

Transnet Freight RAIL

an Operating Division of **TRANSNET SOC LTD**

[hereinafter referred to as **Transnet**]

Registration Number 1990/000900/30

REQUEST FOR QUOTATION [RFQ] No WRAC/KBC/39155

[TFR/2023/02/0003/22274/RFQ]

**FOR THE PROVISION OF: SERVICE FOR OIL REGENERATION, OIL PURIFICATION AND OIL
SAMPLING AT VARIOUS 3KV DC TRACTION SUBSTATIONS**

FOR A PERIOD OF: ONCE OFF

ISSUE DATE: 14 February 2023

CLOSING DATE: 28 February 2023

CLOSING TIME: 10:00 AM

Note to the bidders:

Bidders 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 Bidder can upload 30mb per upload and multiple uploads are permitted.

SECTION 1: SBD1 FORM

PART A

INVITATION TO BID

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF TRANSNET FREIGHT RAIL, A DIVISION TRANSNET SOC LTD							
BID NUMBER:	WRAC/ KBC / 39155 TFR/2023/02/0003/22274/RFQ	ISSUE DATE:	14/02/2023	CLOSING DATE:	28/02/2023	CLOSING TIME:	10:00 am
DESCRIPTION	FOR THE PROVISION OF SERVICE FOR OIL REGENERATION, OIL PURIFICATION AND OIL SAMPLING AT VARIOUS 3KV DC TRACTION SUBSTATIONS						
BID RESPONSE DOCUMENTS 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.							
RESPONDENTS ARE TO UPLOAD THEIR BID RESPONSE PROPOSALS ONTO THE TRANSNET SYSTEM AGAINST EACH TENDER/RFQ SELECTED.							
The Transnet e-Tender Submission Portal can be accessed as follows:							
<ul style="list-style-type: none"> Log on to the Transnet eTenders management platform website/Portal (transnetetenders.azurewebsites.net) (please use Google Chrome to access Transnet link/site free of charge); 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. No late submissions will be accepted. The bidder guide can be found on the Transnet Portal transnetetenders.azurewebsites.net 							
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO				TECHNICAL ENQUIRIES MAY BE DIRECTED TO:			
CONTACT PERSON	Leonie Visagie			CONTACT PERSON	Chris van Vuuren		
TELEPHONE NUMBER	(053) 838 3119			TELEPHONE NUMBER	(051) 408 2206		
FACSIMILE NUMBER				FACSIMILE NUMBER	(011) 774 9784		
E-MAIL ADDRESS	Leonie.Visagie@Transnet.net			E-MAIL ADDRESS	Chris.vanVuuren@Transnet.net		
SUPPLIER INFORMATION							
NAME OF BIDDER							
POSTAL ADDRESS							
STREET ADDRESS							
TELEPHONE NUMBER	CODE			NUMBER			
CELLPHONE NUMBER							
FACSIMILE NUMBER	CODE			NUMBER			
E-MAIL ADDRESS							
VAT REGISTRATION NUMBER							
SUPPLIER COMPLIANCE STATUS	TAX COMPLIANCE SYSTEM PIN:			OR	CENTRAL SUPPLIER DATABASE	UNIQUE REGISTRATION REFERENCE NUMBER: MAAA	

B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE	TICK APPLICABLE BOX] <input type="checkbox"/> Yes <input type="checkbox"/> No	B-BBEE STATUS LEVEL SWORN AFFIDAVIT	[TICK APPLICABLE BOX] <input type="checkbox"/> Yes <input type="checkbox"/> No
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[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT MUST BE SUBMITTED FOR PURPOSES OF COMPLIANCE WITH THE B-BBEE ACT]

1 ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED? <input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES ENCLOSE PROOF]	2 ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED? <input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES, ANSWER QUESTIONNAIRE BELOW]
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QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)? ☐ YES ☐ NO

DOES THE ENTITY HAVE A BRANCH IN THE RSA? ☐ YES ☐ NO

DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA? ☐ YES ☐ NO

DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA? ☐ YES ☐ NO

IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION? ☐ YES ☐ NO

IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 1.3 BELOW.

PART B TERMS AND CONDITIONS FOR BIDDING

1. TAX COMPLIANCE REQUIREMENTS

- 1.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
- 1.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VERIFY THE TAXPAYER'S PROFILE AND TAX STATUS.
- 1.3 APPLICATION FOR TAX COMPLIANCE STATUS (TCS) PIN MAY BE MADE VIA E-FILING THROUGH THE SARS WEBSITE WWW.SARS.GOV.ZA.
- 1.4 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
- 1.5 IN BIDS WHERE UNINCORPORATED CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 1.6 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

NB: FAILURE TO PROVIDE / OR COMPLY WITH ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

SIGNATURE OF BIDDER:

.....

CAPACITY UNDER WHICH THIS BID IS SIGNED:

.....

(Proof of authority must be submitted e.g. company resolution)

DATE: _____

SECTION 2: NOTICE TO BIDDERS

1 Responses to RFQ

Responses to this RFQ [**Quotations**] must not include documents or reference relating to any other quotation or proposal. Any additional conditions must be embodied in an accompanying letter.

2 Formal Briefing

A compulsory pre-proposal RFQ briefing will be conducted at **Property Management Board room, 1 Austen Street, Kimberley on the 23 February 2023, at 11:00**, for a period of \pm 1hour. [Respondents to provide own transportation and accommodation]. The briefing session will start punctually and information will not be repeated for the benefit of Respondents arriving late.

- 2.1 *A Certificate of Attendance in the form set out in Section 8 hereto must be completed and submitted with your Proposal as proof of attendance is required for a **compulsory** site meeting and/or RFQ briefing.*
- 2.2 Respondents failing to attend the compulsory RFQ briefing will be disqualified.
- 2.3 Bidders are required to confirm their attendance and to send their contact details including the number of representatives (where applicable) to the following address: **Chris.vanVuuren@Transnet.net**. This is to ensure that Transnet may make the necessary arrangements for the briefing session.

3 Communication

- 3.1 Specific queries relating to this RFQ before the closing date of the RFQ should be submitted onto the system and to **Chris.vanVuuren@Transnet.net** before **12:00 pm on 27/02/2023**. In the interest of fairness and transparency Transnet's response to such a query will then be made available to other bidders.
- 3.2 It is prohibited for Respondents to attempt, either directly or indirectly, to canvass any officer or employee of Transnet in respect of this RFQ between the closing date and the date of the award of the business.
- 3.3 Respondents found to be in collusion with one another will be automatically disqualified and restricted from doing business with organs of state for a specified period.
- 3.4 Respondents may also, at any time after the closing date of the RFQ, communicate with the **Leonie Visagie** on any matter relating to its RFQ response:

Email: Leonie.Visagie@Transnet.net

- 3.5 All unsuccessful bidders have a right to request Transnet to furnish individual reasons for their bid not being successful. This requested must be directed to the contact person stated in the SBD 1 form

4 Legal Compliance

The successful Respondent shall be in full and complete compliance with any and all applicable national and local laws and regulations.

5 Employment Equity Act

Respondents must comply with the requirements of the Employment Equity Act 55 of 1998 applicable to it including (but not limited to) Section 53 of the Employment Equity Act.

6 Changes to Quotations

Changes by the Respondent to its submission will not be considered after the closing date and time.

7 Binding Offer

Any Quotation furnished pursuant to this Request shall be deemed to be an offer. Any exceptions to this statement must be clearly and specifically indicated.

8 Disclaimers

8.1 Respondents are hereby advised that Transnet is not committed to any course of action as a result of its issuance of this RFQ and/or its receipt of a Quotation in response to it. Please note that Transnet reserves the right to:

- modify the RFQ's goods / service(s) and request Respondents to re-bid on any changes;
- reject any Quotation which does not conform to instructions and specifications which are detailed herein;
- disqualify Quotations submitted after the stated submission deadline;
- not necessarily accept the lowest priced Quotation or an alternative bid;
- place an order in connection with this Quotation at any time after the RFQ's closing date;
- award only a portion of the proposed goods / services which are reflected in the scope of this RFQ;
- split the award of the order/s between more than one Supplier/Service Provider should it at Transnet's discretion be more advantageous in terms of, amongst others, cost or developmental considerations;
- cancel the quotation process;
- validate any information submitted by Respondents in response to this bid. This would include, but is not limited to, requesting the Respondents to provide supporting evidence. By submitting a bid, Respondents hereby irrevocably grant the necessary consent to Transnet to do so;
- request audited financial statements or other documentation for the purposes of a due diligence exercise;
- not accept any changes or purported changes by the Respondent to the bid rates after the closing date and/or after the award of the business, unless the contract specifically provides for it;
- to cancel the contract and/request that National Treasury place the Respondent on its Database of Restricted Suppliers for a period not exceeding 10 years, on the basis that a contract was awarded on the strength of incorrect information furnished by the Respondent or on any other basis recognised in law;
- award the business to the next ranked bidder, provided that he/she is still prepared to provide the required Goods/Services at the quoted price, should the preferred bidder fail to sign or commence with the contract within a reasonable period after being requested to do so. Under such circumstances, the validity of the bids of the next ranked bidder(s) will be deemed to remain valid, irrespective of whether the next ranked bidder(s) were notified of their bid being unsuccessful. Bidders may therefore be requested to advise whether they would still be prepared to provide the required Goods/Services at their quoted price.

9 Specification/Scope of Work

Refer to Page 30 for Scope of Works

10 Legal review

A Proposal submitted by a Respondent will be subjected to review and acceptance or rejection of its proposed contractual terms and conditions by Transnet's Legal Counsel, prior to consideration for an award of business.

11 Security clearance

Acceptance of this bid could be subject to the condition that the Successful Respondent, its personnel providing the goods and its subcontractor(s) must obtain security clearance from the appropriate authorities to the level of CONFIDENTIAL/ SECRET/TOP SECRET. Obtaining the required clearance is the responsibility of the Successful Respondent. Acceptance of the bid is also subject to the condition that the Successful Respondent will implement all such security measures as the safe performance of the contract may require.

12 National Treasury's Central Supplier Database

Respondents 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. Transnet is required to ensure that price quotations are invited and accepted from prospective bidders listed on the CSD. Business may not be awarded to a respondent who has failed to register on the CSD. Only foreign suppliers with no local registered entity need not register on the CSD. The CSD can be accessed at <https://secure.csd.gov.za/>.

For this purpose, the attached SBD 1 Form must be completed and submitted as a mandatory returnable document by the closing date and time of the bid.

13 Tax Compliance

Respondents must be compliant when submitting a proposal to Transnet and remain compliant for the entire contract term with all applicable tax legislation, including but not limited to the Income Tax Act, 1962 (Act No. 58 of 1962) and Value Added Tax Act, 1991 (Act No. 89 of 1991).

It is a condition of this bid that the tax matters of the successful Respondents be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the Respondents tax obligations.

The Tax Compliance status requirements are also applicable to foreign Respondents/ individuals who wish to submit bids.

Where Consortia / Joint Ventures / Sub-contractors are involved, each party must be registered on the Central Supplier Database and their tax compliance status will be verified through the Central Supplier Database.


Transnet urges its clients, suppliers and the general public to report any fraud or corruption to

TIP-OFFS ANONYMOUS:



Ethics Helpdesk (Pty) Ltd
Ethics Management Systems™


You can choose to be Anonymous or Non-Anonymous on ANY of the platforms
PLEASE RETAIN YOUR REFERENCE NUMBER



AI Voice Bot "Jack"
Speak to our AI Voice Chat Bot "JACK", you converse with him like chatting to a human, with the option to record a message and speak to an agent at anytime.



What's App
Speak to an Agent via What's App.




Speak to an Agent
Speak to an Agent via the platform with no call or data charge



Telegram
Speak to an Agent via Telegram




0800 003 056



086 551 4153



reportit@ethicshelpdesk.com



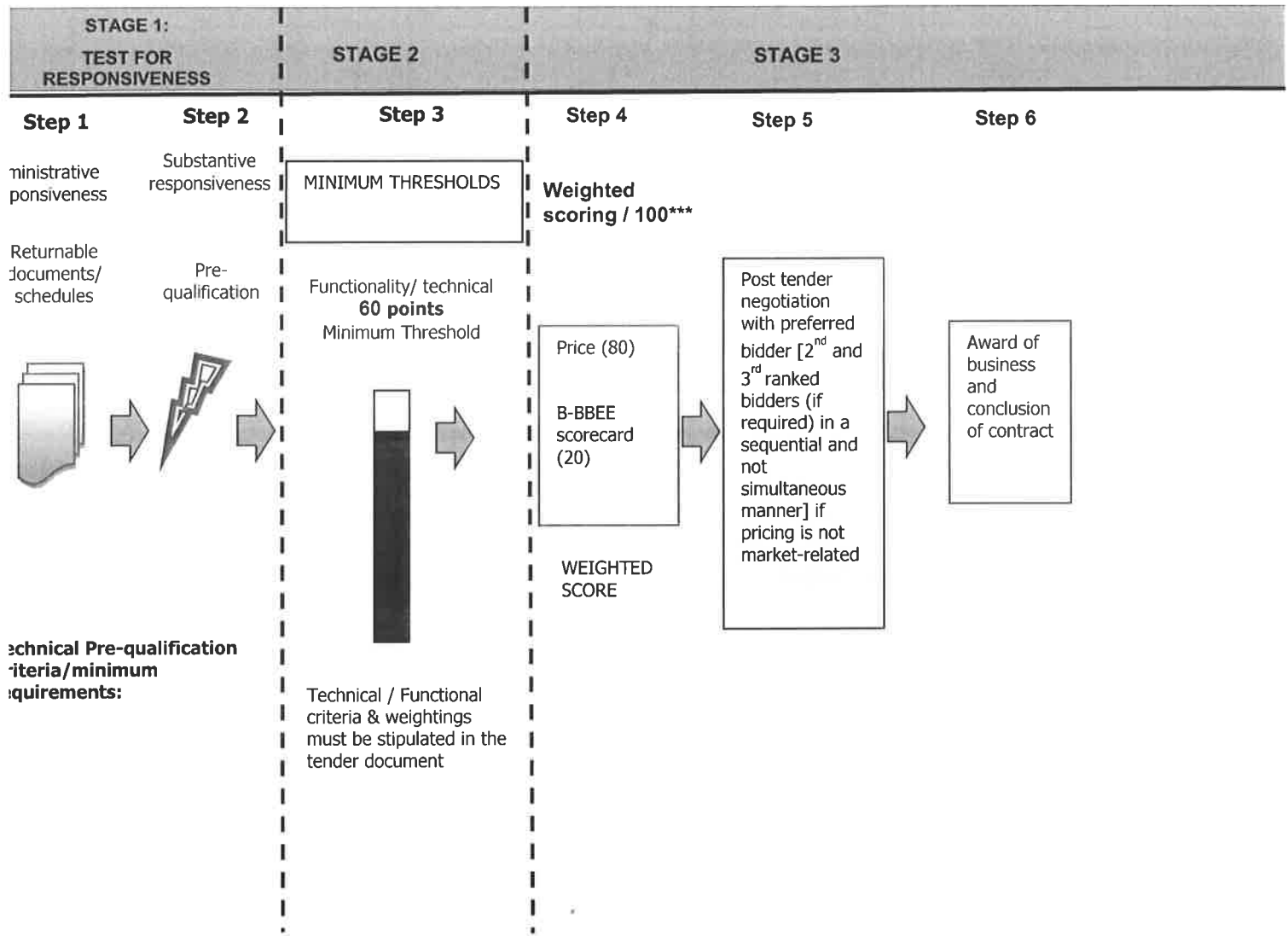
*120*0785980808#

WRAC/KBC/39155 [TFR/2023/02/0003/22274/RFQ]

SECTION 3 EVALUATION METHODOLOGY, CRITERIA AND RETURNABLE DOCUMENTS

1 Evaluation Criteria [Indicate appropriate criteria - remove / add where necessary]

Transnet will utilise the following methodology and criteria in selecting a preferred Supplier/Service provider:



1.1 STEP ONE: Test for Administrative Responsiveness

The test for administrative responsiveness will include the following:

Administrative responsiveness check	RFQ Reference
• Whether the Bid has been lodged on time	
• Whether all Returnable Documents and/or schedules [where applicable] were completed and returned by the closing date and time	Section 3
• Verify the validity of all returnable documents	Section 3
• Verify if the Bid document has been duly signed by the authorised respondent	All sections

The test for administrative responsiveness [Step One] must be passed for a Respondent's Proposal to progress to Step Two for further pre-qualification

1.2 STEP TWO: Test for Substantive Responsiveness to RFQ

The test for substantive responsiveness to this RFQ will include the following:

Check for substantive responsiveness	RFQ Reference
• Whether any general and legislation qualification criteria (excluding preferential procurement) set by Transnet, have been met	<i>All sections</i>
• Whether the Bid contains a priced offer	<i>Section 4 - Quotation Form</i>
• Whether the Bid materially complies with the scope and/or specification given	<i>All Sections</i>

The test for substantive responsiveness [Step Two] must be passed for a Respondent's proposal to progress to Step Three for further evaluation

1.3 STEP THREE: Minimum Threshold 60 points for Technical Criteria

The test for the Technical and Functional threshold will include the following:

Technical Evaluation Criteria	Points Weightings	Scoring guideline
• Previous Experience	60	(0, 1, 2, 3, 4, 5)
• CV of relevant Personnel	20	(0, 1, 2, 3, 4, 5)
• Method Statement	10	(0, 1, 2, 3, 4, 5)
• Health and Safety	10	(0, 1, 2, 3, 4, 5)
Total Weighting:	100	
Minimum qualifying score required:	60	

The following Technical Evaluation Criteria will apply:

1. Previous Experience (Weight 60 %)

Proof of completion (certificates) of relevant project .Providing details of company, type of work completed and contactable references relevant to this RFQ	
Score	Criteria
5	Submitted at least 5 or more completed similar projects
4	Submitted at least 4 completed similar projects
3	Submitted at least 3 completed similar projects
2	Submitted at least 2 completed similar projects
1	Submitted at least 1 completed similar project
0	Submitted 0 completed projects or no valid proof of previous projects

2. Key Persons CV and Experience (Weight 20 %)

2. Key Persons CV and Experience

Submit the following documents as a minimum with your tender document:

1. An organisation chart showing on-site and off-site management (including the key people you have identified in the Contract Data Part two and identify the required legal appointments.)
2. CV's for people proposed for all identified posts including Safety Officer and Project Manager / Quality Assurance Representative.
3. Details of the location (and functions) of offices from which the works will be managed.
4. Details of the experience of the staff who will be working on the works with respect to:
5. An explanation of how you propose to allocate adequate resources to enable you to comply with the requirements and prohibitions imposed on you by or under the statutory provisions relating to health and safety.

Key Persons CV and Experience (Weight 20 %)	
Criteria	Score
5 of the items as per above	5
4 of the items as per above	4
3 of the items as per above	3
2 of the items as per above	2
1 of the item as per above	1
No items addressed as per above items	0

3. Method Statement (Weight 10 %)

Evaluation Schedule: 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 for the **OIL REGENERATION, OIL PURIFICATION AND OIL SAMPLING**
-

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 *Works*.
- Indication of how the above will be achieved in terms of the associated policies and procedures, and relevant specification described in the tender.

Please note: Tenderers are required to provide detailed method statements for the categories as listed above. Each sub-category as listed will be scored based on the linear scale below, and will be averaged and weighed to provide a final score. Tenderers to note that they will not achieve an "acceptable" score should they not

provide the information as required in this Returnable.

The table below will be used as guidelines for scoring / evaluating the method statement submitted by the Tenderer:

Score 0	The tenderer has submitted no information or inadequate information to determine a score.
Score 1	The methodology/approach and work alignment to project schedule is poorly presented, generic and not tailored to address the specific project objectives and methodology.
Score 2	The methodology/approach is generic and not tailored to address the specific project objectives and methodology. The methodology approach does not adequately deal with the critical characteristics of the project.
Score 3	Satisfactory response/solution to the particular aspect of the requirement and evidence given that the stated employer's requirements will be met.
Score 4	The methodology/approach is specifically tailored to address the specific project objectives and methodology and is sufficiently flexible to accommodate changes that may occur during execution. The methodology/approach to manage activities is specifically tailored to the critical characteristics of the project.
Score 5	Besides meeting the "80" rating, the important issues are approached in an innovative and efficient way, indicating that the tenderer has outstanding knowledge of state-of-the-art approaches. The methodology approach details ways to improve the project outcomes and the quality of the outputs.

4 Health and Safety Plan (Weight 10 %)

Submit the following documents as a minimum with your tender:

1. Valid letter of good standing with insurance body.
2. A safety plan to be submitted in accordance with the OHSA 1993 and Transnet Freight Rail's health and Safety Specification TFR-ISM-RN-R&C-FM009
3. Risk assessment
4. Safety File (Index)
5. Safety Work Method Statement

Health and Safety Plan – (Weight 20 %)

Criteria	Score
5 of the items as per above	5
4 of the items as per above	4
3 of the items as per above	3
2 of the items as per above	2
1 of the item as per above	1
No items addressed as per above items	0

Respondents are to note that Transnet will round off final technical scores to the nearest 2 (two) decimal places for the purposes of determining whether the technical threshold has been met.

The minimum threshold for technical/functionality [Step Three] must be met or exceeded for a Respondent's Proposal to progress to Step Four for final evaluation

1.4 STEP FOUR: Evaluation and Final Weighted Scoring

a) Price Criteria [Weighted score 80 points]:

Evaluation Criteria	RFP Reference
• Commercial offer	Section 4

Transnet will utilise the following formula in its evaluation of Price:

$$PS = 80 \left(1 - \frac{Pt - Pmin}{Pmin} \right)$$

Where:

- Ps = Score for the Bid under consideration
 Pt = Price of Bid under consideration
 $Pmin$ = Price of lowest acceptable Bid

b) Broad-Based Black Economic Empowerment criteria [Weighted score 20 points]

- B-BBEE - current scorecard / B-BBEE Preference Points Claims Form
- Preference points will be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table indicated in **Section 4.1** of the B-BBEE Preference Points Claim Form.

1.5 STEP FIVE: Post Tender Negotiations (if applicable)

- Respondents are to note that Transnet may not award a contract if the price offered is not market-related. In this regard, Transnet reserves the right to engage in PTN with the view to achieving a market-related price or to cancel the tender. Negotiations will be done in a sequential manner i.e.:
 - first negotiate with the highest ranked bidder or cancel the bid, should such negotiations fail,
 - negotiate with the 2nd and 3rd ranked bidders (if required) in a sequential manner.
- In the event of any Respondent being notified of such short-listed/preferred bidder status, his/her bid, as well as any subsequent negotiated best and final offers (BAFO), will automatically be deemed to remain valid during the negotiation period and until the ultimate award of business.
- Should Transnet conduct post tender negotiations, Respondents will be requested to provide their best and final offers to Transnet based on such negotiations. Where a market related price has been achieved through negotiation, the contract will be awarded to the successful Respondent(s).

