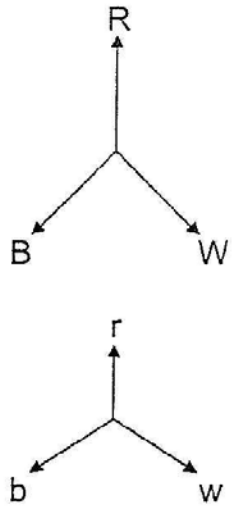
- These accuracies are adequate and easily obtainable.
- Thus apart from ensuring that voltage transformers are not overloaded and that there is not an excessive volt drop in the secondary leads, the question of accuracy of VT's can be ignored and is generally neglected in practice.

Connection of Voltage Transformers

- Electro-magnetic voltage transformers may be connected inter-phase or between phase and earth. Capacitor voltage transformers can only be connected phase-to- earth.
- Voltage transformers are commonly used in 3-phase groups, generally in star-star configuration:

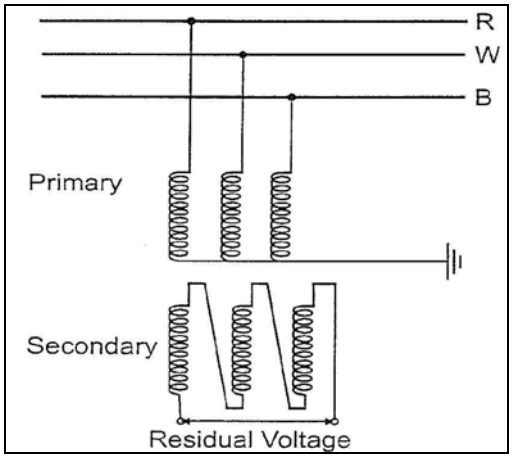


Voltage Transformers connected in star-star configuration.



Vector Diagram for VT'S in star-star configuration

- With this arrangement the secondary voltages provide a complete replica of the primary voltages and any voltage (phase-to-phase or phase-to-earth) may be selected.
- A particular quantity, frequently used in protection is the "residual voltage" which is the vector sum of the three phase voltages. The normal way of obtaining this voltage is as follows:



Connection to source Residual Voltage.

- The residual voltage (neutral displacement voltage, polarising voltage) for earth-fault relays can be obtained from a VT between neutral and earth, for

instance at a power transformer neutral. It can also be obtained from a three-phase set of VTs, which have their primary winding connected phase to earth and one of the secondary windings connected in a broken delta. The Figure below illustrates the measuring principle for the broken delta connecting during an earth-fault in a high-impedance earthed (or unearthed) and an effectively earthed power system respectively.

- From the figure below it can be seen that a solid close-up earth-fault produces an output voltage of $U_{rsd} = U_{5n}$ in a high impedance earthed system, and $U_{rsd} = U_{2n}$ in an effectively earthed system. Therefore a VT secondary normal voltage of;

$$\boxed{U_{2n} = \frac{110}{3} V}$$

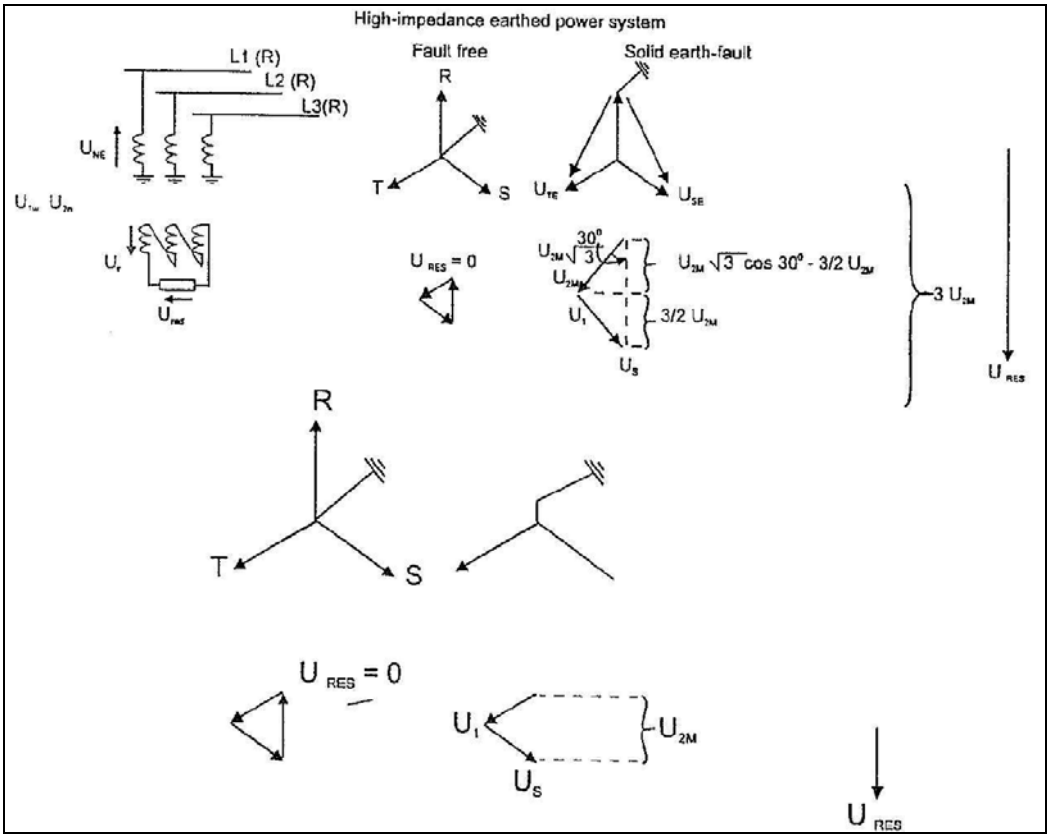
and is often used in high-impedance earthed systems and U_{2n} = 110V in effectively earthed systems. A residual voltage of 110V is the obtained in both cases. VTs with two secondary windings, one for connection in Y and the other in broken delta can then have the ratio;

$$\boxed{\frac{U_n}{V3} / \frac{110}{V3} V / \frac{110}{3} V}$$

and

$$\boxed{\frac{U_n}{V3} / \frac{110}{V3} V / 110V}$$

is used for high impedance and effective earthed systems respectively. Other nominal voltages than 110V e.g. 100V or 115V are also used depending on national standards and practice.



Residual Voltage (neutral displacement voltage) from an open Delta Circuit

- **Ferro-resonance in magnetic voltage transformer**

- When the Ferro-resonance in a CVT is an internal oscillation between the capacitor and the magnetic IVT, the Ferro-resonance in a magnetic voltage transformer is an oscillation between the magnetic voltage transformer and the network. The oscillation can only occur in a network having an insulated neutral. An oscillation can occur between the network's capacitance to ground and the non-linear inductance in the magnetic voltage transformer. The oscillation can be triggered by a sudden change in the network voltage.
- It is difficult to give a general figure of a possible risk of ferro-resonance. It depends on the design of the transformer. We can roughly calculate that there will be a risk of resonance when the zero-sequence capacitance expressed in S km transmission line is

$$S < \frac{42000}{U_n^{\,2}} km$$

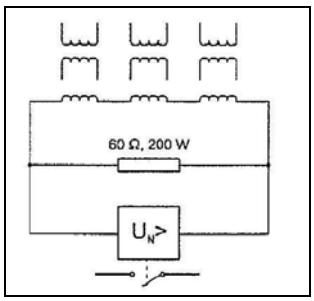
- It is possible to protect a voltage transformer from secondary short-circuit by incorporating fuses in the secondary circuits. High voltage fuses on the primary side will not protect the transformers, they protect only the network. Short-circuit on the secondary windings gives only a few amperes in the primary winding and is not sufficient to rupture a high voltage fuse.
- The voltage drop in the secondary circuit is of importance. The voltage drop in the fuses and long connection wires can change the accuracy of the measurement. It is especially important for revenue metering windings of high accuracy (Class 0.2 and 0.3).
- The total voltage drops in this circuit must not be more than 0.1 percent.

  U_n - System voltage in kV.