1.6 STEP SIX: Award of business and conclusion of contract

- Immediately after approval to award the contract has been received, the successful or preferred bidder(s) will be informed of the acceptance of his/their Quotation by way of a Letter of Award. Thereafter the final contract will be concluded with the successful Respondent(s).
- Otherwise, a final contract will be concluded and entered into with the successful Bidder at the acceptance of a letter of award by the Respondent.

2 Validity Period

Transnet requires a validity period of **90** [Ninety] Business Days from the closing date of this RFQ, excluding the first day and including the last day.

Bidders are to note that they may be requested to extend the validity period of their bid, on 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 bidder(s), the validity of the successful bidder(s)' bid will be deemed to remain valid until a final contract has been concluded.

3 Disclosure of contract information

Johannesburg Stock Exchange Debt Listing Requirements

Transnet may also be required to disclose information relating to the subsequent contract i.e. the name of the company, goods/services provided by the company, the value and duration of the contract, etc. in compliance with the Johannesburg Stock Exchange (JSE) Debt Listing Requirements.

Domestic Prominent Influential Persons (DPIP) OR Foreign Prominent Public Officials (FPPO)

Transnet is free to procure the services of any person within or outside the Republic of South Africa in accordance with applicable legislation. Transnet shall not conduct or conclude business transactions, with any Respondents without having:

- Considered relevant governance protocols;
- Determined the DPIP or FPPO status of that counterparty; and
- Conducted a risk assessment and due diligence to assess the potential risks that may be posed by the business relationship.

As per the Transnet Domestic Prominent Influential Persons (DPIP) and Foreign Prominent Public Officials (FPPO) and Related Individuals Policy available on Transnet website <https://www.transnet.net/search/pages/results.aspx?k=FPIDP#k=DPIP>, Respondents are required to disclose any commercial relationship with a DPIP or FPPO (as defined in the Policy) by completing the following section:

The below form contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By completing the form, the signatory consents to the processing of her/his personal information in accordance with the requirements of the Act. Consent cannot unreasonably be withheld.						
Is the Respondent (Complete with a "Yes" or "No")						
A DPIP/FPPO		Closely Related to a DPIP/FPPO		Closely Associated to a DPIP/FPPO		
List all known business interests, in which a DPIP/FPPO may have a direct/indirect interest or significant participation or involvement.						
No	Name of Entity / Business	Role in the Entity / Business (Nature of interest/ Participation)	Shareholding %	Registration Number	Status (Mark the applicable option with an X)	
					Active	Non-Active
1						
2						
3						

Returnable Document

Respondents declaring a commercial relationship with a DPIP or FPPO are to note that Transnet is required to annually publish on its website a list of all business contracts entered into with DPIP or FPPO. This list will include successful Respondents, if applicable.

4 Returnable Documents

Returnable Documents means all the documents, Sections and Annexures, as listed in the tables below. There are three types of returnable documents as indicated below and Respondents are urged to ensure that these documents are returned with their bids based on the consequences of non-submission as indicated below:

Mandatory Returnable Documents	<i>Failure to provide all these Mandatory Returnable Documents at the Closing Date and time of this RFQ <u>will</u> result in a Respondent's disqualification.</i>
Returnable Documents Used for Scoring	<i>Failure to provide all Returnable Documents used for purposes of scoring a bid, by the closing date and time of this bid will not result in a Respondent's disqualification. However, Bidders will receive an automatic score of zero for the applicable evaluation criterion.</i>
Essential Returnable Documents	<i>Failure to provide essential Returnable Documents <u>will</u> result in Transnet affording Respondents a further opportunity to submit by a set deadline. Should a Respondent thereafter fail to submit the requested documents, this may result in a Respondent's disqualification.</i>

All Returnable Sections, as indicated in the header and footer of the relevant pages, must be signed, stamped and dated by the Respondent.

a) Mandatory Returnable Documents

Respondents are required to submit with their bid submissions the following **Mandatory Returnable Documents**, and also to confirm submission of these documents by so indicating [Yes or No] in the tables below:

Mandatory Returnable Documents	Submitted [Yes or No]
SECTION 1: SBD1 Form	
SECTION 4 : Quotation Form	

b) Returnable Documents Used for Scoring

In addition to the requirements of section (a) above, Respondents are further required to submit with their Proposals the following **Returnable Documents Used for Scoring** and also to confirm submission of these documents by so indicating [Yes or No] in the table below:

RETURNABLE DOCUMENTS USED FOR SCORING	SUBMITTED [Yes or No]
Valid proof of Respondent's compliance to B-BBEE requirements stipulated in Section 7 of this RFP (Valid B-BBEE certificate or Sworn Affidavit)	

Returnable Document

<ul style="list-style-type: none"> • Previous Experience : Proof of completion (certificates) of relevant projects or a List providing details of company, type of work completed and contactable references relevant to this RFQ 	
<ul style="list-style-type: none"> • CV's of relevant Personnel 	
<ul style="list-style-type: none"> • Method Statement with time lines 	
<ul style="list-style-type: none"> • Health and Safety Summary indicated all sub criteria's indicated 	

c) **Essential Returnable Documents:**

Over and the above the requirements of section (a) and (b) mentioned above, Respondents are further required to submit with their Proposals the following **Essential Returnable Documents** and also to confirm submission of these documents by so indicating [Yes or No] in the table below:

ESSENTIAL RETURNABLE DOCUMENTS & SCHEDULES	SUBMITTED [Yes or No]
In the case of Joint Ventures, a copy of the Joint Venture Agreement or written confirmation of the intention to enter into a Joint Venture Agreement	
SECTION 3: Evaluation Methodology, Criteria And Returnable Documents	
SECTION 5: Certificate of Acquaintance with RFQ Documents	
SECTION 6: RFQ Declaration and Breach of Law Form	
SECTION 7: B-BBEE Preference Claim Form	
SECTION 8 : Certificate of attendance of compulsory RFQ Briefing	
SECTION 9 : Protection of Personal Information	

5 CONTINUED VALIDITY OF RETURNABLE DOCUMENTS

The successful Respondent will be required to ensure the validity of all returnable documents, including but not limited to its valid proof of B-BBEE status, for the duration of any contract emanating from this RFQ. Should the Respondent be awarded the contract [**the Agreement**] and fail to present Transnet with such renewals as and when they become due, Transnet shall be entitled, in addition to any other rights and remedies that it may have in terms of the eventual Agreement, to terminate such Agreement immediately without any liability and without prejudice to any claims which Transnet may have for damages against the Respondent.

SECTION 4

QUOTATION FORM

I/We _____

hereby offer to supply the goods/services at the prices quoted in the Price Schedule below, in accordance with the conditions related thereto.

I/We agree to be bound by those terms and conditions in:

- the Standard RFQ Terms and Conditions for the Supply of Goods or Services to Transnet; and
- any other standard or special conditions embodied in this Request for Quotation.

I/We accept that unless Transnet should otherwise decide and so inform me/us, this Quotation [and, if any, its covering letter and any subsequent exchange of correspondence], together with Transnet's acceptance thereof shall constitute a binding contract between Transnet and me/us. I/We further agree that if, after I/we have been notified of the acceptance of my/our Quotation, I/we fail to deliver the said goods/service/s within the delivery lead-time quoted, Transnet may, without prejudice to any other legal remedy which it may have, cancel the order and recover from me/us any expenses incurred by Transnet in calling for Quotations afresh and/or having to accept any less favourable offer.

Price Schedule

I/We quote as follows for the goods/services required, on a "delivered nominated destination" basis, including VAT:

1. SERVICE AND BOQ REFURBISHMENT OF MAIN TRANSFORMER 5MVA AT CONTENT

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
56.388	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 20600L of oil and repair leaks and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Remove main lid and re-gasket with TF-72 gasket as per Transnet Specification	1 Act			

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
56.388	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Transformer oil to be dehydrated and purified according to the Engineering instruction GI.012 specification. Moisture content <10ppm and dielectric strength >60Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P's & G's	Sum			
Sub Total (1)					

1. SERVICE AND BOQ REFURBISHMENT OF MAIN TRANSFORMER 5MVA AT BARKLY WEST

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
38.632	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 20600L of oil and repair leaks and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Remove main lid and re-gasket with TF-72 gasket as per Transnet Specification	1 Act			

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
38.632	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Transformer oil to be dehydrated and purified according to the Engineering instruction GI.012 specification. Moisture content <10ppm and dielectric strength >60Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P's & G's	Sum			
Sub Total (2)					

2. SERVICE AND BOQ

REFURBISHMENT OF MAIN TRANSFORMER 5MVA AT ULCO

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
72.737	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 20600L of oil and repair leaks and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Remove main lid and re-gasket with TF-72 gasket as per Transnet Specification	1 Act			

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
72.737	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Transformer oil to be dehydrated and purified according to the Engineering instruction GI.012 specification. Moisture content <10ppm and dielectric strength >60Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P's & G's	Sum			
Sub Total (3)					

3. SERVICE AND BOQ REFURBISHMENT OF MAIN TRANSFORMER 5MVA AT KNEUKEL

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
83.868	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 20600L of oil and repair leaks and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Remove main lid and re-gasket with TF-72 gasket as per Transnet Specification	1 Act			
	Clean transformer and re – paint according to specification in clause 8.2	1 Act			

Respondent's Signature

WRAC/KBC/39155 [TFR/2023/02/0003/22274/RFQ]

Date & Company Stamp

	in BBB5019 ver 6				
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KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
83.868	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Transformer oil to be dehydrated and purified according to the Engineering instruction GI.012 specification. Moisture content <10ppm and dielectric strength >60Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P's & G's	Sum			
Sub Total (4)					

4. SERVICE AND BOQ REFURBISHMENT OF MAIN TRANSFORMER 5MVA AT PLAUTEA

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
117.659	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 20600L of oil and repair leaks and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Remove main lid and re-gasket with TF-72 gasket as per Transnet Specification	1 Act			
	Clean transformer and re – paint	1 Act			

Respondent's Signature

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	according to specification in clause 8.2 in BBB5019 ver 6				
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KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
117.659	Remove conservator tank to be cleaned, replaced side glasses, re-gasket and resprayed.	1 Act			
	Transformer oil to be dehydrated and purified according to the Engineering instruction GI.012 specification. Moisture content <10ppm and dielectric strength >60Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P's & G's	Sum			
		Sub Total (5)			

5. SERVICE AND BOQ 100KVA AUXILIARY TRANSFORMER INSULATION OIL PURIFICATION AT PLATEAU

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
238.158	Remove Transformer cooling fins to be re-gasket, together with valves	1 Act			
	Drain 273L oil and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
	Top up transformer with 273L purified oil	1 Act			
	Regenerating the transformer 273L, oil to comply to Engineering instruction GI.012 Acidity shall not be more than 0.03 mg KOH/g, moisture content <10ppm and Dielectric Strength >70Kv	1 Act			
	Contractor to clean stone in an acceptable manner	1 Act			

	3 phase Generator hiring	1 Act			
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KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
	Supply and install new Silica gel breather	1 Act			
	New Buchholtz relay to be install	1 Act			
	P & G	Sum			
	Sub Total (6)				

6. SERVICE AND BOQ REFURBISHMENT OF 2 X 1250KVA STEP DOWN TRANSFORMER AT G SUBSTATION

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
	Drain 1260L oil for repair and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Re-gasket HV, LV bushing & Bulchholtz relay	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
3.210	Regenerating the transformer 1260L, oil to comply to Engineering instruction GI.012 Acidity shall not be more than 0.03 mg KOH/g, moisture content <10ppm and Dielectric Strength >70Kv	1 Act			
	Contractor to clean the oil spill in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and fit new TX2 breather	1 Act			
	New Buchholtz relay to be install & repair oil side glass	1 Act			
	P & G	Sum			
	Sub Total (7)				

**7. SERVICE AND BOQ REFURBISHMENT OF 800KVA STEP DOWN TRANSFORMER AT K
 SUBSTATION**

KM	Work Description	Qty	Material	Labour	Sub Total (Excl. VAT)
1.400	Drain 910L oil for repair and take pre – sample to test dielectric strength, DGA moisture content, acid, gases and PCB after work is completed	1 Act			
	Re-gasket HV, LV bushing & Bulchholtz relay	1 Act			
	Put the main transformer under vacuum while oil is removed to prevent any moisture getting inside the main tank	1 Act			
	Clean transformer and re – paint according to specification in clause 8.2 in BBB5019 ver 6	1 Act			
	Regenerating the transformer 910L, oil to comply to Engineering instruction GI.012 Acidity shall not be more than 0.03 mg KOH/g, moisture content <10ppm and Dielectric Strength >70Kv	1 Act			
	Contractor to clean the oil spill in an acceptable manner	1 Act			
	3 phase Generator hiring	1 Act			
	Supply and fit new TX2 breather	1 Act			
	New Buchholtz relay to be install & repair oil side glass	1 Act			
	P & G	Sum			
		Sub Total (8)			

8. SAMPLING AND TESTING OF OIL ANALYSIS FROM BEACONSFIELD – FOURTEEN-STREAMS TRACTION SUBSTATIONS

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
309.163	Beaconsfield	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
301.261	Kamfersdam	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
285.534	Macfarlane	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
274.230	Slypklip	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
262.916	Windsorton	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
252.775	Content	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
242.188	Kareeput	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		
230.090	Fourteenstreams	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
		P&G's	Sum		

Sub Total (9) (Excl. VAT)	
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9. SAMPLING AND TESTING OF OIL ANALYSIS AT 7 LOCATIONS IN BEACONSFIELD – 11KV DISTRIBUTION SUBSTATIONS

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
0.190	D Sub	Sampling and testing of oil sample for 2 X transformers	1 Act		
		P&G's	Sum		
0.650	E Sub	Sampling and testing of oil sample for 2 X transformers	1 Act		
		P&G's	Sum		
1.185	F Sub	Sampling and testing of oil sample for 2 X transformers	1 Act		
		P&G's	Sum		
1.400	K Sub	Sampling and testing of oil sample for 2 X transformers	1 Act		
		P&G's	Sum		
3.210	G Sub	Sampling and testing of oil sample for 5 X transformers	1 Act		
		P&G's	Sum		
3.425	H Sub	Sampling and testing of oil sample for 2 X transformers	1 Act		
		P&G's	Sum		
4.300	A sub	Sampling and testing of oil sample for 1 X transformer	1 Act		
		P&G's	Sum		
Sub Total (10) (Excl. VAT)					

10. SAMPLING AND TESTING OF OIL ANALYSIS FROM FIELDSVIEW – HOTAZEL TRACTION SUBSTATIONS

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
17.400	Fieldsview	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
28.265	Weir	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
38.632	Barkly West	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
49.831	Gong - Gong	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
60.956	Borreskop	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
72.737	Ulco	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
83.868	Kneukel	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
95.108	Nooibos	Sampling and testing of oil sample for 1x Main and 1x	1 Act		

		Auxiliary transformers			
	P&G's		Sum		

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
106.338	Koopmansfontein	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
117.659	Plateau	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
128.888	Ariesfontein	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
140.213	Trewil	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
150.364	Lime Acres	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
162.596	Clifton	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
172.919	Groenwater	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
183.658	Blinklip	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		

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194.258	Tsatsabane	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
206.316	Postmansburg	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
216.692	Beeshoek	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
227.391	Palingpan	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
238.158	Glosam	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
248.480	Lohatlha	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
258.443	Mookaneng	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
265.150	New Sishen	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
280.480	Emil	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		
290.622	Wincanton	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		

Respondent's Signature

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		Auxiliary transformers			
	P&G's		Sum		
312.763	Mamathwane	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act		
	P&G's		Sum		

KM	Substations	Work Description	Qty	Sub Total (Excl. VAT)	Total (Excl. VAT)
334.059	Hotazel	Sampling and testing of oil sample for 1x Main and 1x Auxiliary transformers	1 Act`		
	P&G's		Sum		
Sub Total (11) (Excl. VAT)					

* N.B P&G includes (labour, travel, food and accommodation e.t.c)

Total summary :	
Sub Total (1)	
Sub Total (2)	
Sub Total (3)	
Sub Total (4)	
Sub Total (5)	
Sub Total (6)	
Sub Total (7)	
Sub Total (8)	
Sub Total (9)	
Sub Total (10)	
Sub Total (11)	
Sub Total 1 - 11	R
VAT 15% (If Applicable)	R
Total	R

Delivery Lead-Time from date of purchase order: _____ [days/weeks]

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Respondents are to note that Transnet will round off final pricing scores to the nearest 2 (two) decimal places.

Notes to Pricing:

- a) Respondents are to note that if the price offered by the highest scoring bidder is not market-related, Transnet may not award the contract to that Respondent. Transnet may-
 - (i) negotiate a market-related price with the Respondent scoring the highest points or cancel the RFQ;
 - (ii) if that Respondent does not agree to a market-related price, negotiate a market-related price with the Respondent scoring the second highest points or cancel the RFQ;
 - (iii) if the Respondent scoring the second highest points does not agree to a market-related price, negotiate a market-related price with the Respondent scoring the third highest points or cancel the RFQ.

If a market-related price is not agreed with the Respondent scoring the third highest points, Transnet must cancel the RFQ.

- b) All Prices must be quoted in South African Rand, inclusive of VAT
- c) Any disbursement not specifically priced for will not be considered/accepted by Transnet.
- d) To facilitate like-for-like comparison bidders must submit pricing strictly in accordance with this price schedule and not utilise a different format. Deviation from this pricing schedule will result in a bid being disqualified.
- e) Please note that should you have offered a discounted price(s), Transnet will only consider such price discount(s) in the final evaluation stage if offered on an unconditional basis.
- f) In respect of incoterms conditions, if applicable, please refer to paragraph 25 of the General Bid Conditions which is attached to the RFQ

Respondent's Signature

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1.2 SCOPE OF WORK

All work shall be carried out according to **BBB 5019 VER 6, SANS 1 – 4 & ENGINEERING INSTRUCTION GI.012 & CEE.0229.95**

Details work to be done by the Contractor

5MVA Traction Transformer

1. Drain 105 443L of oil and repair the leaks and pre – sample to test dielectric strength, Moisture content, acidity, Gas DGA, Furanic test and PCB.
2. Remove transformer cooling fins to be re – gasket, together with valves
3. Remove conservator tank to be cleaned, replace side glasses, re- gasket and re – sprayed.
4. Put Main tank of Transformers under vacuum while oil is removed to prevent any moisture getting inside the main tank.
5. Remove main lid and re - gasket with TF – 72 gasket a Transnet Specification.
6. Vacuum fill transformer when all gasket is completed.
7. Take oil sample after the work is completed, submit the results.
8. Top up oil level with virgin oil if needed.
9. Torque main lid according to specifications BBB 5019 VER 6.
10. Clean Transformer and respray according to Transnet Specification.
11. Transformer insulation oil to be regenerated, dehydrated and purified according to Engineering instruction GI.012 and CEE.0229.95.
12. Contractor to clean stone in an accepted manner (remove and clean stone)
13. Contractor must perform Ratio and Insulation test.
14. Torque main lid according to TFR Specification.
15. Contractor to supply all necessary plan, material, tools equipment, sampling tins and labels for the execution of work.
16. Contractor must take oil sampling for ALL Traction and Distribution Substations, 36 x Main, 13 x Auxiliary and 15 x step down transformers.
 - Samples shall be tested for the following,
 - ✓ Full dissolved gas analysis
 - ✓ Dielectric strength
 - ✓ Acidity
 - ✓ Polychlorinated biphenyl (PCB)
 - ✓ Furanic
17. Contractor shall have crane truck that is in good condition.
18. Contractor must provide proof of all employees that are properly trained to operate the machine as well as the duties they will perform onsite.
19. Contractor shall provide valid calibration certificate of all machines onsite.
20. Contractor must submit the specification of material brought for the project

SPECIAL CONDITIONS

1. TFR has the right to limit work before it is allocated to a contractor.
2. The project schedule must be submitted 2 weeks before the work commences.
3. The awarded contract shall have site diary and site instruction book
4. All material to be used shall be submitted to Technical Officer for approval before any work commences.
5. The site must be clean as per original condition.

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6. All work to be done under work permit conditions under the control of an "Electrical Officer" authorised in terms of the Electrical Safety Instruction.
7. TFR representative will be available onsite for the duration of the project.
8. Contractor's safe working procedure with regard to HV testing to be approved by Technical Officer before any work can start.
9. Contractor to submit valid calibration certificates for all instruments to be used for this project and shall be submitted upfront.
10. Work will be carried during working hours and favourable weather conditions.
11. Attached all test sheets for testing purposes.
12. Contractor shall submit all test results sheets before and after commencing/energizing for each substation.
13. All work shall be written in the site diary for payment purposes.
14. The substations km point diagram is attached, and they are taken from Kimberley centre.
15. Oil sampling results must be submitted within 7 days, failure to do so, penalties' of R4 000 will be applied, this will also apply when the contractor fails to finish the project within the time frame.
16. Failure to respond to TFR communications within 7 days, penalties will be applied.
17. Failure to submit the Safety File within 2 weeks of the contract being awarded, penalties will be applied.

Respondent's Signature

WRAC/KBC/39155 [TFR/2023/02/0003/22274/RFQ]

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SECTION 5
CERTIFICATE OF ACQUAINTANCE WITH RFQ DOCUMENTS

By signing this certificate the Respondent is deemed to acknowledge that he/she has made himself/herself thoroughly familiar with, and agrees with all the conditions governing this RFQ. This includes those terms and conditions contained in any printed form stated to form part hereof, including but not limited to the documents stated below. As such, Transnet will recognise no claim for relief based on an allegation that the Respondent overlooked any such term or condition or failed properly to take it into account in calculating tendered prices or any other purpose:

1. Transnet's General Bid Conditions
2. Standard RFQ Terms and Conditions for the supply of Goods or Services to Transnet
3. Transnet's Supplier Integrity Pact
4. Non-disclosure Agreement

Note: Should a Respondent be successful and awarded the bid, they will be required to complete a Supplier Declaration Form for registration as a vendor onto the Transnet vendor master database.

Should the Bidder find any terms or conditions stipulated in any of the relevant documents quoted in the RFQ unacceptable, it should indicate which conditions are unacceptable and offer alternatives by written submission on its company letterhead, attached to its submitted Bid. 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. A material deviation from the Standard terms or conditions could result in disqualification.

Bidders accept that an obligation rests on them to clarify any uncertainties regarding any bid to which they intend to respond, before submitting the bid. The Bidder agrees that he/she will have no claim or cause of action based on an allegation that any aspect of this RFQ was unclear but in respect of which he/she failed to obtain clarity.

The bidder understands that his/her Bid will be disqualified if this Certificate of Acquaintance with RFQ documents included in the RFQ as a returnable document, is found not to be true and/ or complete in every respect.

SIGNED at _____ on this _____ day of _____ 20____

SIGNATURE OF WITNESSES

ADDRESS OF WITNESSES

1 _____

Name _____

2 _____

Name _____

SIGNATURE OF RESPONDENT'S AUTHORISED REPRESENTATIVE: _____

NAME: _____

DESIGNATION: _____

SECTION 6
RFQ DECLARATION AND BREACH OF LAW FORM

NAME OF ENTITY: _____

We _____ do hereby certify that:

1. Transnet has supplied and we have received appropriate responses to any/all questions [as applicable] which were submitted by ourselves for RFQ Clarification purposes;
2. We have received all information we deemed necessary for the completion of this Request for Quotation [**RFQ**];
3. We have been provided with sufficient access to the existing Transnet facilities/sites and all relevant information relevant to the Supply of the Goods as well as Transnet information and Employees, and have had sufficient time in which to conduct and perform a thorough due diligence of Transnet's operations and business requirements and assets used by Transnet. Transnet will therefore not consider or permit any pre- or post-contract verification or any related adjustment to pricing, service levels or any other provisions/conditions based on any incorrect assumptions made by the Respondent in arriving at his Bid Price.
4. At no stage have we received additional information relating to the subject matter of this RFQ from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the RFQ documents;
5. We have complied with all obligations of the Bidder/Supplier as indicated in the Transnet Supplier Integrity Pact which includes but are not limited to ensuring that we take all measures necessary to prevent corrupt practices, unfairness and illegal activities in order to secure or in furtherance to secure a contract with Transnet;
6. We are satisfied, insofar as our entity is concerned, that the processes and procedures adopted by Transnet in issuing this RFQ and the requirements requested from Bidders in responding to this RFQ have been conducted in a fair and transparent manner;
7. We declare that a family, business and/or social relationship **exists / does not exist** [delete as applicable] between an owner / member / director / partner / shareholder of our entity and an employee or board member of Transnet including any person who may be involved in the evaluation and/or adjudication of this Bid;
8. We declare that an owner / member / director / partner / shareholder of our entity **is / is not** [delete as applicable] an employee or board member of the Transnet;
9. In addition, we declare that an owner / member / director / partner / shareholder/employee of our entity **has / has not been** [delete as applicable] a former employee or board member of Transnet in the past 10 years. I further declare that if they were a former employee or board member of Transnet in the past 10 years that they **were/were not** involved in the bid preparation or had access to the information related to this RFQ; and
10. If such a relationship as indicated in paragraph 7, 8 and/or 9 exists, the Respondent is to complete the following section:

Respondent's Signature

WRAC/KBC/39155 [TFR/2023/02/0003/22274/RFQ]

Date & Company Stamp

FULL NAME OF OWNER/MEMBER/DIRECTOR/
PARTNER/SHAREHOLDER/EMPLOYEE:

ADDRESS:

Indicate nature of relationship with Transnet:

[Failure to furnish complete and accurate information in this regard will lead to the disqualification of a response and may preclude a Respondent from doing future business with Transnet]. Information provided in the declarations may be used by Transnet and/or its affiliates to verify the correctness of the information provided.

11. 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 entity in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

BIDDER'S DISCLOSURE (SBD4)

12 PURPOSE OF THE FORM

12.1 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.

12.2 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.

13 Bidder's declaration

13.1 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

13.1.1. 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

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.

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13.2 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution?

YES/NO

13.2.1. If so, furnish particulars:

.....
.....

13.3 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

13.3.1. If so, furnish particulars:

.....
.....

14 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:

14.1 I have read and I understand the contents of this disclosure;

14.2 I understand that the accompanying bid will be disqualified if this disclosure is found not to be true and complete in every respect;

14.3 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.

14.4 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

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.

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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.

14.5 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.

14.6 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.

14.7 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 12, 13 and 14 ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF 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.

BREACH OF LAW

12. We further hereby certify that *I/we **have/have not been*** [delete as applicable] found guilty during the preceding 5 [five] years of a serious breach of law, including but not limited to a breach of the Competition Act, 89 of 1998, by a court of law, tribunal or other administrative body. The type of breach that the Respondent is required to disclose excludes relatively minor offences or misdemeanours, e.g. traffic offences. This includes the imposition of an administrative fine or penalty.

Where found guilty of such a serious breach, please disclose:

NATURE OF BREACH:

DATE OF BREACH: _____

Furthermore, I/we acknowledge that Transnet SOC Ltd reserves the right to exclude any Respondent from the bidding process, should that person or entity have been found guilty of a serious breach of law, tribunal or regulatory obligation.

SIGNED at _____ on this _____ day of _____ 20____

For and on behalf of _____ duly authorised hereto	AS WITNESS:
Name:	Name:
Position:	Position:
Signature:	Signature:
Date:	Registration No of Company/CC _____
Place:	Registration Name of Company/CC _____

SECTION 7

B-BBEE PREFERENCE 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 Broad-Based Black Economic Empowerment [**B-BBEE**] Status Level of Contribution.

Transnet will award preference points to companies who provide valid proof of their B-BBEE status using either the latest version of the generic Codes of Good Practice or Sector Specific Codes (if applicable).

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022.

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
 - the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).
- 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 The 80/20 preference point system will be applicable to this tender.
- 1.4 Preference points for this bid shall be awarded for:
- (a) Price; and
 - (b) B-BBEE Status Level of Contribution.
- 1.5 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	80
B-BBEE STATUS LEVEL OF CONTRIBUTOR	20
Total points for Price and B-BBEE must not exceed	100

- 1.6 Failure on the part of a bidder to submit proof of B-BBEE status level of contributor together with the bid will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.
- 1.7 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"** means:
 - 1) B-BBEE status level certificate issued by an unauthorised body or person;
 - 2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;
 - 3) Any other requirement prescribed in terms of the B-BBEE Act.
- (j) **"QSE"** means a Qualifying Small EEnterprise in terms of a 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.

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

4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

- 4.1 In terms of Transnet SCM Policy on preferential procurement and Procurement Manuals, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (80/20 system)
1	20
2	18
3	14
4	12

5	8
6	6
7	4
8	2
Non-compliant contributor	0

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 .]
EME³	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	
-----	--	----	--

v) Specify, by ticking the appropriate box, if subcontracting with any of the enterprises below:

Designated Group: An EME or QSE which is at least 51% owned by:	EME ✓	QSE ✓
Black people		
Black people who are youth		
Black people who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

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]

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- 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-BBEE status level of contribution indicated in paragraphs 4.1 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 4.1 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 the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis 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:

ADDRESS

.....

.....

SECTION 8

CERTIFICATE OF ATTENDANCE OF COMPULSORY RFQ BRIEFING

It is hereby certified that –

1. _____

2. _____

Representative(s) of _____ *[name of entity]*

Attended the RFQ briefing in respect of the proposed Goods/Services to be rendered in terms of this RFQ on
23 February 2023 at 11: 00

TRANSNET'S REPRESENTATIVE

RESPONDENT'S REPRESENTATIVE

DATE _____

DATE _____

NOTE:

This certificate of attendance must be filled in duplicate, one copy to be kept by Transnet and the other copy to be kept by the bidder.

SECTION 9

PROTECTION OF PERSONAL INFORMATION

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

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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



STANDARD TERMS AND CONDITIONS OF CONTRACT

between

TRANSNET SOC LTD

Registration Number 1990/000900/30

And

.....
Registration Number

**FOR THE APPOINTMENT OF A SERVICE PROVIDER FOR THE PROVISION OF SERVICE FOR
OIL REGENERATION, OIL PURIFICATION AND OIL SAMPLING AT VARIOUS 3KV DC
TRACTION SUBSTATIONS FOR A PERIOD OF 4 MONTHS**

CONTRACT NUMBER	WRAC / KBC/ 39155
DURATION	4 Months
COMMENCEMENT DATE	As soon as Award has been done after closing date
EXPIRY DATE	Pending

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1 SOLE AGREEMENT

Unless otherwise agreed in writing, these terms [**Terms** and each **Term**] and Transnet's purchase order(s) [**Order** or **Orders**] represent the only conditions upon which Transnet SOC Ltd [**Transnet**] procures Goods/Services [**the Goods/Services**] specified in the Order from the person to whom the Order is addressed [**the Supplier/Service Provider**]. Transnet does not accept any other conditions which the Supplier/Service Provider may specify, unless otherwise agreed to by Transnet in writing. In the event of any inconsistency between these Terms and any Order, these Terms shall take precedence.

2 CONFORMITY WITH ORDER

Goods/Services shall conform strictly with the Order. The Supplier/Service Provider shall not vary the quantities specified and/or the specification, if any, stipulated in the Order, without the prior written consent of Transnet. The Supplier/Service Provider warrants that the Goods/Services shall be fit for their purpose and of satisfactory quality.

3 DELIVERY AND TITLE

- 3.1 The delivery dates and addresses are those in the Order. Time shall be of the essence in respect of the Supplier/Service Provider's obligations under the Order.
- 3.2 The Supplier/Service Provider will not be excused for delay in delivery or performance except due to circumstances outside its control and then only subject to the Supplier/Service Provider having notified Transnet in writing on becoming aware of such circumstances. Transnet may terminate an Order, in whole or in part, without incurring any liability to the Supplier/Service Provider if such a delay becomes, in Transnet's absolute opinion, significant.
- 3.3 If on delivery, the Goods/services do not conform to the Order, Transnet may reject the Goods/Services and the Supplier/Service Provider shall promptly rectify any defects or in Transnet's opinion, supply appropriate replacement Goods/Services at the Supplier/Service Provider's expense within the specified delivery times, without any liability due by Transnet.

4 PRICE AND PAYMENT

- 4.1 Prices specified in an Order cannot be increased. Payment for the Goods/Services shall be made by Transnet against an original undisputed invoice(s) [a Tax Invoice], supporting documentation and month-end statement from the Supplier/Service Provider. Tax Invoices plus supporting documentation shall be posted to the address shown in the Order.
- 4.2 Payment of the Supplier/Service Provider's valid Tax Invoice(s) will be made by Transnet in the South African currency and on the terms stated in the Order, the standard payment

terms being 30 [thirty] days from date of receipt by Transnet of a month-end statement, unless otherwise agreed to in writing. Transnet shall arrange for payment of such Tax Invoices and any pre-authorised additional expenses incurred, provided that the authorised expenses are supported by acceptable documentary proof of expenditure incurred [where this is available]. Any amounts due in terms of these Terms shall be paid to the Supplier/Service Provider, taking into account any deduction or set-off and bank charges.

5 PROPRIETARY RIGHTS LIABILITY

If any allegations should be made or any claim asserted against Transnet that ownership of, or any act or omission by Transnet in relation to Goods/Services or any written material provided to Transnet relating to any Goods/Services or pursuant to an Order being a violation or infringement of any third party's contractual, industrial, commercial or intellectual property rights including but not limited to any patent, registered design, design right, trade mark, copyright or service mark on any application thereof, the Supplier/Service Provider hereby indemnifies Transnet against and hold it harmless from any and all losses, liabilities, costs, claims, damages and expenses [including any legal fees] arising directly or indirectly from such allegation or claim provided that this indemnity shall not apply where the allegation or claim arises solely as a result of the Supplier/Service Provider following a design or process originated and furnished by Transnet. The Supplier/Service Provider shall either

- a) procure for Transnet the right to continue using the infringing Goods/Services; or
- b) modify or replace the Goods/services so that they become non-infringing,

provided that in both cases the Goods/services shall continue to meet Transnet's requirements and any specifications stipulated in the Order. Should neither option be possible, the Supplier/Service Provider may remove, with Transnet's prior written consent, such Goods/services and will pay to Transnet a sum equivalent to the purchase price. If Transnet refuses to give such consent, the Supplier/Service Provider shall have no liability in respect of any continued use of the infringing Goods/services after Supplier/Service Provider's prior written request to remove the same.

6 PROPRIETARY INFORMATION

All information which Transnet has divulged or may divulge to the Supplier/Service Provider and any information relating to Transnet's business which may have come into the Supplier/Service Provider's possession whilst carrying out an Order, and the existence of the Order, shall be treated by the Supplier/Service Provider as confidential information and shall not, without Transnet's prior written consent, be disclosed to any third party, or be used or copied for any purposes other than to perform the Order. This clause does not apply to information which is public knowledge or available from other sources other than by breach of this Term. Upon request by Transnet, the Supplier/Service Provider shall return all materials issued pursuant to

the Order and, pending this, shall protect Transnet's rights in any such materials. Such confidential information shall at all material times be the property of Transnet.

7 PROTECTION OF PERSONAL INFORMATION

a) The following terms shall bear the same meaning as contemplated in Section 1 of the Protection of Personal Information Act 4 of 2013 ("POPIA"):

consent; person; personal information; processing; record; Regulator as well as any terms derived from these terms of the POPIA

b) 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.

c) Transnet agrees that in submitting any information or documentation requested in the RFP and in this Agreement, the Supplier/Service Provider consents to the processing of their personal information for the purpose of, but not limited to, risk assessment, contract award, contract management, auditing, legal opinions/litigation, 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.

d) The Parties agree that they may obtain and have access to personal information for the fulfilment of the rights and obligations contained herein. In performing the obligations as set out in this Agreement, the Parties shall at all times ensure that:

- i. they process personal information only for the express purpose for which it was obtained;
- ii. once processed for the purposes for which it was obtained, all personal information will be destroyed to an extent that it cannot be reconstructed to its original form, subject to any legal retention requirements;
- iii. Personal information is provided only to authorised personnel who strictly require the personal information to carry out the Parties' respective obligations under this Agreement;
- iv. they do not disclose personal information of the other Party, other than in terms of this Agreement;
- v. they have all reasonable technical and organisational measures in place to protect all personal information from unauthorised access and/or use;
- vi. they have appropriate technical and organisational measures in place to safeguard the security, integrity and authenticity of all information in their possession or under their control in terms of this Agreement;

- vii. they identify all reasonably foreseeable internal and external risks to personal information in their possession or under their control; establish and maintain appropriate safeguards against the risks identified; regularly verify that the safeguards are effectively implemented; and ensure that the safeguards are continually updated in response to new risks or deficiencies in previously implemented safeguards;
 - viii. such personal information is protected against unauthorised or unlawful processing, accidental loss, destruction or damage, alteration, disclosure or access.
- 9.1. The Parties agree that if personal information will be processed for additional purposes beyond the original purpose for which it was obtained, explicit consent must be obtained beforehand from those persons whose information will be subject to such processing.
- 9.2. Should it be necessary for either Party to disclose or otherwise make available the personal information to any third party (including sub-contractors and employees) that is not already consented to, it may do so only with the prior written consent of the other Party. The Party requiring such consent shall require of all such third parties, appropriate written undertakings to be provided, containing similar terms to that set forth in this clause, and dealing with that third party's obligations in respect of its processing of the personal information. Following approval by the other Party, the Party requiring consent agrees that the provisions of this clause shall mutatis mutandis apply to all authorised third parties who process personal information.
- 9.3. The Parties shall ensure that any persons authorized to process information on their behalf (including employees and third parties) will safeguard the security, integrity and authenticity of all information. Where necessary to meet this requirement, the Parties shall keep all personal information and any analyses, profiles, or documents derived therefrom logically separated from all other information and documentation held by it.
- 9.4. The Parties shall carry out regular assessments to identify all reasonably foreseeable internal and external risks to the personal information in its possession or under its control. The Parties shall implement and maintain appropriate safeguards against the risks which it identifies and shall also regularly verify that the safeguards which it has in place have been effectively implemented.
- 9.5. The Parties agree that they will promptly return, destroy or de-identify any personal information in their possession or control which belongs to the other Party once it no longer serves the purpose for which it was collected in relation to this Agreement, subject to any legal retention requirements. This may be at the request of the other Party and includes circumstances where a person has requested the Parties to delete all instances of their personal information. The information will be destroyed or de-identified in such a manner that it cannot be reconstructed to its original form, linking it to any particular individual or organisation.
- 9.6. Personal Information security breach:

- a) Each Party shall notify the other party in writing as soon as possible after it becomes aware of or suspects any loss, unauthorised access or unlawful use of any personal information and shall, at its own cost, 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. The Parties shall also be required to provide each other with details of the persons affected by the compromise and the nature and extent of the compromise, including details of the identity of the unauthorised person who may have accessed or acquired the personal information.
- b) The Parties shall provide on-going updates on the progress in resolving the compromise at reasonable intervals until such time as the compromise is resolved.
- c) Where required, the Parties must notify the South African Police Service; and/or the State Security Agency and the Information Regulator and the affected persons of the security breach. Any such notification shall always include sufficient information to allow the persons to take protective measures against the potential consequences of the compromise.
- d) The Parties undertake to co-operate in any investigations relating to security which is carried out by or on behalf of the other including providing any information or material in its possession or control and implementing new security measures.

8 PUBLICITY

The Supplier/Service Provider shall not name Transnet or use its trademarks, service marks [whether registered or not] or Goods in connection with any publicity without Transnet's prior written consent.

9 AFTER SALES SERVICE

The Supplier shall provide replacement parts necessary to ensure the uninterrupted operation of the Goods supplied for the duration of the warranty period, from delivery of any particular item of the Goods and if requested by Transnet shall make these parts available to a third party maintainer of Transnet's choice at the same price as if the parts had been supplied to Transnet. The Supplier undertakes to provide a maintenance service for Goods, should Transnet so request, on terms to be agreed. If the Order so indicates, the Supplier will provide a warranty service for the Goods at a level to be agreed with Transnet.

10 NON CONFORMANCE OF GOODS/SERVICES PROCURED

- 10.1 In the case of Goods/services manufactured for and procured by Transnet from the Supplier/Service Provider in terms of this Agreement, being found not to conform to the Transnet standards, specifications and requirements, Transnet at any time may be entitled to raise a Non Conformance Report (NCR) against a Supplier/Service Provider whose Goods/ Services do not conform to Transnet standards, specifications and requirements directing the Supplier/Service Provider to investigate and remedy the non-*

conformance within the stipulated time frame as may be determined by Transnet at its discretion.

- 10.2 *Failure by the Supplier/Service Provider to fully comply with NCR within the period stated in sub-clause 13.1 above, shall entitle Transnet to further conditions to which the Supplier/ Service Provider must discharge in order to close the NCR or to terminate the order without giving the Supplier/Service Provider written notice of termination in terms of this Agreement.*

11 TERMINATION OF ORDER

- 11.1 Notwithstanding the date of signature hereof, the commencement date of this Order is and will expire on , unless:
- this Order is terminated by either Party in accordance with the provisions incorporated herein or in any schedules or annexures appended hereto, or otherwise in accordance with law or equity; or
 - this Order is extended at Transnet's option for a further period to be agreed by the Parties; or
 - the allocated maximum contract value is depleted before the contract expiry date.
- 11.2 Transnet may cancel this Order in whole or in part at any time upon at least 30 [thirty] days' written notice to the Supplier/Service Provider, or when there is a change in control of the Supplier/Service Provider or the Supplier/Service Provider commits any serious breach or any repeated or continued material breach of its obligations under these Terms and/or Order or shall have been guilty of conduct tending to bring itself into disrepute, on written notice to the Supplier/Service Provider when such work on the Order shall stop.
- 11.3 Transnet shall pay the Supplier/Service Provider a fair and reasonable price for justified work in progress, where such price reflects only those costs not otherwise recoverable by the Supplier/Service Provider, at the time of termination, and the Supplier/Service Provider shall give Transnet full assistance to check the extent of such work in progress. Payment of such price shall be in full and final satisfaction of any claims arising out of such termination and upon such payment the Supplier/Service Provider shall deliver to Transnet all work, including any materials, completed or in progress. The sum payable to the Supplier/Service Provider under this clause will not in any event exceed the total amount that would have been payable to the Supplier/Service Provider had the Order not been terminated.
- 11.4 In the event of termination the Supplier/Service Provider must submit all claims within 2 [two] months of termination after which time claims will only be met in what Transnet considers exceptional circumstances.

11.5 If the Goods/services are not provided in accordance with an Order, the Order shall be deemed terminated and the Supplier/Service Provider shall compensate Transnet for any costs incurred in obtaining substitute Goods/services or any damage caused due to the failure or delay in the delivery.

11.6 Both parties to this agreement reserve the right to terminate this agreement:

13.6.1. If the other commits a material breach of this contracts and fails to remedy such breach within a stipulated time frame or within a reasonable time;

13.6.2. There is non-performance from either of the parties; or

13.6.3. If the other party is unable to perform its obligations under this agreement.

12 ACCESS

The Supplier/Service Provider shall be liable for the acts, omissions and defaults of its personnel or agents who, for the purposes of the Order, shall be treated as if they are the Supplier/Service Provider's employees. The Supplier/Service Provider shall ensure that any such personnel or agents, whilst on Transnet's premises, shall comply with Transnet's health and safety, security and system security rules and procedures as and where required.

13 WARRANTY

The Supplier/Service Provider warrants that it is competent to supply the Goods/services in accordance with these Terms to the reasonable satisfaction of Transnet and that all Goods/services delivered under the Order: (a) conform and comply in all relevant legislation, standards, directives and orders related to [*inter alia*] the Goods/services in force at the time of delivery, and to any specifications referred to in the Order; (b) will not cause any deterioration in the functionality of any Transnet equipment; and (c) do not infringe any third party rights of any kind. The Supplier/Service Provider hereby indemnifies Transnet against all losses, liabilities, costs, claims, damages, expenses and awards of any kinds incurred or made against Transnet in connection with any breach of this warranty.

14 INSOLVENCY

If the Supplier/Service Provider shall have a receiver, manager, administrator, liquidator or like person appointed over all or any part of its assets or if the Supplier/Service Provider compounds with its creditors or passes a resolution for the writing up or administration of the Supplier/Service Provider, Transnet is at liberty to terminate the Order or Orders forthwith, or at its option, to seek performance by any such appointed person.

15 SUBCONTRACTING

15.1 The Supplier/Service Provider may only enter into a subcontracting arrangement with the approval of Transnet. If the Supplier subcontracts a portion of the contract to another person without declaring it to Transnet, Transnet must penalise the Supplier up to 10% of the value of the contract.

- 15.2 Should Transnet approve the Supplier's/Service Provider's subcontracting arrangement, the Supplier/Service Provider and not the sub-contractor will at all times be held liable for performance in terms of its contractual obligations.
- 15.3 The Supplier/Service Provider may not subcontract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.
- 15.4 The Supplier/Service Provider may not subcontract 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 of contributor than the Supplier, unless the contract is subcontracted to an Exempted Micro Enterprise (EME) that has the capability and ability to execute the subcontract.