  The corresponding value for cable is:

$$S < \frac{1400}{U_n^{\,2}} km$$

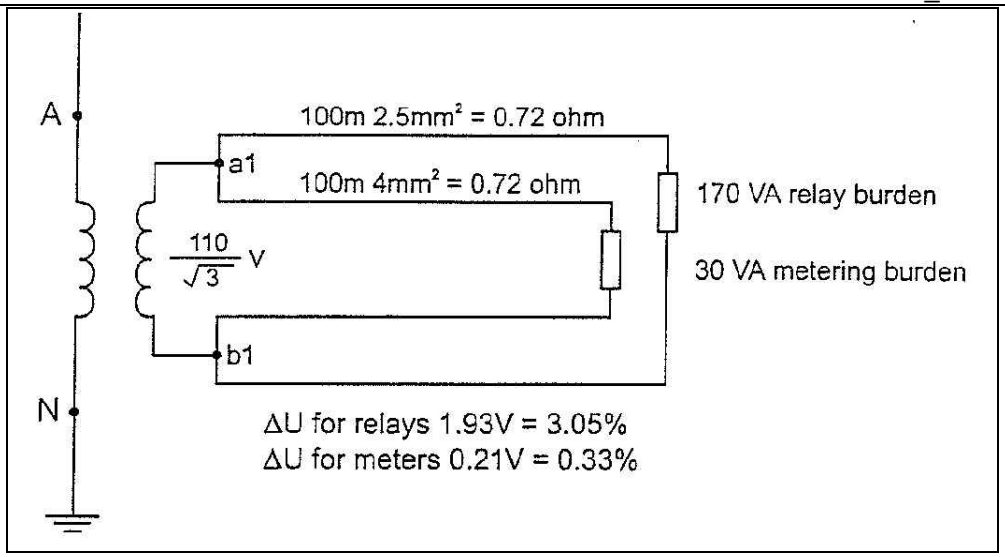
- **Damping of Ferro-resonance**
  - The magnetic voltage transformer will be protected from ferro-resonance oscillation by connecting a resistor across the open delta point in the 3-phase secondary winding! A typical value is 50-60 ohm, 200W.



Resistance in fuses	
Typical values:	
6A	0.048
10A	0.024
16A	0.0076
25A	0.0042

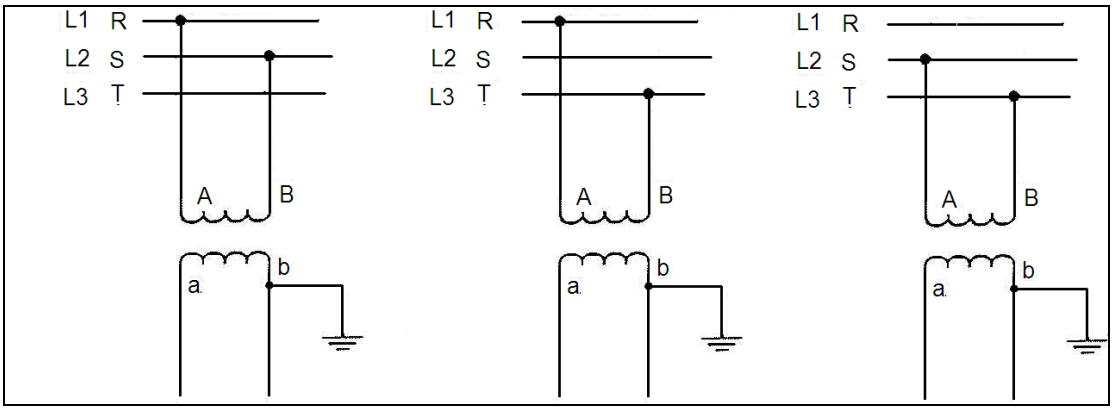
Damping of Ferro-resonance

- 6-10 A is a typical value for safe rupture of the fuses.
- The voltage drop in the leads from the VT to the associated equipment must be considered as this, in practice, can be far from negligible.
- This is where the separation of the metering circuits (with low burden) from protective circuits (with higher burdens) is real.