16 PAYMENT TO SUB-CONTRACTORS

- 16.1 Transnet reserves the right, in its sole discretion, to make payment directly to the sub-contractor of the Supplier/Service Provider, subject to the following conditions:
 - a) Receipt of an undisputed invoice from the sub-contractor; and
 - b) Receipt of written confirmation from the Supplier/Service Provider that the amounts claimed by the sub-contractor are correct and that the services for which the sub-contractor has requested payment were rendered to the satisfaction of the Supplier/Service Provider, against the required standards.
- 16.2 Nothing contained in this clause must be interpreted as bestowing on any sub-contractor a right or legitimate expectation to be paid directly by Transnet. Furthermore, this clause does not bestow any right or legitimate expectation on the Supplier/Service provider to demand that Transnet pay its sub-contractor directly. The decision to pay any sub-contractor directly, remains that of Transnet alone.
- 16.3 The Supplier/Service Provider remains liable for its contractual obligations under the Agreement, including all services rendered by the sub-contractor.
- 16.4 This clause does not establish any contractual relationship between Transnet and any sub-contractor of the Supplier/Service Provider, whatsoever.

17 CESSIONS AND ASSIGNMENTS AS PER NT INSTRUCTION NOTE 08 OF 2022/2023

- 17.1 The Supplier/Service Provider is not allowed to cede its rights for payment in terms of this Agreement without prior written approval from Transnet. Cession shall only be applicable as follows:
 - a) Cession must only be applicable to the transfer of right to payment for goods/services delivered/rendered by a Supplier/Service Provider to an FSP or State Institutions;
 - b) The written request for cession must be by the Supplier/Service Provider and not a third party; and

c) The written request by the Supplier/Service Provider must be accompanied by the cession agreement.

17.2 The Supplier/Service Provider is prohibited from transferring its rights and obligations to perform under this contract. Assignments are against the principles of section 217 of the Constitution mainly, fairness, transparency and competitiveness.

18 SUPPLIER INTEGRITY PACT

The Supplier/Service Provider shall observe and ensure compliance with all requirements and objectives of the Transnet Supplier Integrity Pact as agreed to in response to the RFQ. The general purpose of the Supplier Integrity Pact is to agree to avoid 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 the procurement event leading to this Agreement and this Agreement itself.

19 DATABASE OF RESTRICTED SUPPLIERS

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 Bid shall be awarded to a Bidder 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 Bidder should it be established, at any time, that a bidder has been restricted with National Treasury by another government institution.

20 NOTICES

Notices under these Terms shall be delivered by hand to the relevant addresses of the parties in the Order or may be served by facsimile or by email, in which event notice shall be deemed served on acknowledgement of receipt by the recipient.

21 LAW

Orders shall be governed by and interpreted in accordance with South African law and any disputes arising herein shall be subject to South African arbitration under the rules of the Arbitration Foundation of South Africa, which rules are deemed incorporated by reference in this clause. The reference to arbitration shall not prevent Transnet referring the matter to any South African courts, having jurisdiction, to which the Supplier/Service Provider hereby irrevocably submits but without prejudice to Transnet's right to take proceedings against the Supplier/Service Provider in other jurisdictions and/or obtaining interim relief on an urgent basis from a court of competent jurisdiction pending the decision in other courts or from instituting in any court of competent jurisdiction any proceedings for an interdict or any other injunctive relief. If the Supplier/Service Provider does not have a registered office in the South Africa it will

at all times maintain an agent for service of process in South Africa and shall give Transnet the name and address of such agent as such may be amended, in writing, from time to time.

22 GENERAL

Completion or termination of an Order shall be without prejudice to any Term herein which by its nature would be deemed to continue after completion or termination, including but not limited to clauses 5, 6, 8 and 9. Headings are included herein for convenience only. If any Term herein be held illegal or unenforceable, the validity or enforceability of the remaining Terms shall not be affected. No failure or delay by Transnet to enforce any rights under these Terms will operate as a waiver thereof by Transnet. All rights and remedies available to either party under these Terms shall be in addition to, not to the exclusion of, rights otherwise available at law.

23 COUNTERPARTS

These Terms and conditions may be signed in any number of counterparts, all of which taken together shall constitute one and the same instrument. Any party may enter into this agreement by signing any such counterpart.

Thus signed by the Parties and witnessed on the following dates and at the following places:

SIGNED for and on behalf of Transnet SOC Ltd duly authorised hereto	SIGNED for and on behalf of duly authorised hereto
Registration Number 1990/000900/30	Registration Number
Signature	Signature
Name:	Name:
Position:	Position:
Date:	Date:
Place:	Place:
AS WITNESS: Signature	AS WITNESS: Signature
Name	Name



GENERAL BID CONDITIONS

[June 2022]

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1 DEFINITIONS

Where the following words or phrases are used in this Agreement, such words or phrases shall have the meaning assigned thereto in this clause, except where the context clearly requires otherwise:

- 1.1 **Bid** shall mean a Respondent's tendered response / proposal to a Transnet RFP or RFQ;
- 1.2 **Bid Document(s)** shall mean a reference to a Request for Proposal or Request for Quotation;
- 1.3 **Business Day** shall mean any day other than a Saturday, Sunday or public holiday;
- 1.4 **Goods** shall mean the goods required by Transnet as specified in its Bid Document;
- 1.5 **Parties** shall mean Transnet and the Respondents to a Bid Document;
- 1.6 **Respondent(s)** shall mean a respondent/bidder to a Bid Document;
- 1.7 **RFP** shall mean Request for Proposal;
- 1.8 **RFQ** shall mean Request for Quotation;
- 1.9 **RFX** shall mean RFP or RFQ, as the case may be;
- 1.10 **Services** shall mean the services required by Transnet as specified in its Bid Document;
- 1.11 **Service Provider or Supplier** shall mean the successful Respondent;
- 1.12 **Tax Invoice** shall mean the document as required by Section 20 of the Value-Added Tax Act, 89 of 1991, as may be amended from time to time;
- 1.13 **Transnet** shall mean Transnet SOC Ltd, a State Owned Company; and
- 1.14 **VAT** shall mean Value-Added Tax in terms of the Value-Added Tax Act, 89 of 1991, as may be amended from time to time.

2 GENERAL

All Bid Documents and subsequent contracts and orders shall be subject to the following general conditions as laid down by Transnet and are to be strictly adhered to by any Respondent to this RFX.

3 SUBMITTING OF BID DOCUMENTS

- 3.1 A Bid, which shall hereinafter include reference to an RFP or RFQ, shall be submitted to Transnet no later than the closing date and time specified in accordance with the directions issued in the Bid Documents. Late Bids will not be considered.
- 3.2 The Bid Documents must be completed in their entirety and Respondents are required to complete and submit their Bid submissions by uploading them into the system against each tender selected. The bidder guide can be found on the Transnet Portal transnetetenders.azurewebsites.net.

4 USE OF BID FORMS

- 4.1 Where special forms and/or formats are issued by Transnet for the submission of Bids, Respondents are required to submit their Bids by completion of the appropriate sections on such official forms and/or formats and not in other forms and/or formats or documents bearing their own terms and conditions of contract. Non-compliance with this condition may result in the rejection of a Bid.
- 4.2 Respondents must note that the original Bid forms and/or formats must be completed for submission.
- 4.3 Only if insufficient space has been allocated to a particular response may a Respondent submit additional information under separate cover using the Company's letterhead. This must be duly cross-referenced in the RFX.

5 BID FEES

A bid fee is not applicable. The Bid Documents may be downloaded directly from National Treasury's e-Tender Publication Portal at www.etenders.gov.za and may also be downloaded from the Transnet website at www.transnet.net free of charge.

6 VALIDITY PERIOD

- 6.1 The Respondents must hold their Bid valid for acceptance by Transnet at any time within the requested validity period after the closing date of the bid.
- 6.2 Respondents may be requested to extend their validity period for a specified additional period. In such instances, Respondents will not be allowed to change any aspect of their Bid, unless they are able to demonstrate that the proposed change/s is as a direct and unavoidable consequence of Transnet's extension of the validity period.

7 SITE VISITS / BRIEFING SESSIONS

Respondents may be requested to attend a site visit or briefing session where it is necessary to view the site in order to prepare their Bids, or where Transnet deems it necessary to provide Respondents with further information to allow them to complete their Bids properly. Where such visits or sessions are indicated as compulsory in the RFX Document, Respondents are obliged to attend these meetings as failure to do so will result in their disqualification.

8 CLARIFICATION BEFORE THE CLOSING DATE

Should clarification be required on any aspect of the Bid before the closing date, the Respondent must upload questions onto the Transnet e-Tender Submission Portal or direct such queries to the contact person listed in the RFX Document in the stipulated manner.

9 COMMUNICATION AFTER THE CLOSING DATE

After the closing date of a Bid (i.e. during the evaluation period) the Respondent may only communicate with the contact person listed in the RFX Document.

10 UNAUTHORISED COMMUNICATION ABOUT BIDS

Respondents may at any time communicate with the contact person listed in the RFX Document on any matter relating to its Bid but, in the absence of written authority from the delegated individual (BEC chairperson), no communication on a question affecting the subject of a Bid shall take place between Respondents or other potential service providers or any member of the Bid Adjudication Committee or official of Transnet during the period between the closing date for the receipt of the Bid and the date of the notification of the successful Respondent(s). A Bid, in respect of which any such unauthorised communication has occurred, may be disqualified.

11 RETURNABLE DOCUMENTS

All returnable documents listed in the RFX Documents must be submitted with Respondent's Bid. Failure to submit mandatory returnable schedules / documents will result in disqualification. Failure to submit other schedules / documents may result in disqualification.

12 DEFAULTS BY RESPONDENTS

If the Respondent, after it has been notified of the acceptance of its Bid fails to:

- 12.1 enter into a formal contract when called upon to do so within such period as Transnet may specify; or
- 12.2 accept an order in terms of the Bid;
- 12.3 furnish satisfactory security when called upon to do so for the fulfilment of the contract; or
- 12.4 comply with any condition imposed by Transnet,

Transnet may, in any such case, without prejudice to any other legal remedy which it may have, proceed to accept any other Bid or, if it is necessary to do so, call for Bids afresh, and may recover from the defaulting Respondent any additional expense incurred by Transnet in calling for new offers or in accepting a less favourable offer.

13 CURRENCY

All monetary amounts referred to in a Bid response must be in Rand, the currency of the Republic of South Africa [ZAR], save to the extent specifically permitted in the RFP.

14 PRICES SUBJECT TO CONFIRMATION

Prices which are quoted subject to confirmation will not be considered.

15 ALTERATIONS MADE BY THE RESPONDENT TO BID PRICES

All alterations made by the Respondent to its Bid price(s) prior to the submission of its Bid Documents must be done by deleting the incorrect figures and words where required and by inserting the correct figures and words against the items concerned. All such alterations must be initialled by the person who signs the Bid Documents. Failure to observe this requirement may result in the particular item(s) concerned being excluded in the matter of the award of the business.

16 EXCHANGE AND REMITTANCE

- 16.1 The Respondent should note that where the whole or a portion of the contract or order value is to be remitted overseas, Transnet shall, if requested to do so by the Supplier/Service Provider, effect payment overseas directly to the foreign principal or manufacturer of such percentage of the contract or order value as may be stipulated by the Respondent in its Bid Documents.
- 16.2 It is Transnet's preference to enter into Rand-based agreements. Transnet would request, therefore, that the Respondent give favourable consideration to obtaining forward exchange cover on the foreign currency portion of the Agreement at a cost that is acceptable to Transnet to protect itself against any currency rate fluctuation risks for the duration of any resulting contract or order.
- 16.3 The Respondent who desires to avail itself of the aforementioned facility must at the time of bidding furnish the information called for in the Exchange and Remittance section of the Bid Documents and also furnish full details of the principals or manufacturer to whom payment is to be made.
- 16.4 The South African Reserve Bank's approval is required before any foreign currency payments can be made to or on behalf of Respondents.
- 16.5 Transnet will not recognise any claim for adjustment of the order and/or contract price if the increase in price arises after the date on which the Goods/Services were to be delivered, as set out in the order and/or contract, or any subsequent agreement between the parties.
- 16.6 Transnet reserves the right to request a pro-forma invoice/tax invoice in order to ensure compliance with the contract and Value-Added Tax Act no. 89 of 1991 [VAT Act].

17 ACCEPTANCE OF BID

- 17.1 Upon the acceptance of a Bid by Transnet, the parties shall be bound by these General Bid Conditions and any contractual terms and/or any schedule of "Special Conditions" or otherwise which form part of the Bid Documents.
- 17.2 Where the Respondent has been informed by Transnet of the acceptance of its Bid, an email communication that has been successfully sent to the Respondent shall be regarded as proof of delivery to the Respondent 1 day after the date of submission.

18 NOTICE TO UNSUCCESSFUL RESPONDENTS

- 18.1 Unsuccessful Respondents shall be advised in writing that their Bids have not been accepted as soon as possible after the closing date of the Bid. On award of business to the successful Respondent all unsuccessful Respondents must be informed of the name of the successful Respondent and of the reason as to why their Bids had been unsuccessful.

19 TERMS AND CONDITIONS OF CONTRACT

- 19.1 The Supplier/Service Provider shall adhere to the Terms and Conditions of Contract issued with the Bid Documents, together with any schedule of "Special Conditions" or otherwise which form part of the Bid Documents.
- 19.2 Should the Respondent find any conditions unacceptable, it should indicate which conditions are unacceptable and offer amendments/ alternatives by written submission on a company letterhead. Any such submission shall be subject to review by Transnet's Legal Counsel who shall determine whether the proposed amendments /alternative(s) are acceptable or otherwise, as the case may be. Respondents will be afforded an opportunity to withdraw an unacceptable deviation, failing which the respondent will be disqualified.

20 CONTRACT DOCUMENTS

- 20.1 The contract documents will comprise these General Bid Conditions, the Terms and Conditions of Contract and any schedule of "Special Conditions" which form part of the Bid Documents.
- 20.2 The abovementioned documents together with the Respondent's Bid response will constitute the contract between the parties upon receipt by the Respondent of Transnet's letter of acceptance, subject to all additional amendments and/or special conditions thereto as agreed to by the parties.
- 20.3 Should Transnet inform the Respondent that a formal contract will be signed, the abovementioned documents together with the Respondent's Bid response [and, if any, its covering letter and any subsequent exchange of correspondence] as well as Transnet's Letter of Acceptance, shall constitute a binding contract until the final contract is signed.

21 LAW GOVERNING CONTRACT

The law of the Republic of South Africa shall govern the contract created by the acceptance of a Bid. The *domicilium citandi et executandi* shall be a place in the Republic of South Africa to be specified by the Respondent in its Bid at which all legal documents may be served on the Respondent who shall agree to submit to the jurisdiction of the courts of the Republic of South Africa. A foreign Respondent shall, therefore, state in its Bid the name of its authorised representative in the Republic of South Africa who is empowered to sign any contract which may be entered into in the event of its Bid being accepted and to act on its behalf in all matters relating to the contract.

22 IDENTIFICATION

If the Respondent is a company, the full names of the directors shall be stated in the Bid. If the Respondent is a close corporation, the full names of the members shall be stated in the Bid. If the Respondent is a partnership or an individual trading under a trade name, the full names of the partners or of such individual, as the case may be, shall be furnished.

23 RESPONDENT'S SAMPLES

- 23.1 If samples are required from Respondents, such samples shall be suitably marked with the Respondent's name and address, the Bid number and the Bid item number and must be despatched in time to reach the addressee as stipulated in the Bid Documents on or before the closing date of the Bid. Failure to submit samples by the due date may result in the rejection of a Bid.
- 23.2 Transnet reserves the right to retain samples furnished by Respondents in compliance with Bid conditions.
- 23.3 Payment will not be made for a successful Respondent's samples that may be retained by Transnet for the purpose of checking the quality and workmanship of Goods/Services delivered in execution of a contract.
- 23.4 If Transnet does not wish to retain unsuccessful Respondents' samples and the Respondents require their return, such samples may be collected by the Respondents at their own risk and cost.

24 SECURITIES

- 24.1 The successful Respondent, when called upon to do so, shall provide security to the satisfaction of Transnet for the due fulfilment of a contract or order. Such security shall be in the form of a Deed of Suretyship [Deed of Suretyship] furnished by an approved bank, building society, insurance or guarantee corporation carrying on business in South Africa.
- 24.2 The security may be applied in whole or part at the discretion of Transnet to make good any loss or damage which Transnet may incur in consequence of a breach of the contract or any part thereof.
- 24.3 Such security, if required, shall be an amount which will be stipulated in the Bid Documents.
- 24.4 For the purpose of clause 24.124.1 above, Transnet will supply a Deed of Suretyship form to the successful Respondent for completion and no guarantee in any other form will be accepted. A copy of such form will be supplied to Respondents on request. For this purpose a Deed of Suretyship form will be provided which shall be completed and returned to Transnet or a designated official by the successful Respondent within 30 [thirty] calendar days from the date of the letter of acceptance. No payment will be made until the form, duly completed, is delivered to Transnet. Failure to return the Deed of Suretyship within the prescribed time shall, save where prior extension has been granted, entitle Transnet without notice to the Supplier/Service Provider to cancel the contract with immediate effect.
- 24.5 Additional costs incurred by Transnet necessitated by reason of default on the part of the Supplier/Service Provider in relation to the conditions of this clause 244 will be for the account of the Supplier/Service Provider.

25 PRICE AND DELIVERY BASIS FOR GOODS

- 25.1 Unless otherwise specified in the Bid Documents, the prices quoted for Goods must be on a Delivered Duty Paid [latest ICC Incoterms] price basis in accordance with the terms and at the delivery point or

points specified in Transnet's Bid Documents. Bids for supply on any other basis of delivery are liable to disqualification. The lead time for delivery stated by the Respondent must be inclusive of all non-working days or holidays, and of periods occupied in stocktaking or in effecting repairs to or overhauling plant, which would ordinarily occur within the delivery period given by the Respondent.

25.2 Respondents must furnish their Bid prices in the Price Schedule of the Bid Documents on the following basis:

- a) Local Supplies - Prices for Goods to be manufactured, produced or assembled in the Republic of South Africa, or imported supplies held in South Africa, to be quoted on a Delivered RSA named destination basis.
- b) Imported Supplies - Prices for Goods to be imported from all sources to be quoted on a Delivered Duty Paid [latest ICC Incoterms] basis, to end destination in South Africa, unless otherwise specified in the Bid Price Schedule.

26 EXPORT LICENCE

The award of a Bid for Goods to be imported may be subject to the issue of an export licence in the country of origin or supply. If required, the Supplier/Service Provider's manufacturer or forwarding agent shall be required to apply for such licence.

27 QUALITY OF MATERIAL

Unless otherwise stipulated, the Goods offered shall be NEW i.e. in unused condition, neither second-hand nor reconditioned.

28 VALUE-ADDED TAX

28.1 In respect of local supplies, i.e. Goods to be manufactured, produced or assembled in the Republic of South Africa, or imported supplies held or already in transit to South Africa, the prices quoted by the Respondent are to be inclusive of VAT which must be shown separately at the standard rate on the Tax Invoice.

28.2 In respect of foreign Services rendered:

- a) the invoicing by a South African Service Provider on behalf of its foreign principal rendering such Service represents a Service rendered by the principal; and
- b) the Service Provider's Tax Invoice(s) for the local portion only [i.e. the "commission" for the Services rendered locally] must show the VAT separately.

29 IMPORTANT NOTICE TO RESPONDENTS REGARDING PAYMENT

29.1 Method of Payment

- a) The attention of the Respondent is directed to the Terms and Conditions of Contract which set out the conditions of payment on which Bid price(s) shall be based.
- b) However, in addition to the foregoing the Respondent is invited to submit offers based on alternative methods of payment and/or financing proposals.
- c) The Respondent is required to give full particulars of the terms that will be applicable to its alternative offer(s) and the financial merits thereof will be evaluated and taken into consideration when the Bid is adjudicated.

- d) The Respondent must, therefore, in the first instance, tender strictly in accordance with clause 29.1 (a) above. Failure to comply with clause 29.1 (a) above may preclude a Bid from further consideration.

NOTE: The successful Respondent [the **Supplier/Service Provider**] shall, where applicable, be required to furnish a guarantee covering any advance payments.

29.2 Conditional Discount

Respondents offering prices which are subject to a conditional discount applicable for payment within a specific period are to note that the conditional period will be calculated as from the date of receipt by Transnet of the Supplier/Service Provider's month-end statement reflecting the relevant Tax Invoice(s) for payment purposes, provided the conditions of the order or contract have been fulfilled and the Tax Invoice is correct in all respects as referred to in the contract or order. Incomplete and/or incorrect Tax Invoices shall be returned and the conditional period will be recalculated from the date of receipt of the correct documentation.

30 CONTRACT QUANTITIES AND DELIVERY REQUIREMENTS

30.1 Contract Quantities

- a) It must be clearly understood that although Transnet does not bind itself to purchase a definitive quantity under any contract which may be entered into pursuant to this Bid, the successful Respondent nevertheless undertakes to supply against the contract such quantities as may be ordered against the contract, which orders are posted or delivered by hand or transmitted electronically on or before the expiry date of such contract.
- b) It is furthermore a condition that Transnet will not accept liability for any material/stocks specially ordered or carried by the Respondent with a view to meeting the requirements under any such contract.
- c) The estimated planned quantities likely to be ordered by Transnet per annum are furnished in relevant section of the Bid Documents. For avoidance of doubt the estimated quantities are estimates and Transnet reserves the right to order only those quantities sufficient for its operational requirements.

30.2 Delivery Period

- a) **Period Contracts and Fixed Quantity Requirements**
It will be a condition of any resulting contract/order that the delivery period embodied therein will be governed by the provisions of the Terms and Conditions of Contract.
- b) **Progress Reports**
The Supplier/Service Provider may be required to submit periodical progress reports with regard to the delivery of the Goods/Services.
- c) **Emergency Demands as and when required**
If, due to unforeseen circumstances, supplies of the Goods/Services covered by the Bid are required at short notice for immediate delivery, the Supplier/Service Provider will be given first right of refusal for such business. If it is unable to meet the desired critical delivery period, Transnet reserves the right to purchase such supplies as may be required to meet the emergency outside the contract if immediate delivery can be offered from any other source.

The *Total or Partial Failure to Perform the Scope of Supply* section in the Terms and Conditions of Contract will not be applicable in these circumstances.

31 PLANS, DRAWINGS, DIAGRAMS, SPECIFICATIONS AND DOCUMENTS

31.1 Copyright

Copyright in plans, drawings, diagrams, specifications and documents compiled by the Supplier/Service Provider for the purpose of contract work shall be governed by the Intellectual Property Rights section in the Terms and Conditions of Contract.

31.2 Drawings and specifications

In addition to what may be stated in any Bid Document, the Respondent should note that, unless notified to the contrary by Transnet or a designated official by means of an official amendment to the Bid Documents, it is required to tender for Goods/Services strictly in accordance with the drawings and/or specifications supplied by Transnet, notwithstanding that it may be aware that alterations or amendments to such drawings or specifications are contemplated by Transnet.

31.3 Respondent's drawings

Drawings required to be submitted by the Respondent must be furnished before the closing time and date of the Bid. The non-receipt of such drawings by the appointed time may disqualify the Bid.

31.4 Foreign specifications

The Respondent quoting for Goods/Services in accordance with foreign specifications, other than British and American standards, is to submit translated copies of such specifications with the Bid. In the event of any departures or variations between the foreign specification(s) quoted in the Bid Documents, full details regarding such departures or variations must be furnished by the Respondent in a covering letter attached to the Bid. Non-compliance with this condition may result in disqualification.

32 BIDS BY OR ON BEHALF OF FOREIGN RESPONDENTS

32.1 Bids submitted by foreign principals may be forwarded directly by the principals or by its South African representative or agent to the designated official of Transnet according to whichever officer is specified in the Bid Documents.

32.2 In the case of a representative or agent, written proof must be submitted to the effect that such representative or agent has been duly authorised to act in that capacity by the principal. Failure to submit such authorisation by the representative or agent shall disqualify the Bid.

32.3 When legally authorised to prepare and submit Bids on behalf of their principals not domiciled in the Republic of South Africa, representatives or agents must compile the Bids in the names of such principals and sign them on behalf of the latter.

32.4 South African representatives or agents of a successful foreign Respondent must when so required enter into a formal contract in the name of their principals and must sign such contract on behalf of the latter. In every such case a legal Power of Attorney from their principals must be furnished to Transnet by the South African representative or agents authorising them to enter into and sign such contract.

a) Such Power of Attorney must comply with Rule 63 (Authentication of documents executed outside the Republic for use within the Republic) of the Uniform Rules of Court: Rules

regulating the conduct of the proceedings of the several provincial and local divisions of the Supreme Court of South Africa.

- b) The Power of Attorney must be signed by the principal under the same title as used in the Bid Documents.
- c) If a Power of Attorney held by the South African representative or agent includes matters of a general nature besides provision for the entering into and signing of a contract with Transnet, a certified copy thereof should be furnished.
- d) The Power of Attorney must authorise the South African representative or agent to choose the *domicilium citandi et executandi*.

32.5 If payment is to be made in South Africa, the foreign Supplier/Service Provider [i.e. the principal, or its South African agent or representative], must notify Transnet in writing whether, for payment by electronic funds transfer [EFT]:

- a) funds are to be transferred to the credit of the foreign Supplier/Service Provider's account at a bank in South Africa, in which case the name and branch of such bank shall be furnished; or
- b) funds are to be transferred to the credit of its South African agent or representative, in which case the name and branch of such bank shall be furnished.

32.6 The attention of the Respondent is directed to clause 24 above [Securities] regarding the provision of security for the fulfilment of contracts and orders and the manner and form in which such security is to be furnished.

33 DATABASE OF RESTRICTED SUPPLIERS

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 Bid shall be awarded to a Bidder 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 Bidder should it be established, at any time, that a bidder has been restricted with National Treasury by another government institution.

34 CONFLICT WITH ISSUED RFX DOCUMENT

34.1 Should a conflict arise between these General Bid Conditions and the issued RFX document, the conditions stated in the RFX document shall prevail.

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NON DISCLOSURE AGREEMENT

[April 2020]

THIS AGREEMENT is made between

Transnet SOC Ltd [Transnet] [Registration No. 1990/000900/30]

whose registered office is at 49th Floor, Carlton Centre, 150 Commissioner Street, Johannesburg 2001,

and

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 Bid Document.

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** 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 Bid or for the subsequent performance of any contract between the parties in relation to the Bid.
- 2.3 Notwithstanding clause 2.1 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 2.2 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 2.4 below.
- 2.4 In the event that the Receiving Party is required to disclose any Confidential Information in accordance with clause 2.3.2 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 Bid 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 Bid 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 Bid 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 Bid 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 Bid 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.

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Important Note: All potential bidders must read this document and certify in the RFX Declaration Form that they have acquainted themselves with, and agree with the content. The contract with the successful bidder will automatically incorporate this Integrity Pact as part of the final concluded contract.

INTEGRITY PACT

Between

TRANSNET SOC LTD

Registration Number: 1990/000900/30

("Transnet")

And The Bidder / Supplier/ Service Provider / Contractor (hereinafter referred to as the "Bidder / Supplier")

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 Bidders / Suppliers.

In order to achieve these goals, Transnet and the Bidder / Supplier hereby enter into this agreement hereinafter referred to as the "Integrity Pact" which will form part of the Bidder's / Supplier'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 Bidders / Suppliers 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 Bidder / Supplier 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 Bidders / Suppliers 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 Bidder, either for themselves or for any person, organisation or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to any contract.
- 2.2 Transnet will, during the registration and bidding process treat all Bidders / Suppliers with equity, transparency and fairness. Transnet will in particular, before and during the registration process, provide to all Bidders / Suppliers the same information and will not provide to any Bidders / Suppliers confidential / additional information through which the Bidders / Suppliers could obtain an advantage in relation to any bidding process.
- 2.3 Transnet further confirms that its employees will not favour any prospective bidder in any form that could afford an undue advantage to a particular bidder during the tendering stage, and will further treat all Bidders / Supplier participating in the bidding process in a fair manner.
- 2.4 Transnet will exclude from the bidding process such employees who have any personal interest in the Bidders / Suppliers participating in the bidding process.

3 OBLIGATIONS OF THE BIDDER / SUPPLIER

- 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 Bidder / Supplier commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any ensuing contract stage in order to secure the contract or in furtherance to secure it and in particular the Bidder / Supplier commits to the following:
- a) The Bidder / Supplier 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 bidding process or to any third person any material or other benefit or payment, in order to obtain in exchange an advantage during the bidding process; and
 - b) The Bidder / Supplier 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 bidding process, or to any person, organisation or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.
- 3.3 The Bidder / Supplier will not collude with other parties interested in the contract to preclude a competitive bid price, impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract. The Bidder / Supplier further commits itself to delivering against all agreed upon conditions as stipulated within the contract.
- 3.4 The Bidder / Supplier will not enter into any illegal or dishonest agreement or understanding, whether formal or informal with other Bidders / Suppliers. This applies in particular to certifications, submissions or non-submission of documents or actions that are restrictive or to introduce cartels into the bidding process.
- 3.5 The Bidder / Supplier will not commit any criminal offence under the relevant anti-corruption laws of South Africa or any other country. Furthermore, the Bidder / Supplier 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 Bidder / Supplier 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 bidding process. Similarly, the Bidder / Supplier of South African nationality shall furnish the name and address of the foreign principals, if any, involved directly or indirectly in the registration or bidding process.
- 3.7 The Bidder / Supplier will not misrepresent facts or furnish false or forged documents or information in order to influence the bidding process to the advantage of the Bidder / Supplier or detriment of Transnet or other competitors.

- 3.8 Transnet may require the Bidder / Supplier 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 Bidder / Supplier will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 3.10 The Bidder/Supplier 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 BIDDING

- 4.1 For the purposes of this undertaking in relation to any submitted Bid, the Bidder declares to fully understand that the word "competitor" shall include any individual or organisation, other than the Bidder, whether or not affiliated with the Bidder, who:
- a) has been requested to submit a Bid in response to this Bid invitation;
 - b) could potentially submit a Bid in response to this Bid invitation, based on their qualifications, abilities or experience; and
 - c) provides the same Goods and Services as the Bidder and/or is in the same line of business as the Bidder.
- 4.2 The Bidder has arrived at his submitted Bid 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 bidding.
- 4.3 In particular, without limiting the generality of paragraph 4.2 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 Bid;
 - e) the submission of a Bid which does not meet the specifications and conditions of the RFP; or
 - f) bidding with the intention of not winning the Bid.
- 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 Bid relates.
- 4.5 The terms of the Bid as submitted 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.
- 4.6 Bidders are 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 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

5 DISQUALIFICATION FROM BIDDING PROCESS

- 5.1 If the Bidder / Supplier has committed a transgression through a violation of paragraph 3 of this Integrity Pact or in any other form such as to put its reliability or credibility as a Bidder / Supplier into question, Transnet may reject the Bidder's / Supplier's application from the registration or bidding process and remove the Bidder / Supplier from its database, if already registered.
- 5.2 If the Bidder / Supplier has committed a transgression through a violation of paragraph 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 Bidder / Supplier from future bidding 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 Bidder / Supplier 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 Bidder / Supplier 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 DATABASE OF RESTRICTED SUPPLIERS

- 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 Bid shall be awarded to a Bidder 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 Bidder should it be established, at any time, that a bidder has been restricted with National Treasury by another government institution.
- 6.2 All the stipulations on Transnet's restriction process as laid down in Transnet's Supply Chain Policy and Procurement Procedures Manual are included herein by way of reference. Below follows a condensed summary of this restriction 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 supplier or contractor to Transnet may not subcontract any portion of the contract to a restricted company.
- 6.7 Grounds for restriction include: If any person/Enterprise which has submitted a Bid, concluded a contract, or, in the capacity of agent or subcontractor, has been associated with such Bid or contract:
 - a) Has, in bad faith, withdrawn such Bid after the advertised closing date and time for the receipt of Bids;
 - b) has, after being notified of the acceptance of his Bid, failed or refused to sign a contract when called upon to do so in terms of any condition forming part of the bid documents;
 - c) has carried out any contract resulting from such bid 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) has submitted false information regarding any other matter required in terms of the Preferential Procurement Regulations, 2017 issued in terms of the Preferential Procurement Policy Framework Act which will affect the evaluation of a Bid or where a Bidder has failed to declare any subcontracting arrangements;
 - h) caused Transnet damage, or to incur costs in order to meet the contractor's requirements and which could not be recovered from the contractor;
 - i) has litigated against Transnet in bad faith.

7 PREVIOUS TRANSGRESSIONS

- 7.1 The Bidder / Supplier 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 Bidder's / Supplier's database or any bidding process.
- 7.2 If it is found to be that the Bidder / Supplier made an incorrect statement on this subject, the Bidder / Supplier can be rejected from the registration process or removed from the Bidder / Supplier 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 Bidder / Supplier from the bidding process or call off the pre-contract negotiations without giving any compensation to the Bidder / Supplier. However, the proceedings with the other Bidders / Suppliers may continue;
- b) Immediately cancel the contract, if already awarded or signed, without giving any compensation to the Bidder / Supplier;
- c) Recover all sums already paid by Transnet;
- d) Encash the advance bank guarantee and performance bond or warranty bond, if furnished by the Bidder / Supplier, in order to recover the payments, already made by Transnet, along with interest;
- e) Cancel all or any other contracts with the Bidder / Supplier;
- f) Exclude the Bidder / Supplier from entering into any bid with Transnet and other organs of state in future for a specified period; and
- g) If the Supplier subcontracted a portion of the bid to another person without declaring it to Transnet, Transnet must penalise the Supplier up to 10% of the value of the contract.

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 bidding / 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 bid committee member or any person involved in the sourcing process must be declared in a prescribed form.

9.3 If a Bidder / Supplier 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 bid which will be considered for the bid process, the Bidder / Supplier:

- 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 Bidder / Supplier 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 Bidder / Supplier.

10 DISPUTE RESOLUTION

10.1 Transnet recognises that trust and good faith are pivotal to its relationship with its Bidders / Suppliers. When a dispute arises between Transnet and its Bidder / Supplier, 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 restriction process as mentioned in paragraph 6 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 supplier make a false statement either in giving evidence or on an affidavit;
- c) **Scurrilous allegations:** where a supplier makes allegations regarding a senior Transnet employee which are without proper foundation, scandalous, abusive or defamatory; and
- d) **Abuse of court process:** when a supplier abuses the court process in order to gain a competitive advantage during a bid 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 bidding 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 Bidder / Supplier be confronted with dishonest, fraudulent or corruptive behaviour of one or more Transnet employees, Transnet expects its Bidders / Suppliers 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 abide by it. To the best of the Parties' knowledge and belief, the information provided in this Integrity Pact is true and correct.

oooOOOooo

**FOR THE PROVISION OF SERVICE FOR OIL REGENERATION, OIL PURIFICATION AND OIL SAMPLING
AT VARIOUS 3KV DC TRACTION SUBSTATIONS**

ANNEXURES: Specifications

1. CEE – 0229_ISS95
2. CEE – GI_012_ISS_2
3. SANS 555 – 1
4. SANS 555 – 2
5. SANS 555 – 3
6. SANS 555 – 4
7. BBB 5019_Ver_6

**SPOORNET
(INFRASTRUCTURE) (ELECTRICAL)**

SPECIFICATION No. CEE.0229.95

**DRY-OUT AND REGENERATION OF INSULATING OIL AND RECLAIMING AND
DE-SLUDGING OF TRANSFORMERS**

This specification covers Spoornet's requirements for in situ dry-out and de-sludging of power transformers and reclaiming insulating oil by means of regeneration

SPECIFICATION No. CEE.0229.95

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SPECIFICATION No. CEE.0229.95

1.0 SCOPE

This specification covers Spoornet's requirements for the dry-out and de-sludging of power transformers and reclaiming of insulating oil by means of regeneration.

2.0 REFERENCE AND STANDARDS

The following publication is referred to herein.

South African Bureau of Standards

SABS 555 : Mineral Insulating Oil for Transformers and Switch gear.

3.0 METHOD OF TENDERING

3.1 Tendering shall be in accordance with Spoornet (Infrastructure) (Electrical) specification CEE.0012.

Complies/Does not comply

3.2 Tendering prices shall be based on cost of the process that will achieve the results required as per clause 9.0 for each individual transformer described in Appendix 1,2 & 3.

Complies/Does not comply

3.3 Tenderer's shall quote separately for the replacement of lost oil if required, (per litre).

Complies/Does not comply

3.4 Spoornet reserves the right to inspect the Tenderer's facilities prior to awarding the contract in order to ensure that suitable equipment is available for the type of operation.

Complies/Does not comply

4.0 APPENDICES

The following appendices form an integral part of this specification:

Appendix 1: Schedule of transformers to be regenerated.

Appendix 2: Schedule of transformers to be de-sludged.

Appendix 3: Schedule of transformers to be dried-out.

Appendix 4: Moisture content of oil leaving transformer at which dry-out process must be terminated for various transformers temperatures.

SPECIFICATION No. CEE.0229.95

5.0 TRANSFORMER DRY-OUT (DE-ENERGISED)

- 5.1 Note: Any moisture present in the transformer will be partly in the oil and partly in the layers of solid insulation. Normally more than 95 percent of moisture in the transformer is trapped in the insulation and less than 5 percent in the oil. Removal of moisture from the solid insulation in situ is a slow process due to the slow rate of diffusion of moisture between insulation and oil. No quick dry-out processes (eg 48 hours) will thus be accepted, as this will dry-out the oil only and not the solid insulation.

- 5.2 The dry-out plant shall include a vacuum type drier, or alternative dry-out method with suitable filter (see clause 6.2.1) to remove the solid particles and a suitable pump (see clause 6.2.2).

Complies/Does not comply

- 5.2.1 The hoses between the dry-out plant and the transformer shall have a built-in earth conductor to avoid static electricity to be charged to a high potential. The filter and tanks in the plant shall also be connected to earth.

Complies/Does not comply

- 5.2.2 The transformer tank shall not be subjected to a vacuum in excess of the maximum possible indication on the transformer name plate.

Complies/Does not comply

- 5.2.3 The oil temperature inside the transformer tank shall not exceed 90 degrees Celsius while the dry-out process is in progress.

Complies/Does not comply

- 5.3 The silica gel crystals in the transformer breather shall be replaced at the start of the dry-out process and the colour change shall be monitored during the process. New crystals shall be provided when more than 50 percent of the crystals are coloured pink.

Complies/Does not comply

5.4 ON LOAD DRY-OUT

- 5.4.1 When using an on load dry-out plant the Contractor shall work in close conjunction with the Regional Engineer Electrical staff, who will lay down the requirements for safe operation of the plant.

Complies/Does not comply

6.0 REGENERATION OF OIL (Purification)

- 6.1 In order to remove acidic and colloidal contaminants an activated clay or Fuller's earth process shall be used to achieve the results required as per clause 9.0.

Complies/Does not comply

SPECIFICATION No. CEE.0229.95

- 6.1.1 The purification plant shall include provision for heating, automatic vacuum degasser, and shall be able to draw a vacuum in the transformer as well as circulate the oil in the transformer.
- Complies/Does not comply
- 6.2 In the event of reclaiming of oil only being required, the complete volume of oil in the transformer may be replaced with new or factory regenerated oil as alternative to clause 6.1. When pumping oil into electrical equipment, the following precautionary measures shall be taken:
- 6.2.1 A paper filter (0,5 micron) shall always be installed between the pump and the equipment.
- Complies/Does not comply
- 6.2.2 Pumps shall not have metal-to-metal friction which can release conductive metal particles into the oil.
- Complies/Does not comply
- 6.2.3 The Contractor shall ensure that no air is trapped in the transformer while new oil is being added to the transformer. The tenderer shall indicate what method will be used to prevent air being trapped.
- Complies/Does not comply
- 7.0 DE-SLUDGING OF TRANSFORMERS
- 7.1 The transformer shall be de-sludged in situ, completely filled with oil in accordance with the following process:-
- Complies/Does not comply
- 7.1.1 The oil shall be heated and maintained at a temperature of approximately 90 degrees Celsius in the transformer, where the sludge in the transformer will go from a solid to a solution, re-entering the oil. A temperature of approximately 80 degrees Celsius should be reached in the core of the transformer and shall then be subjected to multiple passes of hot oil, for sufficient time to dissolve the sludge inside the transformer. The dissolved sludge is to be removed from the oil by passing the oil through an activated clay or Fuller's earth medium.
- Complies/Does not comply
- 7.2 If required, and in agreement with Spoornt, the transformer may be kept on load to minimise the amount of external energy to obtain the laid down temperature of approximately 80 degrees Celsius in the core.

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8.0 REPLACEMENT OF LOST OIL

On completion of the process the oil level in the conservator shall be at the original level prior to the commencement of the dry-out, reclaiming or the de-sludging processes.

Complies/Does not comply

9.0 TESTS ON OIL

- 9.1 The oil shall be tested by Spoornet immediately after completion of the process to confirm compliance with the requirements of SABS 555 for both reclaiming and de-sludging. The requirements for dielectric strength shall be 65kV.

Comply/Does not comply

- 9.2 During the filtration dry-out process the oil shall be tested by the contractor periodically and the process shall be stopped if the moisture content in the oil leaving the transformer core is in accordance with the moisture content values as stipulated in appendix 4.

Complies/Does not comply

- 9.2.1 Tests shall be carried out 2 weeks after termination of the dry-out process to ensure that the moisture content in the oil is still within the permissible limits (see Appendix 4).

Complies/Does not comply

10.0 PRECAUTIONARY MEASURES

- 10.1 If reclamation is done on the transformer oil in the main tank with positive head pressure, a non-return check valve shall be installed between the transformer and the outlet hose from the filtration plant, in order to prevent excessive spilling of oil in the event of failure of the outlet hose.

Complies/Does not comply

- 10.2 An automatic isolating valve must be coupled to the transformer valve on the inlet side of the plant which will be closed automatically, in the event of a plant malfunction or when the oil level in the tank drops due to an inlet hose failure.

Complies/Does not comply

- 10.2.1 The following protection alarms must be provided on the dry-out plant if not attended full time:

- 10.2.1.1 Thermal motor failure.

Complies/ Does not comply

- 10.2.1.2 Pressure loss by using pressure switches.

Complies/ Does not comply

SPECIFICATION No. CEE.0229.95

- 10.2.1.3 The plant must have a leak proof base, with an automatic detection device to shut off the plant.

Complies/ Does not comply

- 10.2.2 The above alarms can be coupled via the Spoornet tellecontrol to give an alarm indication to Electrical Control.

- 10.2.3 Precautionary measures shall be taken to prevent environmental pollution.

Complies/Does not comply

11.0 INSPECTION

- 11.1 Spoornet reserves the right to be present during any stage of the process and must be timeously advised of dates of recommencement of any process.

Complies/Does not comply

12.0 GUARANTEE

- 12.1 The Contractor shall guarantee the transformer oil for a period of 12 months after the reclaiming and de-sludging process has been completed to comply with the requirements of clause 9.1, except for dielectric strength and water content.

Complies/Does not comply

- 12.2 The moisture content of the transformer shall be guaranteed to comply with the requirements of clause 9.2.1.

Complies/ Does not comply

- 12.3 Should the oil fail the tests as stated in clause 9.0, the Contractor shall repeat the process at his own cost.

Complies/Does not comply

TENDERER'S SIGNATURE

DATE

CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)

SPECIFICATION No. CEE.0229.95

APPENDIX 1

PAGE 1 OF 1

SCHEDULE OF TRANSFORMERS TO BE REGENERATED

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
Oil Properties	Before	After	After 12 Months
3. Acid content (mg KOH/g oil):	_____	_____	_____
4. Moisture content (ppm):	_____	_____	_____
5. Dielectric strength (kV):	_____	_____	_____
6. Sludge content (< 0,02%):	_____	_____	_____

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
Oil Properties	Before	After	After 12 Months
3. Acid content (mg KOH/g oil):	_____	_____	_____
4. Moisture content (ppm):	_____	_____	_____
5. Dielectric strength (kV):	_____	_____	_____
6. Sludge content (< 0,02%):	_____	_____	_____

CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)

REFERENCE :

SPECIFICATION No. CEE.0229.95

APPENDIX 2

PAGE 1 OF 1

SCHEDULE OF TRANSFORMERS TO BE DE-SLUDGED

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
Oil Properties	Before	After	After 12 Months
3. Acid content (mg KOH/g oil):	_____	_____	_____
4. Moisture content (ppm):	_____	_____	_____
5. Dielectric strength (kV):	_____	_____	_____
6. Sludge content (> 0,02%):	_____	_____	_____

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
Oil Properties	Before	After	After 12 Months
3. Acid content (mg KOH/g oil):	_____	_____	_____
4. Moisture content (ppm):	_____	_____	_____
5. Dielectric strength (kV):	_____	_____	_____
6. Sludge content (> 0,02%):	_____	_____	_____

CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)

REFERENCE :

SPECIFICATION No. CEE.0229.95

APPENDIX 3

PAGE 1 OF 1

SCHEDULE OF TRANSFORMERS TO BE DRIED-OUT

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
3. Maximum permissible tank vacuum: _____ torr			
Oil Properties	Before	After	After 2 Weeks
4. Moisture content (ppm):	_____	_____	_____
5. Transformer oil temp (deg C)	_____	_____	_____
6. Dielectric strength (kV):	_____	_____	_____

Identification / Location: _____			
1. Type of transformer: _____			
2. Volume of oil inside transformer: _____ litres.			
3. Maximum permissible tank vacuum: _____ torr			
Oil Properties	Before	After	After 2 Weeks
4. Moisture content (ppm):	_____	_____	_____
5. Transformer oil temp (deg C)	_____	_____	_____
6. Dielectric strength (kV):	_____	_____	_____

**CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)**

REFERENCE :

SPECIFICATION No. CEE.0229.95

APPENDIX 4

PAGE 1 OF 1

**MOISTURE CONTENT OF OIL LEAVING TRANSFORMER AT WHICH DRY-OUT PROCESS
MUST BE TERMINATED FOR VARIOUS TRANSFORMER TEMPERATURES.**

Oil Temperature Degrees Celsius	Moisture Content of Oil ppm (mg/kg)	Oil Temperature Degrees Celsius	Moisture Content of Oil ppm (mg/kg)
10	1,5	55	16,0
15	2,0	60	21,0
20	2,5	65	28,0
25	3,3	70	35,5
30	4,2	75	44,0
35	5,5	80	54,0
40	7,2		
45	9,3		
50	12,0		

Note 1: This table is based on moisture content of not more than 2,0 percent in the paper.