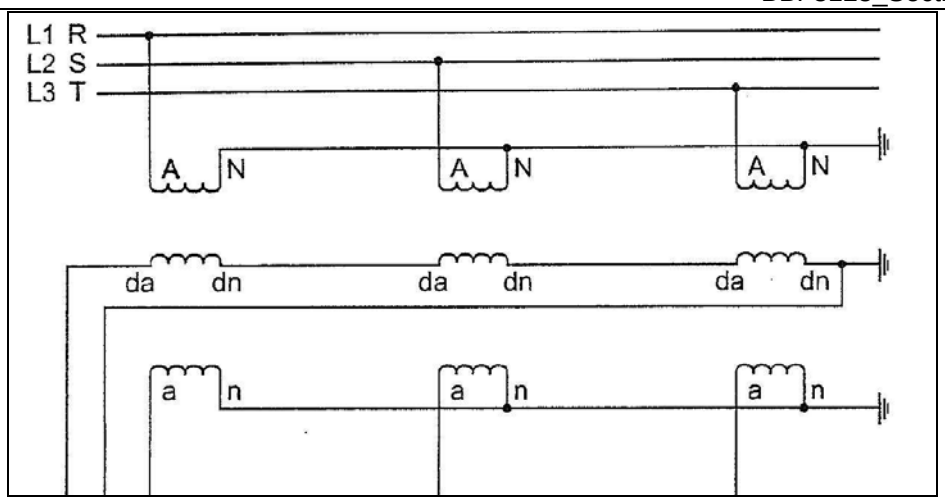


The accuracy of a Voltage Transformer is guaranteed at the Secondary Terminals.

- **Secondary Earthing of Voltage Transformers**
  - To prevent secondary circuits from reaching dangerous potential, the circuits shall be earthed. Earthing shall be made at only one point of a VT secondary circuit or galvanically interconnected circuits.
  - A VT which on the primary is connected phase-to-earth shall have the secondary earthing at terminal n.
  - A VT with the primary winding connected between two phases, shall have that secondary terminal earthed which has a voltage lagging the other terminal by 120 degrees.
  - Windings not used shall be earthed.

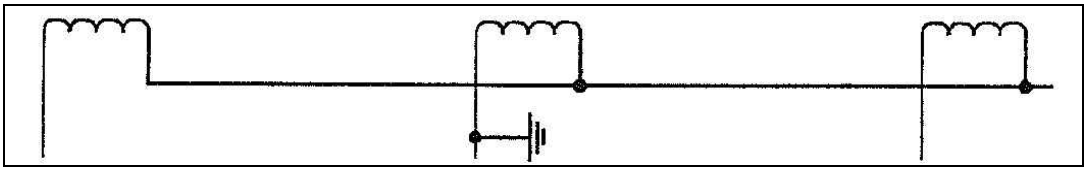


VT's connected between phases.



A set of VT's with one Y-connected and one broken delta secondary circuit.

- Alternatively, it is often common practice to earth the white phase as shown below. This practice stems from Metering where the 2 watt meter method requires 2 CT's and 2 line voltages. With this arrangement the red and blue phases now at line potential to the white and it saves the expense and bother of running a neutral conductor throughout the panels.



VT secondary earthed on white phase

- **REFERENCE**

Les Hewitson Pr. Eng. PSP Training. “Power Protection course Version 3.01 May 1998, Commonwealth English Edition.

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1 April 2025

To Whom It May Concern,

CERTIFICATE OF INSURANCE: TRANSNET (SOC) LIMITED – PRINCIPAL CONTROLLED INSURANCE

In our capacity as Insurance Brokers to the Transnet Group of Companies, we hereby certify that the undermentioned insurances are currently in place:

INSURED:	Transnet (SOC) Limited
PERIOD:	1 April 2025 to 31 March 2026 (Both days inclusive)
DIVISION:	Transnet Freight Rail, Transnet Engineering, Transnet Properties, Transnet Pipelines, Transnet National Ports Authority and Transnet Port Terminals
THE INSURED'S VAT NO:	4720103177
THE INSURED'S COMPANY REGISTRATION NO:	1990/000900/30
POSTAL ADDRESS (Head Office)	Carlton Centre, 150 Commissioner Street, Johannesburg, 2001