Note 2: The oil temperature shall be the top oil temperature of the transformer.

Note 3: For temperatures falling in between the numbers in the table, use the next lower value.

**CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)**

REFERENCE :

**SPOORNET
(INFRASTRUCTURE) (ELECTRICAL)**

DISTRIBUTION	ENGINEERING INSTRUCTION	GENERAL
A, B	SUPERVISION AND MAINTENANCE OF INSULATING OILS IN ELECTRICAL EQUIPMENT	GI.012 ISSUE 2

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APPENDIX 2	PROCEDURES TO BE FOLLOWED FOR ROUTINE TESTING OF ELECTRICAL INSULATING OILS
APPENDIX 3	MAXIMUM PERMISSIBLE WATER CONTENT OF OIL IN TRANSFORMERS VERSUS TEMPERATURE OF TOP OIL SAMPLE UNDER EQUILIBRIUM CONDITIONS
APPENDIX 4	PROCEDURE TO BE FOLLOWED FOR PREPARATION OF CHEMICALS FOR OIL TESTING

1.0 SCOPE

Note: All references to "oil" in this instruction shall mean mineral insulating oil.

- 1.1 This instruction covers the procedure for storage, handling, testing and maintenance of oil used in electrical equipment.
- 1.2 This instruction does not cover insulating liquids containing Polychlorinated Biphenols (PCB). These are toxic and should be handled strictly in accordance with Engineering Instruction G.009.
- 1.3 This instruction does not cover other synthetic dielectric fluids which should be maintained as per suppliers instructions.

2.0 STORAGE OF OIL IN DRUMS

- 2.1 Drums of insulating oil shall be stored indoors, or under cover.
- 2.2 Drums shall be stored upside down, i.e. with bungs at the bottom.
- 2.3 Before use, oil stored in drums shall be tested for compliance with clause 14.1.1 (Dielectric strength).

3.0 PUMPING OF OIL

- 3.1 When pumping oil into electrical equipment, the following precautionary measures shall be taken:
 - 3.1.1 A 0,5 micron paper filter shall always be installed between the pump and the equipment.
 - 3.1.2 Pumps shall not have metal-to-metal friction which can release conductive metal particles into the oil.

4.0 FILTERING TO RESTORE DIELECTRIC STRENGTH OF OIL

Note: It is not possible to reduce the acidity of insulating oil by filtration. Therefore, if the acidity exceeds the permissible upper limit laid down in clause 14.1.2 the oil must be reclaimed, or replaced (See clause 6.0).

- 4.1 To maintain a high dielectric strength it is important that the oil should be free of impurities such as water and solid particles.
- 4.2 To restore dielectric strength to a permissible level as per clause 14.1.1, one of the following methods shall be used to remove moisture and solid particles from the oil:
 - 4.2.1 Heat-vacuum process
 - 4.2.1.1 This method requires an external heating system, with a suitable oil filter for removal of solid particles and a vacuum-type drier capable of providing a vacuum of 5 mm Hg (5 mm Hg = 5 Torr).

- 4.2.1.2 The advantage of the vacuum process in contrast to heat alone, lies in the de-gasification effect, which removes dissolved water and other gasses from the oil. This does not occur with other methods of filtering the oil.

4.2.2 Cartridge filter press

The traditional filter press or cartridge filter cannot remove dissolved water from the oil but is effective in removing solid impurities and thereby improving the dielectric strength.

Note: Only plants of the heat-vacuum type shall be purchased in the future due to the shortcomings of the traditional filter presses as mentioned above.

5.0 TRANSFORMER DRY-OUT

Note: In the event of the acidity of oil being in excess of the permissible level (clause 14.1.2) the oil shall be reclaimed or replaced as per clause 6.0 prior to proceeding with the dry-out process.

- 5.1 Any moisture present in the transformer will be partly in the oil and partly deposited in the layers of insulation. It has been established that more than 95 percent of moisture in a transformer is trapped in the insulation, and less than 5 percent in the oil.

- 5.2 To determine the water content of oil in a transformer, the test method as described in Appendix 2, clause 3.2 shall be used. Should the water content exceed the values indicated in Appendix 3, one of the following procedures shall be used to remove the water from the transformer:

5.2.1 Transformer on site and de-energised

- 5.2.1.1 This procedure requires a filter with vacuum-type drier plus a heater, as per clause 4.2.1.1. This is a slow process due to the slow rate of diffusion of moisture between the insulation and the oil. Depending on the amount of moisture present in the core, this process can take up to 6 weeks to complete.

- 5.2.1.2 The effectiveness of the dry-out process can be monitored by measuring the rate of water extraction by the plant. During filtration the oil shall be tested periodically and the dry-out process terminated when the moisture content of the oil leaving the transformer is not more than 3 parts per million (ppm). A check must be carried out 2 weeks after termination of the process to ensure that moisture content is still within permissible levels as per Appendix 3.

- 5.2.1.3 Should the withdrawal of a transformer from service for lengthy periods be undesirable, the alternative method as per clause 5.2.2 should be considered.

5.2.2 Transformer on site and on load

This method requires an on-load filtration plant, using Fullers earth as filter medium and which is equipped with suitable safety devices. Depending on the amount of water present, the dry-out process can last from 8 to 20 weeks. On site dry-out with a transformer on load can only be carried out by suitably qualified contractors.

5.2.3 Oven dry-out

If the dry-out is being done in a workshop, the core may be removed from the tank and dried in an oven. Larger units may be dried in their tanks inside a suitable enclosure.

Note: During dry-out the temperature of the transformer shall not exceed 140 degrees Celsius to prevent degradation of the insulation.

6.0 RECLAIMING OR REPLACING OF OIL

Note: In the event of the acidity of the oil being in excess of the permissible level (clause 14.1.2) the oil shall be reclaimed or replaced.

6.1 Reclaiming is a process which uses Fullers earth as a medium to remove the acidic and colloidal contaminants and other products of oil deterioration from the oil. This process produces clean dry oil which complies with the specification for new oil.

6.2 The choice of whether oil should be reclaimed or replaced with new oil shall depend upon practical and economic considerations for a given situation.

6.3 Reclaiming of oil can either be carried out on site, with the transformer/equipment de-energised or alternatively in the factory or workshop. On site reclaiming is carried out using specialised equipment and can only be carried out by suitably qualified contractors. See Specification CEE.0229 to be used for contract purposes

6.4 Oil that has been reclaimed or replaced shall be tested after 6 months and should the acidity have increased by more than 0,03 mg Potassium Hydroxide (KOH)/g oil, the transformer shall be de-sludged as described in clause 7.0.

7.0 TRANSFORMER DE-SLUDGE

7.1 Transformers must be desludged as soon as the permissible sludge limit as per clause 14.1.3 is exceeded; or when accelerated deterioration sets in after reclaiming or replacing the oil as per clause 6.4.

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- 7.2 This procedure has two requirements to accomplish effective de-sludging of a transformer:
 - 7.2.1 The oil must be heated to the temperature at which the sludge will dissolve (i.e. 72 degrees Celsius to 82 degrees Celsius).
 - 7.2.2 The oil must be clean.
- 7.3 The sludge deposited on the interior of the transformer will, in the presence of the clean hot oil, go from a solid into a solution, re-entering the oil. This oil is then filtered through Fullers earth where the dissolved sludges are stripped out by adsorption and the clean oil is returned to the transformer.
- 7.4 For successful de-sludging the hot oil must penetrate into all parts of the transformer, i.e. the insulating paper, the cooling radiators, through the cooling ducts and in between the windings. The transformer must be subjected to multiple passes of hot oil throughout the entire structural system, so that the sludge is exposed to the hot oil for sufficient time in order to effectively remove the sludge from the inside of the transformer. The complete de-sludging process normally requires 40 to 80 re-circulations of hot oil through the transformer.
- 7.5 This process requires specialised equipment, and can at present only be carried out by suitably qualified contractors. The process is carried out only on site with the transformer energised. See Specification CEE.0229 to be used for contract purposes.
- 8.0 PREVENTION OF OIL CONTAMINATION IN TRANSFORMERS BY MOISTURE
 - 8.1 To avoid moisture contamination of oil in transformers fitted with dehydration type breathers, the silica-gel charge shall be replaced when approximately 50 percent of crystals have turned pink.
 - 8.2 Inspection vents, caps or plugs on the conservator tank and breathers shall at the same time be checked for leaks.
 - 8.3 The following precautions must be taken when replacing gaskets on a transformer tank:
 - 8.3.1 The work is to commence as soon as possible after de-energising the transformer so that the oil is as hot as possible when the tank is opened to atmosphere.
 - 8.3.2 The tank is to be sealed overnight and a vacuum is to be drawn, if possible.
 - 8.3.3 The work is to be completed without undue delay.

- 9.0 SWITCH-GEAR
 - 9.1 Routine tests shall be carried out on switch-gear oil in accordance with clause 12.2 and should the test be failed, the oil shall be filtered or replaced.
 - 9.1.1 In the case of oil filtering, the appropriate procedure described in clause 4.0 shall be used.
 - 9.1.2 After filtration, the oil shall be re-tested.
 - 9.1.3 On complete overhaul of switch-gear, the oil shall be filtered or replaced with new oil.
- 10.0 OIL COOLED RECTIFIERS
 - 10.1 No tests are prescribed for oil in oil cooled rectifiers.
 - 10.2 In the event of flash-overs occurring inside the rectifier, the oil shall be replaced.
- 11.0 OIL TO BE TESTED BEFORE USE
 - 11.1 New oil in tanks and drums shall be tested for dielectric strength before use, as per Appendix 2, clause 2.0.
 - 11.2 Oil in equipment that has been decommissioned for longer than 3 months shall be tested for dielectric strength and water content in accordance with Appendix 2, clauses 2.0 and 3.0 before commissioning.
 - 11.3 The results shall be recorded in the test book used by electrical laboratory personnel. See Engineering Instruction GI.008.
- 12.0 ROUTINE TESTING OF OIL
 - 12.1 Oil in transformers shall be tested as per Appendix 2 on a routine basis as follows:
 - 12.1.1 A schedule for tests shall be drawn up. The intervals between tests shall be determined in accordance with the operating conditions of the individual equipment, but shall not exceed the following:
 - 12.1.1.1 Transformers of 500 kVA and greater, 4 yearly except dissolved gas analysis (DGA).
 - 12.1.1.2 Dissolved gas analysis must be performed annually on all traction transformers above the age of 25 years. In addition, all transformers classified as strategic, as recommended in section 5 of publication CEE EP.005 (Condition Monitoring of Network Transformers), must be monitored on an annual basis. If the gas content exceeds the limits as per clause 14.1.5, more regular monitoring should take place as specified in the same clause.

- 12.1.1.3 Should sufficient historical data on transformer failures be available, economic and risk analysis must be carried out on all transformers other than traction, before a routine DGA is introduced. If justified, DGA should be carried out annually.
- 12.2 Oil in switch-gear shall be tested annually for dielectric strength in accordance with Appendix 2, clause 2.0.
- 12.2.1 In the event of switch-gear not having operated during the 12 months since the last test, the test may be postponed for another year.
- 13.0 OIL PROPERTIES TO BE TESTED FOR
- 13.1 Dielectric strength
- 13.1.1 This test serves to indicate the presence of conductive contaminants such as free water, dirt, cellulosic fibres, filter dust, metallic cuttings or splinters but not dissolved water under 80 percent saturation, acids, or sludge.
- Note: A good dielectric strength (i.e. 35 kV or higher) can disguise a dissolved water problem.
- 13.1.2 This test shall be carried out as per Appendix 2, clause 2.0 and the oil shall be deemed acceptable if complying to the limits as per clause 14.1.1.
- 13.2 Neutralisation number (Acidity)
- 13.2.1 The neutralisation number of an oil is a measure of the acid content of the oil. It may be used as a guide for determining when oil should be replaced or reclaimed.
- 13.2.2 The acid content is expressed as the number of milligrams of potassium hydroxide (KOH), a base, that is required to neutralise the acid in a one gram sample of oil. Appendix 2, clause 4.0 describes the test method and is used for both new and used oil.
- Note: This method is not very sensitive and cannot be used for determining neutralisation numbers below 0,005 mg KOH/g oil (effect of one drop of 0,1 N mg KOH/g oil). A more accurate method for determining neutralisation number below 0,005 is to use potentiometric titration equipment and involves specialised laboratory procedures.
- 13.2.3 The results of routine tests carried out on a particular item of equipment shall be plotted in graphical form. The neutralisation number should increase linearly with time within the accuracy of the test method used. Should a significant non-linearity occur in the graph the test shall be repeated and if confirmed as correct, the office of the Chief Engineer (Electrical) must be consulted for further action to be taken. The neutralisation number shall in any event not be allowed to exceed the value given in clause 14.1.2.

13.3 Dissolved gas analysis

- 13.3.1 Faults caused by partial electrical discharges or localised overheating and arcing inside the transformer leads to decomposition (breakdown) of the oil and insulation materials (paper, barrier board, resin, etc.). This decomposition of insulation causes gas generation which will generally dissolve in oil.
- 13.3.2 The Buchholtz relay is a gas collector relay in the transformer and operates on a large release of gas or on the accumulation of approximate 250 cc volume gas. However, it does not respond to breakdowns which produce gas at a very slow rate.
- 13.3.3 The technique of gas-chromatography has been developed which makes it possible to separate a mixture of gases dissolved in oil to identify the various types of gases present. If the gases are generated slowly, they are quantitatively dissolved in the oil and if these faults are not discovered, they can slowly attack the insulation to a point where serious damage results to the transformer. For this reason there is a general trend, especially with larger transformers, to monitor the oil for degenerated gases in the solution. The amounts and quantity of gases in the oil can identify the severity and type of faults. The magnitude of the normal concentrations of gas depends on the age and loading of the transformers but limiting values for the concentrations for various decomposition gases can be determined empirically. The permissible concentrations of various types of gases are given in clause 14.1.5.
- 13.3.4 In the event of Buchholtz relay operation, it is recommended that oil samples be taken for dissolved gas analysis, rather than analysing the trapped gas in the relay.
- 13.3.5 The dissolved gas analysis can only be done by suitably equipped laboratories providing this service.

13.4 Water content

- 13.4.1 Moisture in oil may emanate from either the atmosphere via the breather or leaking gaskets, or is produced by deterioration of paper and oil in transformers and equipment.
- 13.4.2 Water, even in minute quantities is harmful in power equipment because it is attracted to the places where electrical stress is highest. Concentration of moisture in those areas may result in ultimate failure of the insulation.
- 13.4.3 Water also accelerates the deterioration of the insulating material (paper etc.) and more water is produced during this process. This is a continuous cycle and once the paper has been degraded it can never (unlike the oil) be returned to its original condition.

13.4.4 It is therefore essential that the moisture content of the oil in transformers be measured accurately, using the Karl Fischer method as per Appendix 2, clause 3.0. The maximum permissible moisture content is shown in Appendix 3.

13.5 Sludge

13.5.1 Oil in service is subject to deterioration due to oxidation reactions which are accelerated by elevated temperature and the presence of metals or organometallic compounds or both, acting as oxidation promoters. Change in colour, formation of acid compounds and at an advanced stage of oxidation, separation of sludge may occur which in turn will result in the dielectric properties being impaired.

13.5.2 The sludge content of oil must be tested according to the method described in Appendix 2, clause 5.0. Where sludge is detected (see clause 14.1.3) the oil must be reclaimed or replaced as per clause 6.0 and the transformer must be desludged.

Note: Precipitable sludge occurs only when oxidation is sufficiently advanced. Experience shows that the sludge test is not needed as long as the neutralisation number (NN) is below 0,4 mg KOH/g oil.

14.0 PERMISSIBLE LIMITS FOR PROPERTIES TESTED

14.1 The following values for the various tests shall be considered as being the permissible limits.

14.1.1 Dielectric breakdown strength:
New oil - not less than 35 kV.
Oil in service - not less than 30 kV.

14.1.2 Neutralisation number (acidity):
New oil - not more than 0,03 mg KOH/g oil.
Oil in service - not more than 0,50 mg KOH/g oil.

Note: The neutrality number for new oil may be increased to 0,05 mg KOH/g oil when phenolphthalein indicator is used instead of alkali blue.

14.1.3 Sludge content:

Oil in service - not more than 0,02 percent.

Note: A sludge test must be carried out only when the neutralisation number (NN) exceeds 0,4 mg KOH/g oil.

- 14.1.4 Water content:
 New oil - Not more than 10 ppm.
 Oil in service - See Appendix 3.

Note: Dielectric strength, neutralisation number, sludge and water content values are based on IEC 422, tables 1 and 2.

14.1.5 Dissolved gas analysis (DGA)

If any one of the gas concentrations indicated in the first column below is exceeded, the gas analysis must be performed every six months and every three months for the concentrations indicated in the second column:

	6 monthly level	3 monthly level
Hydrogen	150 ppm	1 000 ppm (V/V)
Methane	25 ppm	80 ppm (V/V)
Ethane	10 ppm	35 ppm (V/V)
Ethylene	20 ppm	100 ppm (V/V)
Acetylene	15 ppm	70 ppm (V/V)

Where: ppm (V/V) = parts per million volume / volume of specific gas in oil.

Note: The above values are based on DE GRIJP M.H.B.(Dissolved Gas Analysis and its interpretation).

- 14.1.5.1 The transformer must be de-energised when the average total gas content (including CO and CO₂) increases at a rate of more than 10 percent per month, or when recommended by the laboratory.

15.0 ENVIRONMENTAL PRECAUTIONS

When mineral oil has to be disposed of, certain precautions are necessary to avoid risk of environmental pollution, and legal requirements may apply. Normally, if the precautions and regulations applicable to the handling and disposal of industrial and other lubricants (e.g. automobile crank case oil) are applied to mineral insulating oils, no problems should arise. See Guide to Legislation Concerning Hazardous Substance Act (Act 15 of 1973) and the Environmental Conservation Act (Act 73 of 1989).

16.0 ASSOCIATED DOCUMENTS, SPECIFICATIONS, ENGINEERING INSTRUCTIONS AND APPENDICES

- 16.1 The following documents are referred to in this instruction:

- 16.1.1 Guide to Legislation Concerning Hazardous Substance Act (Act 15 of 1973).

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- 16.1.2 DE GRIJP M.H.B. Dissolved Gas Analysis and its interpretation, Hogeschool West-Brabant, Sector Technical Science, Department Electrical Heavy Current, Report 1. October 1989 - Transformer Department ESKOM.
- 16.1.3 The Environmental Conservation Act (Act 73 of 1989).
- 16.1.4 Condition Monitoring of Network Transformers, CEE EP.005.
- 16.2 The following specifications are referred to in this instruction:
 - 16.2.1 ASTM D 1553/79: Standard Test Method for Water in Insulating Liquids. (Karl Fischer Method).
 - 16.2.2 BS 148 : Unused Mineral Insulating Oils for Transformers and Switch-gear.
 - 16.2.3 CEE 0229: Reclamation of Insulating Oil and De-sludging of Transformers.
 - 16.2.4 IEC 156: Method for the Determination of the Electric Strength of Insulating Oils.
 - 16.2.5 IEC 422: Supervision and Maintenance Guide for Mineral Insulating Oils in Electrical Equipment.
 - 16.2.6 IEC 567: Guide for the sampling of gases and oil from oil-filled electrical equipment and for the analysis of free and dissolved gases.
- 16.3 The following Engineering Instructions are referred to in this instruction:
 - 16.3.1 G.009: Electrical Equipment Containing Askarels (Polychlorinated Biphenyls).
 - 16.3.2 GI.008: "Toerusting wat in Elektriese Substasies en algemene Masjienkamers voorsien moet word".
- 16.4 The following appendices form part of this instruction:
 - 16.4.1 APPENDIX 1: Procedure to be Followed for Sampling of Electrical Insulating Oil.
 - 16.4.2 APPENDIX 2: Procedures to be Followed for Routine Testing of Electrical Insulating Oils.
 - 16.4.3 APPENDIX 3: Maximum Permissible Water Content of Oil in Transformers Versus Temperature of Top Oil Sample Under Equilibrium Conditions.
 - 16.4.4 APPENDIX 4: Procedure to be Followed for Preparation of Chemicals for Oil Testing.

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17.0 AMENDMENTS

17.1 This instruction has undergone a general change in format.

17.2 Reference to Dissolved Gas Analysis (DGA) made throughout instruction.

17.3 This instruction supersedes Engineering Instruction GI.012 (Issue 1) of August 1992.

END



**CHIEF ENGINEER (INFRASTRUCTURE)
(ELECTRICAL)**

**SPOORNET
(INFRASTRUCTURE) (ELECTRICAL)**

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A, B	SUPERVISION AND MAINTENANCE OF INSULATING OILS IN ELECTRICAL EQUIPMENT	GI.012 ISSUE 2 APPENDIX 1

PROCEDURE TO BE FOLLOWED FOR SAMPLING OF ELECTRICAL INSULATING OIL

1.0 SAMPLING INSULATING OIL:

Note: The oil sampling procedure is of the utmost importance, as incorrect sampling can result in wrong analysis/diagnosis.