CONTRACT WORKS INSURANCE

Cover Provided :	Contract Works - Physical loss or damage to the Property Insured which being materials, plant and other things for incorporation into the permanent works.
Insurer :	Mirabilis (Santam Limited)
Policy Number :	MZAR35023-CAR
The Contract Site :	Any location within the Territorial Limits upon which The Insured Contract is to be executed or carried out as more fully defined in The Insured Contract documents together with so much of the surrounding area as may be required or designated for the performance of The Insured Contract.
Territorial Limits :	The Republic of South Africa.
Additional Co-Insureds:	
The Contractor:	All Contractors undertaking work in connection with The Insured Contract including the Employer to the extent that the Employer undertakes work in connection with The Insured Contract;
Sub-Contractors:	All Sub-Contractors employed by the Contractor and all other Sub- Contractors (whether nominated or otherwise) engaged in fulfilment of The Insured Contract; and to the extent required by any contract or agreement; transporters, suppliers, manufacturers, vendors, other persons, persons providing storage facilities, plant

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owners and/or operators in respect of liability loss or damage arising out of The Insured Contract; project managers, architects, land surveyors, quantity surveyors, engineers and other advisors or consultants or sub-consultants appointed in the performance of the Insured Contract activities arising at the Contract Site provided always that any such person shall not be insured hereunder in respect of liability loss or damage arising out of such person's error or omission in the performance of the professional services for which he was appointed;

Provincial & Government:

any Local Provincial or Government Department with which the Insured enters into any contract or agreement for the performance of The Insured Contract; all for their respective rights and interests.

Insured Contracts :

All Contracts (including any undertaking awarded or commenced prior to Inception of the Period of Insurance) involving design, construction, Performance Testing and Commissioning in respect of the Works and shall Include capital expenditure, upgrade, modification, maintenance or overhaul, refurbishment, renovation, retrofitting or alterations and additions to existing facilities undertaken by the Insured or other Insured Parties acting on their behalf but **excluding;**

a) contracts which at award stage have a value in excess of R 1,000,000,000;

b) contracts with an estimated construction period exceeding 48 months but increasing to 60 months in respect of rail maintenance contracts and Transnet Freight and Rail contracts for logistical support for inline inspections and identification of defects over a 5 year period in respect of Transnet's pipeline assets (excluding Defects Liability/Maintenance period); c) contracts involving construction or erection of petrochemical manufacturing plant(s) but this exclusion shall not apply to pipelines and other associated works undertaken by or on behalf of the Insured;

d) contracts in or on any aircraft;

e) Off-shore contracts;

f) Wet Risk Contracts which at award exceeds R500,000,000;

g) Dam Contracts

h) Tunnel contracts which at award exceeds R50,000,000;

i) Tunnel contracts using tunnel boring machines;

j) Underground Mining Contracts;

k) Horizontal Directional Drilling Contracts which at award exceeds R50,000,000;

l) Horizontal Directional Drilling Contracts where total drilling exceeds 1 km;

m) Horizontal Directional Drilling Contracts for pipe diameters greater than 76 cm.

Definitions

1. *"Off-shore contracts" means all works and installations in the sea or on the seabed including dredging which are accessible only by ship boat barge or helicopter and do not constitute normal wet works like harbours moles bridges wharves or sewage or cooling water intake or outlet facilities. "OffShore Contracts" shall include oilrigs and oil platforms (but not including oil platforms when connected to the land on completion). The term shall not*

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apply to pre-fabrication works on land associated with an Off-Shore Contract.

2 *"Wet Risk Contracts" shall mean any Contract and/or Works where more than thirty-five (35) percentile of its value is in a permanent body of water or is below the high water mark of any tidal body of water. The term shall include contracts for the construction of wharves, piers, marinas, causeways, breakwaters, jetties, dry docks and offshore pipelines when connected directly to on-shore facilities and canal developments. Wet Risks shall exclude Off- Shore Contracts;*

3 *"Dam Contracts", which term shall include weirs and hydroelectric projects involving the construction of dams or weirs;*

4 *"Horizontal Directional Drilling Contracts", means micro-tunnelling work for the construction of tunnels utilising surface based horizontal directional drilling equipment.*

5 *Tunnels" means Tunnels (Including declines) involving all of the following;*
- *(a)* Works below ground level; and
- *(b)* Tunnelling machinery below ground level; and
- *(c)* A tunnelling crew operating the machinery below ground level;
- *(d)* But shall not include Horizontal Directional Drilling Contracts

6 *"Horizontal Directional Drilling Contracts", means micro-tunnelling work for the construction of tunnels utilising surface based horizontal directional drilling equipment.*

7 *"Underground Mining Contracts", which shall mean any contract involving underground mining.*

Testing Period: 120 Days not consecutive.

Maintenance Period : 12 Months

Main Policy Extensions :

- Costs & Expenses - Limited to a maximum of R50,000,000.
- Expediting Measures – Limited to a maximum of R50,000,000.
- Professional Fees In Reinstatement Of Property Insured - Limited to a maximum of R50,000,000.
- Costs & Expenses For Removal Of Debris No Damage - Limited to a maximum of R50,000,000.
- Surrounding Property in care custody or control of the contractor – Limited to a maximum of R55,000,000.
- Fire Brigade & Public Authorities - Limited to a maximum of R10,000,000.
- Public Authority Reinstatement Costs - Limited to a maximum of R20,000,000

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- Public Relationship Costs - Limited to a maximum of R1,000,000. Records - Limited to a maximum of R2,000,000.
- Removal to Gain Access - Limited to a maximum of R20,000,000
- Road Reserve and Servitude Extensions - Limited to a maximum of R10,000,000

- Search & Locate Costs - Limited to a maximum of R20,000,000.
- Borrowing Of Plant For Commissioning Purposes - Limited to a maximum of R10,000,000
- Escalation during Construction – 30%
- Marine Contribution Clause
- Claim Preparation Costs – Limited to a maximum of R10,000,000

Main Policy Exclusions :

- War
- Nuclear Energy Risks
- Terrorism
- Computer Loss General Exception
- DE4 (All types of Works) for defective material workmanship design plan or specification.
- LEG 3 (Mechanical or Electrical Engineering Works only) for defective material workmanship design plan or specification. Limited to maximum of 10% of the total estimated contract value in the aggregate.
- Loss or damage arising during air transit or any ocean voyage or whilst in storage thereafter.
- Occurring during any defects/maintenance period unless cause occurred prior to such defects/maintenance period
- Disappearance or by shortage revealed during routine inventory or periodic stocktaking.
- Consequential loss of whatsoever nature.
- Normal wear and tear, normal atmospheric conditions, rust, erosion, corrosion or oxidisation.
- Due to its own explosion breakdown or derangement occurring after the Testing Period which has operated under load conditions.
- Second hand property due to its own electrical or mechanical breakdown or explosion.
- Cyber and Data
- Beneficial Occupation – 12 months
- Risk Mitigation – Safety Measures with Respect to Precipitation, Flood and Inundation – 10 years return period

Deductibles:

In respect of loss or damage:

Major Perils shall mean damage caused by storm, rain, tempest, wind, flood, theft, malicious damage, subsidence, collapse, earthquake, testing or commissioning and

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the consequences of defective design, specification, materials or workmanship (DE4).

Minor Perils shall mean damage caused by a peril not defined as Major Perils defined above.

Contracts with a contract value :	Major perils	Minor perils
0 to R100,000,000	R25,000	R15,000
R100,000,001 to R250,000,000	R50,000	R15,000
R250,000,001 to R500,000,000	R100,000	R25,000
R500,000,001 to R1,000,000,000	R150,000	R25,000

Minimum wet risk deductible of R100,000 per occurrence to apply.

Electrical Cables, Wiring and Accessories 10% of claim minimum R100,000

LEG 3 Deductible (Only in respect of Mechanical and Electrical contracts);

Contracts with a contract value	Deductible
0 to R500,000,000	R1,000,000 per occurrence
R500,000,001 to R1,000,000,000	R1,500,000 per occurrence

PUBLIC LIABILITY

Cover Provided : Contract Works Public Liability – cover the Insured's legal liability in respect of loss or damage or injury to third parties arising out of work performed in respect of the Insured Contracts.

Insurer : Stalker Hutchinson (Santam Limited)

Policy Number: 6000/132335

Territorial Limits : The Republic of South Africa.