- 1.1 A thief for obtaining oil samples from 200 litre drums is shown in figure 1. It can be made either of metal, or a piece of glass tubing 1 m long to drain or to siphon samples from the drum.
- 1.2 The sample shall be taken with the thief in contact with the bottom of the drum.
- 1.3 To reduce absorption of moisture from the air, samples should not be drawn from containers until the oil is at least as warm as the surrounding air.
- 1.4 Notwithstanding the requirements for storage as per clause 2.1 of this instruction, samples shall never be taken while it is raining.
- 1.5 To take a sample from a drum using the thief method, the top hole shall be closed with the thumb and the open end quickly thrust to the bottom of the drum. The thumb must then be removed. When the thief is filled, the top hole must again be closed by means of the thumb, the thief quickly withdrawn from the drum and the sample of oil drained into the clean sample container.
- 1.6 The free hand shall not be used to block the bottom of the tube or guide the stream of oil.
- 1.7 Care shall be taken when obtaining and handling samples to avoid contamination to ensure accurate test results.

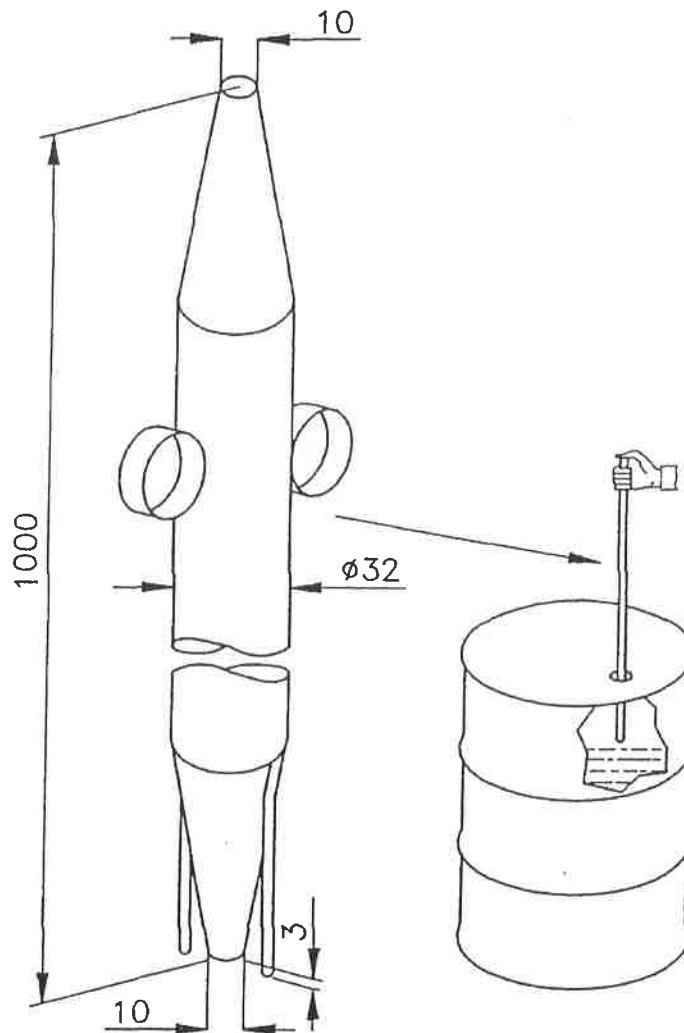
Note: If the sample does come into contact with the sampler's hands or breath, the sample must be retaken.

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APPENDIX 1

- 1.8 For most samples the container may be dark amber glass or plastic of at least 1 litre capacity but for gas analysis, aluminium or tin vessels shall be used. The oil samples shall not be exposed to strong light. An oil resistant seal shall be used in the screw caps to seal the sample against loss of gas or ingress of moisture.
- 1.9 The container shall be cleaned by rinsing with nheptane, iso-propane or trichloroethylene, dried and capped.
- 1.10 Sampling flanges and valves must be cleaned with lint-less cloths before taking samples.
- 1.11 When a sample is taken from drain valves at the bottom of transformers, other electrical equipment or road/rail tank cars, a sufficient amount of oil shall be discarded initially (at least 1 litre). This is to ensure that the sample taken is not the liquid which was trapped in the drain valve or pipe.
- 1.12 The container must be rinsed with the next approximately 200 ml of oil and the valve adjusted to give a steady flow. The valve must not be operated again until the sampling is complete. The container must be filled to the top, the cap secured immediately and taken to the laboratory for test.
- 1.13 When taking samples for water content tests, the operating temperature of the transformer oil must be recorded. If the water content of the first sample exceeds the permissible limit as indicated in appendix 3, a further sample must be taken and the average temperature of the oil in the transformer over the 24 hour period prior to taking the sample, must be taken for the purpose of passing/failing the oil. The oil temperature must be taken by using a glass thermometer held at the opening of the drain valve while taking the sample.
- Note: In the case of transformers, the sample shall not be taken within 24 hours after energising or de-energising the transformer.
- 1.14 Free gases in transformer oil could cause operation of the Buchholtz relay and an alarm trip. After the occurrence of a Buchholtz relay operation, the electrical maintenance staff must contact the Senior Engineering Technician (Electrical) of the Regional Test Laboratory to take samples of the oil for analysis of gas content.
- 1.15 The sampling point on the transformer must be chosen to obtain a representative sample of oil. It is thus essential to take a top and bottom sample from the transformer main tank, if possible.
- 1.16 Sampling containers must be properly labelled and suitably packed. The containers must not be opened until the sample is ready for analysis.

- 1.17 The date, type and location of the equipment, and in case of transformers, the oil temperature must be recorded on the label.
- 1.18 The sample shall be analysed within one week after being taken.



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FIG. 1: DRUM THIEF AND METHOD OF SAMPLING

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PROCEDURES TO BE FOLLOWED FOR ROUTINE TESTING OF ELECTRICAL INSULATING OILS

1.0 VISUAL EXAMINATION

1.1 The colour and odour of the oil can provide valuable information regarding condition of the oil and these aspects must be recorded. This examination must be used to control the validity of the individual tests described in clauses 2.0 to 5.0 of this Appendix.

1.2 Cloudiness may be due to suspended moisture, or solid matter such as iron oxide or sludge.

1.2.1 Dark brown oil is indicative of dissolved asphaltene.

1.2.2 Green oil indicates the presence of copper soap and further deterioration of the oil can be expected to be rapid.

1.2.3 An acid smell is indicative of volatile acids.

2.0 DIELECTRIC STRENGTH

2.1 Test instrument

Dielectric strength shall be measured with a test cell complying with the latest edition of IEC 156 recommendation and shall have spherical electrodes.

2.2 Test method

2.2.1 The sphere gap shall be set to 2,5 plus minus 0,1 mm.

2.2.2 The cell and oil shall initially stand for 5 minutes and shall be covered during this period.

2.2.3 The voltage applied shall be raised at a uniform rate of 2 kV/s until breakdown occurs. This voltage shall be recorded.

2.2.4 After each breakdown test, the oil shall be gently stirred using a clean, dry glass rod or an automatic stirrer if provided, and then be allowed to stand for one minute.

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- 2.2.5 Six breakdown tests shall be carried out on the same cell filling.
- 2.2.6 The dielectric strength is deemed to be the arithmetic mean of the six tests.
- Note: Complete breakdown is indicated by the operation of the circuit breaker protecting the test set. This may be automatically recorded by some of the newer oil test sets.
- 2.3 Dielectric strength tests must be undertaken in a temperature controlled room and the oil samples must have attained a fixed room temperature of 25 plus minus 2 degrees Celsius.
- 3.0 WATER CONTENT
- 3.1 The crackle method is a crude method of detecting water in oil and only indicates presence of free water and may therefore only be used to test oil in switch-gear.
- 3.2 To test the moisture content of oil in transformers it is essential to make use of the Standard Test Method for testing for water in insulating liquids ASTM D 1553/79 method B (Karl Fischer Method). This method can determine water content of insulating liquids in the range 0 to 75 ppm.
- 3.2.1 The Coulometric automatic Karl Fischer titration instrument shall be used for this test.
- 4.0 NEUTRALISATION NUMBER (ACIDITY)
- 4.1 Apparatus
- 4.1.1 25 ml pipette.
- 4.1.2 4 or 5 litre beaker.
- 4.1.3 100 ml graduated cylinder, with 1 ml divisions.
- 4.1.4 250 ml beaker.
- 4.1.5 10 ml burette with 0,1 ml graduations and 0,02 ml division.
- 4.2 Solutions
- 4.2.1 Sufficient volume of normalised solution of potassium hydroxide in alcohol (Alcohol KOH) prepared as per Appendix 4 (Normality [N]).

4.2.2 Carrier-solution

Use 4760 ml isopropyl alcohol, add 240 ml distilled water, stir this mixture thoroughly. Add 5 litres of white spirits to the first mixture and stir well.

Note: Always add the distilled water to the isopropyl alcohol and not vice versa.

4.3 Indicators

Phenolphthalein or Paranaphtholbenzene or Alkali Blue
(See note clause 14.1.2 of Instruction).

4.4 Test method

4.4.1 Take approximately 100 ml of carrier-solution, add three drops of phenolphthalein indicator and stir thoroughly using a clean glass rod.

4.4.2 Fill the 10 ml burette with alcohol KOH and titrate against the above colourless solution until the colour changes to pink (not crimson). This should take between one and five drops of KOH. Note the burette reading (X).

4.4.3 Pipette 25 ml of oil and add this to the titrated solution obtained in clause 4.4.2.

4.4.4 Titrate KOH against the solution of clause 4.4.3 until the colour changes and note the burette reading (A). The colour change will be dependent upon the original solution colour. If phenolphthalein indicator is used the change could be to an orange colour. With colourless oil the change would be to a pink colour. With light green oil the change would be to a light brown colour. If alkali blue indicator is used, the colour change will be from blue/blue green to a strong red colour.

4.4.5 Calculate the acid content of the oil using the following formula:

$$(A-X) \times 2,65 \times N \text{ mg KOH/g oil}$$

Where: N = Normality of KOH.

A = First titration KOH.

X = Second titration oil.

4.4.6 In some instances oil is a very dark red-amber colour, and when diluted with carrier-solution it may still mask the indicator change to pink. To overcome this situation either:

- 4.4.6.1 Use the alternative indicator (paranaphtholbenzene) or
- 4.4.6.2 Neutralise 300 ml carrier-solution and add 25 ml of the oil under test. Phenolphthalein indicator may be used unless the solution still has a definite red tint.

Note: Paranaphtholbenzene will change from an amber colour to green or green-brown.

5.0 DETERMINATION OF SEDIMENT AND SLUDGE

- 5.1 To determine the content of sludge in the oil, the method described in IEC 422, Appendix A, or BS 148 must be used.

- 5.2 This test requires specialised apparatus and can only be carried out by specially equipped laboratories.

6.0 DISSOLVED GAS ANALYSIS

To determine the gas content in oil, the method described in IEC 567 must be used.

Note: The dissolved gas analysis can only be done by suitably equipped laboratories providing this service.

END

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MAXIMUM PERMISSIBLE WATER CONTENT OF OIL IN TRANSFORMERS
VERSUS TEMPERATURE OF TOP OIL SAMPLE UNDER EQUILIBRIUM
CONDITIONS

TEMP. OIL Deg. Celsius	MOISTURE ppm	TEMP. OIL Deg. Celsius	MOISTURE ppm
10	8	31	24
11	9	32	26
12	9	33	27
13	10	34	29
14	10	35	30
15	11	36	31
16	11	37	32
17	12	38	34
18	12	39	36
19	13	40	38
20	13	41	40
21	14	42	43
22	15	43	46
23	16	44	50
24	17	45	53
25	18	46	57
26	19	47	60
27	20	48	64
28	21	49	67
29	22	50	71
30	23		

Note 1: If the water content exceeds 50 ppm, irrespective of temperature, the office of Chief Engineer (Electrical) must be notified.

Note 2: This table is based on values being used by ESKOM for moisture content of 5 percent in the paper insulation.

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PROCEDURE TO BE FOLLOWED FOR PREPARATION OF CHEMICALS FOR OIL TESTING

1.0 INDICATORS

These are made by dissolving approximately 1 g of the indicating material (solid) in 100 ml carrier-solution.

Note: Alkali blue does not readily dissolve and should be refluxed in the carrier-solution.

2.0 ALCOHOL KOH

Note: KOH pellets must be kept in sealed bottles. This material absorbs water which will affect weight.

2.1 Dissolve 15 g KOH in plus minus 15 ml of distilled water. When completely dissolved, add the solution to 5 litres isopropyl alcohol. Allow the final solution to stand for 1 week and shake the final mixture every day for ten minutes, then decant clear liquid from the residue. Store in a dark amber bottle at approximately constant temperature in a dark place for 3 months before use.

2.2 Normalisation and storage:

2.2.1 Take approximately 0,5 g of potassium hydrogen phthalate and determine the mass accurately (W g).

2.2.2 Dissolve the potassium hydrogen phthalate in 100 ml distilled water. Add three drops phenolphthalein indicator.

2.2.3 Titrate alcohol KOH from a 10 ml burette into the above solution until the colour of the solution changes to pink. Record the volume of KOH used (V ml).

2.2.4 The KOH normality is calculated from the formula:

$$\text{Normality KOH} = \frac{W}{V} \times \frac{1000}{204,23}$$

$$= \frac{W}{V} \times 4,9$$

Where: N = Normality of KOH.

W = Mass potassium hydrogen phthalate.

V = Volume KOH pellets.

2.2.5 Always store alcohol (KOH) in amber bottles at constant temperature in a dark place.

END

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Part 1: Unused inhibited mineral insulating oils for transformers and switchgear

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was prepared by National Committee SABS/TC 028/SC 02, *Petroleum products, biofuels and lubricants – Lubricants*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in December 2018.

Reference is made in 4.4.2, the note to 6.17 and the note to 6.18 to the "relevant national legislation". In South Africa this means the National Management: Waste Act 2008 (Act No. 59 of 2008).

SANS 555 consists of the following parts, under the general title *Fluids for Electrotechnical applications*:

Part 1: Unused inhibited mineral insulating oils for transformers and switchgear.

Part 2: Unused uninhibited mineral insulating oils for transformers and switchgear.

Part 3: Recycled inhibited mineral insulating oils for transformers and switchgear.

Part 4: Recycle uninhibited mineral insulating oils for transformers and switchgear.

Annex B forms an integral part of this document. Annex A is for information only.

Compliance with this document cannot confer immunity from legal obligations.

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Fluids for electrotechnical applications

Part 1:

Unused inhibited mineral insulating oils for transformers and switchgear

1 Scope

1.1 This part of SANS 555 is applicable to specifications and test methods for unused and recycled mineral insulating oils. It applies to oil delivered to the agreed point and time of delivery, intended for use in transformers, switchgear and similar electrical equipment in which oil is required for insulation and heat transfer. These oils are obtained by refining, modifying and/or blending of petroleum products and other hydrocarbons.

1.2 This part of SANS 555 applies to oils with and without additives.

1.3 This part of SANS 555 is applicable only to unused mineral insulating oils.

1.4 This part of SANS 555 does not apply to recycled oils.

1.5 This part of SANS 555 does not apply to mineral insulating oils used as impregnants in cables or capacitors.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.

ASTM D93, *Standard test methods for flash point by Pensky-Martens closed cup tester.*

ASTM D97, *Standard test method for pour point of petroleum products.*

ASTM D445, *Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity).*

ASTM D971, *Standard test method for interfacial tension of oil against water by the ring method.*

ASTM D1275, *Standard test method for corrosive sulfur in electrical insulating liquids.*

ASTM D1533, *Standard test method for water in insulating liquids by Coulometric Karl Fischer titration.*

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ASTM D2112, *Standard test method for oxidation stability of inhibited mineral insulating oil by pressure vessel.*

ASTM D4052, *Standard test method for density, relative density and API gravity of liquids by digital density meter.*

DIN 51353, *Testing of insulating oils; detection of corrosive sulfur; silver strip test.*

EN 14210, *Surface active agents – Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method.*

IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method.*

IEC 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity.*

IEC 60422, *Mineral insulating oils in electrical equipment – Supervision and maintenance guidance.*

IEC 60475, *Method of sampling liquid dielectrics.*

IEC 60628, *Gassing of insulating liquids under electrical stress and ionization.*

IEC 60666, *Detection and determination of specified additives in mineral insulating oils.*

IEC 60814, *Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration.*

IEC 60970, *Insulating liquids – Methods for counting and sizing particles.*

IEC 61125, *Unused hydrocarbon-based insulating liquids – Test methods for evaluating the oxidation stability.*

IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds.*

IEC 61619, *Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography.*

IEC 61620, *Insulating liquids – Determination of the dielectric dissipation factor by measurement of the conductance and capacitance – Test method.*

IEC 62021-1, *Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration.*

IEC 62021-2, *Insulating liquids – Determination of acidity – Part 2: Colourimetric titration.*

IEC 62535: 2008, *Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oils.*

IEC 62697-1, *Insulating liquids – Quantitative determination of corrosive sulfur compounds in used and unused insulating liquids – Part 1: Test method for quantitative determination of dibenzyl disulfide (DBDS).*

ISO 2719, *Determination of flash point – Pensky-Martens closed cup method.*

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ISO 3016, *Petroleum products – Determination of pour point.*

ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 3675, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.*

ISO 12185, *Crude petroleum and petroleum products – Determination of density – Oscillating U-tube method.*

ISO 14596, *Petroleum products – Determination of sulfur content – Wavelength-dispersive X-ray fluorescence spectrometry.*

IP 346, *Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions – Dimethylsulfoxide extraction refractive index method.*

IP 373, *Determination of sulfur content– Oxidative microcoulometry method.*

SANS 290, *Mineral insulating oils – Management of polychlorinated biphenyls (PCBs).*

3 Definitions

For the purposes of this document, the following definitions apply.

3.1

acceptable

acceptable to the authority administering part of SANS 555, or to the parties concluding the purchase contract, as relevant

3.2

additive

chemical substance that is added to mineral insulating oil in order to improve certain characteristics

3.3

antioxidant additive

additive incorporated in mineral insulating oil that improves oxidation stability

NOTE A large number of additives which improve oxidation stability, including inhibitors, peroxide decomposers, metal passivators and metal deactivators are available and may be used in oils if declared (see 6.11.1 and 6.11.2).

3.3.1

inhibitor

antioxidant additives of the phenolic-or amine- type, such as 2,6-di-tert-butyl-para-cresol (DBPC) and 2,6-di-tert-butyl-phenol (DBP) described in IEC 60666

NOTE Dibenzyl Disulphide (DBDS) will not be used.

3.3.2

other antioxidant additive

antioxidant additive of the sulfur- or phosphorous- type

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3.3.3

passivator

metal passivator additive used primarily as electrostatic charging depressant, but which may also improve oxidation stability

NOTE Metal passivators are sometimes described as metal deactivators or corrosion inhibitors.

3.4

mineral insulating oil

insulating oil obtained by refining, modifying or blending of petroleum products (or both) and other hydrocarbons

NOTE This does not include insulating liquids such as esters, synthetic aromatics or silicone fluids.

3.5

transformer oil

mineral insulating oil for transformers and similar electrical equipment

3.6

inhibited oil

mineral insulating oil containing a minimum of 0,35 % and a maximum of 0,40 % of total inhibitor content as measured by IEC 60666

3.7

unused mineral insulating oil

mineral insulating oil not recycled as delivered by the supplier

NOTE 1 Such an oil has not been used in, nor been in contact with electrical equipment or other equipment not required for manufacture, storage or transport. The manufacturer and supplier of unused oil will have taken all reasonable precautions to ensure that there is no contamination with polychlorinated biphenyls (PCB) or terphenyls (polychlorinated PCT), used, recycled or dechlorinated oil or other contaminants.

NOTE 2 A blend of unused and recycled oil in any proportion is regarded as being recycled.

4 Requirements (Properties of oil)

NOTE Oil characteristics are listed in tables 1 and 2 and in clause 6.

4.1 Functional properties

These are properties of oil that have an impact on its function as an insulating and cooling liquid.

NOTE Functional properties include viscosity, density, pour point, water content, breakdown voltage and dielectric dissipation factor.

4.2 Refining and stability

This applies to properties of oil that are influenced by quality and type of refining and additives.

NOTE These properties can include appearance, interfacial tension, sulfur content, acidity, corrosive sulfur, 2-furfural and related compounds content and stray gassing.

4.3 Performance

This applies to properties of oil that are related to the long-term behaviour of oil in service or its reaction to high electric stress and temperature (or both).

NOTE Examples include oxidation stability, gassing tendency and electrostatic charging tendency (ECT).

4.4 Health, safety and environment (HSE) properties

4.4.1 Requirements for health, safety and environment (HSE) properties are listed in table 1. The mineral insulating oils which are the subject of this part of SANS 555 should be handled with due regard to personal hygiene. Direct contact with the eyes may cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice should be sought. Some of the tests specified in this part of SANS 555 involve the use of processes that could lead to a hazardous situation.

4.4.2 The disposal of these items should be carried out according to the relevant national legislation (see foreword) with regard to their impact on the environment. Every precaution should be taken to prevent the release of mineral insulating oil into the environment.

NOTE Examples can include flash point, density, (polycyclic aromatics (PCA) and polychlorinated biphenyls/ polychlorinated terphenyls (PCB/PCT)).

5 Classification, identification, general delivery requirements and sampling

5.1 Classification

5.1.1 Classes

For the purposes of this part of SANS 555, mineral insulating oils are classified into the following four classes:

- a) uninhibited unused;
- b) inhibited unused;
- c) uninhibited recycled; and
- d) inhibited recycled.

5.1.2 Antioxidant additive (inhibitor) content

Transformer oils are classified into the following two groups, according to their content of antioxidant additive:

- a) uninhibited transformer oils: marked with U; and
- b) inhibited transformer oils: marked with I.

5.2 Requirements

5.2.1 General requirements of this part of SANS 555 are given in table 1.

5.2.2 Specific requirements are defined under clause 7.

5.3 Miscibility

Unused mineral insulating oils of the same class (see 5.1.1), same group (see 5.1.1), viscosity and pour point as well as containing the same types of additives are considered to be miscible and compatible with each other (see IEC 60422).

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5.4 Identification and general delivery requirements

Identification and general delivery requirements are as follows:

- a) Oil is normally delivered in bulk, rail tank cars, tank containers or packed in new drums or intermediate bulk containers (IBC). These shall be clean and suitable for this purpose to avoid any contamination.
- b) Oil drums and sample containers shall carry at least the following markings:
 - 1) supplier's designation;
 - 2) oil classification (see 5.1); and
 - 3) oil quantity.
- c) As agreed between the supplier and purchaser, each oil delivery may be accompanied by a document specifying the supplier's designation, oil classification, oil compliance certificate and cleanliness certificate.

NOTE This part of SANS 555 may be traceable to a specific batch of oil processed.

- d) The supplier shall declare the generic type of all additives, and their concentrations in the cases of inhibitors and passivators.