Insured Contracts: All contracts (including any undertaking awarded or commenced prior to inception of the period of Insurance) involving design, construction, performance testing and commissioning in respect of the works and shall include capital expenditure, upgrade, modification, maintenance or overhaul, refurbishment, renovation, retrofitting or alterations and additions to existing facilities undertaken by the Insured or other Insured Parties acting on their behalf but **Excluding**:

a) Contracts which at award stage have a value in excess of R 1,000,000,000.
b) Contracts with an estimated construction period at award exceeding 48 months but 60 months in respect of contracts awarded prior to 1 April 2020 for rail maintenance contracts For Transnet Freight & Rail and for Transnet Pipeline's logistical support for inline inspections and identification of defects in respect of Transnet's pipeline assets (all excluding Defects Liability/Maintenance period).

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c) Contracts with a Contractual Defects Liability Maintenance Period exceeding 24 months.

d) Contracts involving construction or erection of petrochemical manufacturing plant(s) but this exclusion shall not apply to pipelines and other associated works undertaken by or on behalf of the Insured.

e) Contracts in or on any aircraft.

f) Off-shore contracts - “Off-shore contracts” means all works and installations in the sea or on the seabed and do not constitute normal Wet Risk Contracts like harbours, moles, bridges, wharves or sewage or cooling water intake or outlet facilities, piers, marinas, causeways, breakwaters, jetties, dry docks and offshore pipelines when connected directly to onshore facilities and canal developments. "Off-Shore contracts" shall include oilrigs and oil platforms.

Policy Limits:

Contractors Public Liability	R100,000,000 any one occurrence / unlimited during the Period of Insurance
Contractors Negligent Removal or weakening of Support	R100 000 000 any one occurrence and R100,000,000 per site in the aggregate during the Period of Insurance.
Statutory Legal Defence Costs	*R5 000 000 in the aggregate during the Period of Insurance.
Arrest / Assault / Defamation	*R5 000 000 in the aggregate during the Period of Insurance.
Prevention of Access	*R5 000 000 in the aggregate during the Period of Insurance.
Trespass / Nuisance	*R5 000 000 in the aggregate during the Period of Insurance.
Claims Preparation Costs	R5 000 000 any one occurrence

*Where the limits are noted as in the aggregate during the policy period of insurance, that such aggregated limit is applicable to all Transnet Insured Contracts collectively and in total and does not apply to each contract separately.

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Deductible(s) : R50,000 per occurrence but increased to R5,000,000 in respect of Spread of Fire and/or Hot Works and R250,000 in respect of Sudden and Accidental Pollution and/or Goods on the Hook and/or R150,000 in respect of Developers Removal of Support.

General Policy Exclusions :

The policy does not cover:-

- deliberate, conscious and intentional disregard to take reasonable precautions. fines, penalties, punitive and exemplary damages.
- Pollution unless caused by a sudden, unintended and unexpected occurrence.
- cost of removing, nullifying or cleaning up the effects of pollution unless caused by a sudden, unintended and unexpected occurrence.
- the hazardous nature of asbestos.
- War And Terrorism Risks.
- Nuclear Risks.
- Actual or alleged unlawful competition, unfair practices, abuse of monopoly power, cartel activities

- Compulsory Insurance
- Loss or damage and any consequence therefrom to any Data. •
- Sanctions Exclusion Grid Failure

PROFESSIONAL INDEMNITY

Cover Provided : Professional Indemnity

a) In respect of damages which the Insured shall become legally liable to pay in consequence of neglect, error or omission by or on behalf of the Insured in the conduct or execution of their Professional Activities and Duties as defined.

b) Prior To Handover/Rectification - against loss arising out of any defect in the works discovered prior to the issue of any practical completion or take-over certificate provided that any such defects are caused by a negligent breach of a Professional Activity or Duty by the Insured in consequence of neglect, error or omission by or on behalf of the Insured.

Insurer : Stalker Hutchinson (Santam Limited)

Policy Number: 6000/132337

Jurisdiction : Worldwide excluding North America

Insured Contracts: All contracts (including any undertaking awarded or commenced prior to inception of the period of Insurance) involving design, construction, performance testing and commissioning in respect of the works and shall include capital expenditure, upgrade, modification, maintenance or overhaul, refurbishment, renovation,

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retrofitting or alterations and additions to existing facilities undertaken by the Insured or other Insured Parties acting on their behalf but **Excluding**:

a) Contracts which at award stage have a value in excess of R 1,000,000,000.
b) Contracts with an estimated construction period at award exceeding 48 months (excluding Defects Liability/Maintenance period).
c) Contracts with a Contractual Defects Liability Maintenance Period exceeding 24 months.
d) Contracts involving construction or erection of petrochemical manufacturing plant(s) but this exclusion shall not apply to pipelines and other associated works undertaken by or on behalf of the Insured.
e) Contracts in or on any aircraft.
f) Off-shore contracts - "Off-shore contracts" means all works and installations in the sea or on the seabed and do not constitute normal Wet Risk Contracts like harbours, moles, bridges, wharves or sewage or cooling water intake or outlet facilities, piers, marinas, causeways, breakwaters, jetties, dry docks and offshore pipelines when connected directly to onshore facilities and canal developments. "Off-Shore contracts" shall include oilrigs and oil platforms.

Limit Of Indemnity:

Professional Indemnity - *R100,000,000 in the aggregate during the policy period of insurance.

*Where the limit is noted as in the aggregate during the policy period of insurance, that such aggregated limit is applicable to all Transnet Insured Contracts collectively and in total and does not apply to each contract separately.

Policy Extension Limits Of Indemnity:

Claims Preparation Costs - *R7,500,000 in the aggregate during the policy period of insurance.

Loss of Documents - *R2,000,000 in the aggregate during the policy period of insurance.

Statutory Defence Costs - *R5,000,000 in the aggregate during the policy period of insurance.

Defamation - *R5,000,000 in the aggregate during the policy period of insurance.

Infringement of Copyright - *R5,000,000 in the aggregate during the policy period of insurance.

*Where the limits are noted as in the aggregate during the policy period of insurance, that such aggregated limit is applicable to all Transnet Insured Contracts collectively and in total and does not apply to each contract separately.

Deductibles:

R5,000,000 each and every but R10,000 in respect of Claims Preparation Costs, Loss of Documents, Statutory Defence Costs, Defamation and Infringement Of Copyright.

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Policy Special Conditions :

Condition precedent to liability that the Insured is fully qualified and registered with the relevant Industry Body/Association in terms of legislation as applicable.

Prior to hand over/rectification – the insured must give prior written notice to the Insurers of the intention to take remedial action to rectify such defect and obtain the Insurers' written agreement to such action being taken and the costs and expenses expected to be expended.

Policy Main Exclusions:

- Excludes all consequential loss other than cost of re-design, rectification and replacement as a consequence of the defect.
- Excludes Supervision.
- Excludes liability arising out of environmental impairment / pollution
- Excludes the cost of removing, nullifying or cleaning-up the effects of environmental impairment/ pollution.
- Excludes war, invasion, acts of foreign enemies, hostilities or warlike operations (whether war be declared or not), civil war, rebellion, revolution, insurrection, civil commotion assuming the proportions of or amounting to an uprising, military or usurped power, any act of terrorism and nuclear risks.
- Excludes fines, penalties, punitive and exemplary damages, multiplication of compensatory damages and/or any other noncompensating damages of any kind.
- Excludes liability from the hazardous nature of asbestos.
- Excludes medical malpractice.
- Excludes failure to meet contractual requirements relating to efficiency, output or durability.
- Excludes failure to meet completion dates
- Excludes the estimation of probable costs other than cost advice and cost planning services normally provided by a Quantity Surveyor or Project manager.
- Excludes incorrect authorisation of payment.
- Excludes breach of any statutory regulation.
- Excludes liability from the insolvency, liquidation or judicial management of the Insured.
- Excludes the certification of value of work executed by any contractor where the Insured has an equity interest in such contractor;
- Excludes liability due to unlawful competition, unfair practices, abuse of monopoly power, cartel activities or breach of a competitions ac
- Sanctions Exclusion
- Grid Failure

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This certificate of the insurance cover arranged is issued as a matter of information only and confers no rights upon the certificate holder. This certificate does not amend, extend or alter the coverage afforded by the policies issued by Insurers.

Langa Sigodi

Account Executive: Corporate and Global Markets

Authorised Financial Services Provider
Registration in South Africa Number 2013/150155/07
Authorized FSP Licence Number 44889