5.5 Sampling

Sampling shall be carried out in accordance with the procedure described in IEC 60475.

6 Methods of test

6.1 Viscosity

Viscosity of oil influences heat transfer rates and, consequently, the temperature rise of the equipment or apparatus. The lower the viscosity, the easier the oil circulates leading to improved heat transfer. At low temperatures, the resulting higher viscosity of oil is a critical factor for the cold start of transformers with poor or no circulation of oil and, therefore, possible overheating at the hot spots, and negatively influences the speed of moving parts such as in power circuit breakers, switchgear, on-load tap changer mechanisms, pumps and regulators.

6.2 Pour point

The pour point of mineral insulating oil is the lowest temperature at which the oil will just flow. It is recommended that the pour point should be at least 10 K below the lowest cold start energizing temperature (LCSET). If a pour point depressant additive is used, this shall be declared by the supplier to the user. Pour point shall be measured in accordance with ISO 3016.

6.3 Water content

A low water content of mineral insulating oil is necessary to achieve adequate breakdown voltage and low dissipation losses. To avoid separation of free water, unused insulating oil shall have limited water content. Before filling the electrical equipment, the oil shall be treated to meet the requirements of IEC 60422. Water content shall be measured in accordance with IEC 60814.

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6.4 Breakdown voltage

The breakdown voltage of transformer oil indicates its ability to resist electrical stress in electrical equipment. Breakdown voltage shall be measured in accordance with IEC 60156. The supplier shall demonstrate that after treatment to reduce particles, water and dissolved air by a vacuum procedure, the oil shall have a high dielectric strength (breakdown voltage > 70 kV).

NOTE This treatment referred to consists of filtration of the oil at 60 °C by vacuum (pressure below 2,5 kPa) through a sintered glass filter (with a maximum pore size of 2,5 µm).

6.5 Dielectric dissipation factor (DDF)

Dielectric dissipation factor (DDF) is a measure for dielectric losses within the oil. DDF values above requirements of table 2 can indicate contamination of the oil by polar contaminants or poor refining quality. DDF shall be measured in accordance with IEC 60247 or IEC 61620 at 90 °C. In case of dispute, IEC 60247 at 90 °C should be used.

NOTE By agreement between parties, DDF can be measured at temperatures other than 90 °C. In such cases the temperature of measurement can be stated in the report.

6.6 Appearance

A visual inspection of insulating oil (oil sample in transmitted light under a thickness of approximately 10 cm and at ambient temperature) will indicate the presence of visible contaminants, free water or suspended matter.

6.7 Acidity

Unused mineral insulating oil should be free from any acidic compound. Acidity shall be measured in accordance with IEC 62021-1 or IEC 62021-2.

6.8 Interfacial tension (IFT)

Low interfacial tension (IFT) sometimes indicates the presence of polar compounds. IFT shall be measured in accordance with ASTM D971 or EN 14210.

6.9 Sulfur content

6.9.1 Different organo-sulfur compounds are present in mineral oils, dependent on the crude oil origin and the degree and type of refining. Refining reduces the content of sulfur and aromatic hydrocarbons. As some naturally present sulfur compounds have an affinity to metals, they may act as natural oxidation inhibitors or they may promote corrosion.

6.9.2 Sulfur content is a specific requirement of 7.1.

6.9.3 Sulfur content shall be measured following IP 373 or ISO 14596.

6.10 Corrosive and potentially corrosive sulfur

6.10.1 Some sulfur compounds, for example, mercaptans, are very corrosive to metal surfaces, such as steel, copper and silver (switchgear contacts) and shall not be present in new oil. This type of corrosive sulfur shall be detected following DIN 51353.

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6.10.2 Some other sulphur compounds, for example, dibenzylsulphide (DBDS), may result in the deposition of copper sulphide (Cu_2S) in paper insulation, reducing its electrical insulation properties (see annex A). This has resulted in several equipment failures in service.

6.10.3 General

6.10.3.1 IEC 62535, provides the best currently available method to detect potentially corrosive sulfur compounds in oil. It applies only to oils that do not contain a metal passivator additive (declared or undeclared).

6.10.3.2 For passivator-containing oils, see A.3.

6.11 Additives (see 3.2)

6.11.1 General

The generic type of all additives shall be declared in product data sheets and certificates of compliance. For antioxidant additives and passivators, their concentrations shall also be stated.

6.11.2 Antioxidant additives (see 3.3)

6.11.2.1 Antioxidants slow down the oxidation of oil and, therefore, the formation of degradation products such as oil sludge and acidity. It is useful to know whether and in what proportion antioxidant additives have been added in order to monitor additive depletion during service.

6.11.2.2 Additives that slow down the oxidation of mineral insulating oils include:

- a) Inhibitors such as phenols and amines (see 3.3.1). The most widely used inhibitors are DBPC and DBP (see 3.3.1). Detection and measurement of DBPC and DBP shall be carried out in accordance with IEC 60666. IEC test methods are not available for other types of inhibitors.
- b) Other antioxidant additives such as sulfur- and phosphor- containing compounds, for example, organic polysulfides and dithiophosphates (see 3.3.2). An antioxidant additive of this type is DBDS (see 6.10), but it is not accepted as it is known to be corrosive to copper and will likely result in the oil failing the potentially corrosive sulfur test of IEC 62535. IEC test methods are in preparation only for DBDS (see 6.21) and not for the other antioxidant additives of this type.
- c) Metal passivators (see 6.11.3).

6.11.3 Metal passivators

6.11.3.1 Metal passivators have been used in the past to remediate corrosive sulfur activity in some transformers. This may result in contamination of recycled oils. The presence of these metal passivators therefore indicates that the oil is potentially corrosive and may also result in overstated oxidation stability. Some of these additives form thin films on copper, preventing the catalytic effect of copper in oil and the formation of harmful copper sulphide deposits in paper by reaction with corrosive sulfur compounds contained in the oil. Some of them protect the oil from the catalytic action of metals and slow down the rate of oxidation of oil. Passivators, therefore, slow down the oxidation process in IEC 61125 as they passivate the surface of the catalysing copper-wire, thus leading to an optimistic result of the oxidation stability test. Some of them are also used to reduce the electrostatic charging tendency of oils (see 6.14).

6.11.3.2 Three main types of benzotriazole derivatives are typically used as metal passivator additives: N-bis(2- Ethyl hexyl)-aminomethyl-tolutriazole, benzotriazole (BTA) and 5-methyl-1 H-benzotriazole. Detection and measurement of these additives shall be in accordance with IEC 60666.

6.11.3.3 Several other compounds can be used as metal passivator additives, such as N,N-bis(2-ethylhexyl)-1H-1,2,4-triazole-1 methanamine, diamino-diphenyldisulphide, nicotinic acid, hydroquinoline and other sulfur-based compounds, for which no IEC test methods are available.

6.11.4 Pour point depressants

These additives are used to improve the viscosity and pour point of oils at very low temperatures. Detection and measurement of the two main types of pour point depressant additives used (polynaphthalenes and polymethacrylates) shall be in accordance with IEC 60666.

6.12 Oxidation stability

Oxidation of oil gives rise to acidity and sludge formation. This can be reduced by using oils with a high oxidation stability leading to longer service life time by minimizing sludge deposition and maximizing insulation life.

6.13 Gassing tendency

6.13.1 Gassing tendency of mineral insulating oil such as the gas absorbing property of oil when subjected to corona partial discharges, is only necessary and important for special equipment such as HV (high voltage) instrument transformers and bushings. It is a measure of the rate of absorption or evolution of gas into oil under prescribed laboratory conditions. Gas absorption properties could be related to oil aromatic content. Gassing tendency is measured using method A of IEC 60628.

6.13.2 Gassing tendency testing is a specific requirement of 7.3.

NOTE Additives such as 1,2,3,4 – tetrahydronaphthalene (tetralin), mono or dibenzyltoluene and others have been proposed to reduce the gassing tendency of some oils, but are not described in IEC 60666. Mono and dibenzyltoluene are described in IEC 60867.

6.14 Electrostatic charging tendency (ECT)

ECT of oil is an important property for certain designs of HV and EHV transformers which have oil pumping rates that can give rise to the build-up of electrostatic charge. This charge can result in energy discharge causing transformer failure. ECT testing is a specific requirement of 7.2.

NOTE A method to measure ECT is proposed by CIGRE Technical Brochure 170. ECT can be reduced by using metal passivator additives such as benzotriazole (BTA) and 5-methyl-1 H-benzotriazole (TTA).

6.15 Flash point

The safe operation of electrical equipment requires an adequately high flash point that is measured in accordance with ASTM D93.

6.16 Density

In cold climates, density of oil shall be low enough to avoid the ice that results from the freezing of free water to float to the oil surface and possibly lead to fault conditions developing such as flashover of conductors. Density shall be measured in accordance with ASTM D4052.

6.17 Polycyclic aromatic contents (PCAs)

Some polycyclic aromatic contents (PCAs) are classified to be carcinogens and, therefore, need to be controlled to an acceptable level in mineral insulating oil. The total amount of PCAs can be measured by extraction with dimethylsulfoxide (DMSO) in accordance with the conditions of IP 346.

NOTE Acceptable limits of total or individual PCAs are specified in the relevant national legislation (see foreword).

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6.18 Polychlorinated biphenyl contents (PCBs)

Unused mineral insulating oil shall be free from polychlorinated biphenyl contents (PCBs). The reference test method is IEC 61619 or alternatives as listed in SANS 290.

NOTE Acceptable limits of total or individual PCBs are specified in the relevant national legislation (see foreword). Further European specifications are described in Directive 96/59/EC.

6.19 2-Furfural (2-FAL) and related compounds content

6.19.1 2-FAL and related compounds in unused mineral insulating oils can result either from improper re-distillation after solvent extraction during refining or from contamination with used oil.

6.19.2 Unused mineral insulating oils should have a low level of 2-FAL and related compounds; measurement should be carried in accordance with IEC 61198.

NOTE "Related compounds" are: 5-hydroxymethyl-2-furfural (5HMF), 2-furfuryl alcohol (2FOL), 2-acetylfuran (2ACF) and 5-methyl-2-furfural (5MEF).

6.20 Particle content

Particles in unused mineral insulating oil may result from manufacturing, storage or handling of the oil, and may affect its breakdown voltage (see 6.4). Measurement shall be carried out in accordance with IEC 60970.

6.21 DBDS content

This compound is corrosive at normal transformer operating temperatures and can produce copper sulphide. It, therefore, shall not be present in insulating oil (see 6.10). Measurement shall be carried out in accordance with IEC 62697-1.

6.22 Stray gassing of oil

Some oils can produce gases such as hydrogen, hydrocarbons and carbon oxides at low temperatures (<120 °C) without thermal or electrical faults in a transformer, sometimes even without operational stress. This phenomenon could result in a high production of gases and a misinterpretation of dissolve gas analysis (DGA) results.

NOTE Methods to measure stray gassing are described in CIGRE Brochure 296 and ASTM D7150. Inhibited grades typically produce less stray gassing than uninhibited ones.

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Table 1 — General requirements

1	2	3
Property	Test method	Limits
		Transformer oil
1 – Function		
Viscosity at 40 °C	ASTM D445 or ISO 3104	Max. 12 mm ² /s
Viscosity at –30 °C	ASTM D445	Max. 1 800 mm ² /s
Pour point	ASTM D97	Max. –40 °C
Water content	IEC 60814/ASTM D1533	Max. 20 mg/kg ^a / 30 mg/kg ^b /13 mg/kg ^c
Breakdown voltage	IEC 60156	Min. 60 kV ^a / 50 kV ^b / 70 kV ^c
Density at 20 °C	ASTM D4052, ISO 3675 or ISO 12185	Max. 0,895 g/ml
DDF at 90 °C	IEC 60247 or IEC 61620	Max. 0,005
Particle content	IEC 60970	No general requirement ^d
2 – Refining/stability		
Appearance	–	Clear, free from sediment and suspended matter
Acidity	IEC 62021-1 or IEC 62021-2	Max. 0,01 mg KOH/g
Interfacial tension	EN 14210 or ASTM D971	≥ 40 mN/m
Total sulfur content	IP 373 or ISO 14596	No general requirement ^e
Corrosive sulfur	DIN 51353	Not corrosive
Potentially corrosive sulfur	IEC 62535/ASTM D1275	Not corrosive
DBDS	IEC 62697-1	Not detectable (< 5 mg/kg)
Inhibitors of IEC 60666	IEC 60666	(I) inhibited oils: 0,40 % min
Metal passivator additives of IEC 60666	IEC 60666	Not detectable (< 5mg/kg), or as agreed upon between the supplier and the purchaser in accordance with annex B
Other additives	–	See footnote ^e
2-Furfural and related compounds content	IEC 61198	Not detectable (< 0,05 mg/kg) for each individual compound
Stray gassing	See 6.22	No general requirement ^f
3 – Performance		
Oxidation stability	IEC 61125 (Method C) test duration (I) Inhibited oil: 500 h. RPVOT ASTM D2112	For oils with other antioxidant additives and metal passivator additives, see 6.12. > 220 min
Total acidity ^g	IEC 61125	Max. 1,2 mg KOH/g
Sludge	IEC 61125	Max. 0,8
DDF at 90 °C ^h	IEC 61125 and IEC 60247	Max. 0,500
Gassing tendency	IEC 60628: Method A	± 5
ECT	See 6.14	No general requirement ^h

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Table 1 (concluded)

Property	Test method	Limits
		Transformer oil
4 – Health, safety and environment (HSE)		
Flash point	ASTM D93/ISO 2719	Min. 135 °C
PCA content	IP 346	Max. 3 %
PCB content	IEC 61619	—
^a For bulk supply.		
^b For delivery in drums and IBC.		
^c After laboratory treatment (see 6.5).		
^d Particle content in drums at delivery of oil can be agreed between the supplier and customer, based on a statistical reference at delivery.		
^e The supplier shall declare the generic type of all additives, and their concentrations in the case of antioxidant additives.		
^f To be agreed upon between the supplier and the purchaser in accordance with annex B.		
^g At the end of oxidation stability tests.		
^h A DDF of max. 0,020 after 2 h of oxidation (see IEC 61125: Method C) can be used for application in EHV instrument transformers and bushings.		

7 Specific requirements for special applications

7.1 Higher oxidation stability and low sulfur content

For transformers with higher operating temperatures or designed for extended service life, there may exist restricted limits after oxidation test (see method C of IEC 61125). Mostly, such oil is inhibited.

- a) Total acidity: max. 0,3 mg KOH/g;
- b) Sludge: max. 0,05 %;
- c) DDF at 90 °C: max. 0,050; and
- d) Total sulfur content: max. 0,05 % (before oxidation test).

7.2 Electrostatic charging tendency (ECT)

For equipment with high oil circulation speed (OF- or OD-cooled power transformers (SANS 60076-2), as, for example, HV/DC transformers, a limit may be agreed upon between the purchaser and manufacturer.

7.3 Gassing tendency

For equipment with high electrical field stress or special design, gases formed when subjected to corona partial discharges (see 6.13) shall be absorbed by the oil. Therefore, the gassing tendency, in accordance with IEC 60628, shall be agreed upon between the supplier and the purchaser of the oil for such equipment in accordance with annex B.

Annex A

(informative)

Potentially corrosive sulfur

A.1 Mechanism of copper sulphide deposition

A.1.1 The mechanism of copper sulphide (Cu_2S) deposition is still not fully elucidated, but it may involve dissolution and transport of copper by sulfur containing species forming complexes with copper. These complexes can then be absorbed by cellulosic insulation where they decompose into Cu_2S .

A.1.2 The strong influence of temperature and oxygen on this process indicates that some oxidized sulfur species may be more active than those originally present in oil, or that other oxidation products are important as co-complexing agents (see CIGRE Technical Brochure 378). Cu_2S deposition occurs preferentially in equipment where corrosive sulfur compounds are present in oil, unvarnished or unprotected copper is used, operating temperatures are high and the amount of oxygen in oil is limited. The optimal oxygen content for copper transport seems to be relatively low, probably in the region of a few thousand $\mu\text{l/l}$, but deposition may occur over a wide range of oxygen contents.

A.2 Corrosive sulfur compounds in oil

Although many sulfur compounds are known to be corrosive for copper, few have been identified as components of insulating oil. The only compound shown so far to be a potent Cu_2S forming agent and to be present in significant amounts in transformer oil is dibenzyl disulfide (DBDS). Most oils found to be forming Cu_2S contain this substance. However, refining processes using severe hydrotreatment can easily remove this reactive compound from oil. Several other substances (including disulphides, thioethers, various oxidized sulfur compounds and elemental sulfur) have been shown to cause Cu_2S formation in the IEC 62535 test, when added to originally non-corrosive oils.

A.3 Detection of corrosive sulfur compounds in passivator-containing oils

A.3.1 General

A.3.1.1 When oil in a transformer contains a metal passivator additive, a thin protective layer of passivator is formed on copper surfaces, preventing copper from dissolving in oil, reacting with corrosive sulfur compounds present in oil, and depositing in paper insulation as harmful copper sulphide (Cu_2S).

A.3.1.2 The same occurs when testing passivator-containing oils in accordance with IEC 62535. This test method, therefore, cannot detect corrosive sulfur compounds present in passivating oils and may provide "false negative" results for such oils. Passivator-containing oils testing negative as new oils may then test positive and start depositing harmful Cu_2S after the additive has been consumed by aging in transformers service.

A.3.1.3 In order to detect corrosive sulfur compounds in oil containing a metal passivator additive (declared or suspected), the passivator additive has to be removed first from the oil. The two procedures described in A.3.2 and A.3.3 can be used for that purpose. Both are intended for newly available types of oils only, not for normal deliveries of oil.

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A.3.2 Procedure 1

A.3.2.1 Stir 100 mL of passivator-containing oil with 500 mg of a suitable adsorbent (a strong, mixed-mode, polymer-based cation exchanger for basic analytes), for 1 h, then filter out the adsorbent; or

A.3.2.2 Extract 60 mL of oil under a slight vacuum on a 3 mL column containing 200 mg of the adsorbent, if the initial concentration of passivator was < 200 mg/kg.

A.3.3 Procedure 2

A.3.3.1 This procedure is based on the observation that metal passivator additives in oil are consumed by oxidation aging (in accelerated tests in the laboratory and in transformers in service).

A.3.3.2 Run the passivator-containing oil in the test cell used in method C of IEC 61125 at 120 °C for 164 h with an air flow of 0,15 L/h to ensure that the passivator has been consumed by oxidation.

A.3.3.3 Test the aged oil for corrosive sulfur in the test cell of IEC 62535 with new paper wrapped conductor.

A.3.3.4 Confirm Cu₂S deposition with Scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDX) or other techniques in accordance with annex B of IEC 62535:2008 to avoid false positives with the aged oil (for example, where oxidation aging compounds of oil are mistakenly interpreted as Cu₂S). False positives can also be avoided by carrying out a second IEC 62535 test without copper strip and with paper only, and comparing the appearance of papers after both tests with and without copper.

NOTE 1 The protective layer of passivator on copper has been observed to remain on copper after aging tests in the laboratory, but there is little knowledge on whether and how long it will remain on copper in transformers in service.

NOTE 2 As a complement to IEC 62535 and procedures 1 and 2 for passivator-containing oils, the quantification of corrosive sulfur compounds in oil (for example, dibenzyldisulphide (DBDS) and total disulphide) can be used to ensure that none of these potentially harmful compounds are present in oil.

A.4 Contamination of oils

Mineral insulating oils suspected of having been accidentally contaminated with silicone oils, phthalates or other surface-active chemicals or oils should not be introduced in transformers, since these compounds can produce foaming in oil when trying to degas the transformer, thus making it difficult or impossible to fully degas the transformer oil. The foaming tendency test of ISO 6247 can be used to detect such a contamination.

Annex B
(normative)

Notes to purchasers

The following information shall be agreed upon between the supplier and the purchaser:

- a) the metal passivator additives (see table 1); and
- b) the gassing tendency (see table 1 and 7.3).

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Bibliography

Standards

ASTM D7150, *Standard test method for the determination of gassing characteristics of insulating liquids under thermal stress.*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons.*

IEC 62701, *Fluids for electrotechnical applications – Recycled mineral insulating oils for transformers and switchgear.*

ISO 6247, *Petroleum products – Determination of foaming characteristics of lubricating oils.*

SANS 1518, *Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks.*

SANS 10229-1, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging.*

SANS 10232-1, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transport.*

SANS 10233, *Transport of dangerous goods – Intermediate bulk containers for road and rail transport.*

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SANS 60076-2/IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers.*

Other publications

CIGRE Technical Brochure 170, *Static electrification in power transformers, 2000.*

CIGRE Technical Brochure 296, *Recent developments in DGA interpretation, 2006.*

CIGRE Technical Brochure 378, *Copper sulphide in transformer insulation, 2009.*

European Council Directive (96/59/EC) of 16 September 1996 – *Disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT).*

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Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Fluids for electrotechnical applications

Part 2: Unused uninhibited mineral insulating oils for transformers and switchgear

WARNING
This document references other documents normatively.

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was prepared by National Committee SABS/TC 028/SC 02, *Petroleum products, biofuels and lubricants – Lubricants*, in accordance with procedures of the SABS, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in March 2017.

Reference is made in 4.1.8, the note to 6.18 and the note to 6.19 to "relevant national legislation". In South Africa this means the National Environmental Management Act, 1998 (Act No. 107 of 1998).

SANS 555 consists of the following parts, under the general title *Fluids for electrotechnical applications*:

Part 1: Unused inhibited mineral insulating oils for transformers and switchgear.

Part 2: Unused uninhibited mineral insulating oils for transformers and switchgear.

Part 3: Recycled inhibited mineral insulating oils for transformers and switchgear.

Part 4: Recycle uninhibited mineral insulating oils for transformers and switchgear.

Annex A is for information only.

Compliance with this document cannot confer immunity from legal obligations.

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Fluids for electrotechnical applications

Part 2:

Unused uninhibited mineral insulating oils for transformers and switchgear

1 Scope

1.1 This part of SANS 555 specifies requirements and test methods for unused mineral insulating oils for use in transformers, switchgear and similar electrical equipment in which oil is required for insulation and heat transfer.

1.2 This part of SANS 555 applies to oils with and without additives, and applies only to unused uninhibited mineral insulating oils.

1.3 This part of SANS 555 does not cover recycled oils.

NOTE IEC 62701 covers recycled oils.

1.4 This part of SANS 555 does not apply to mineral insulating oils used as impregnants in cables or capacitors.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS.

ASTM D93, *Standard test methods for flash point by Pensky-Martens closed cup tester.*

ASTM D445, *Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity).*

ASTM D971, *Standard test method for interfacial tension of oil against water by the ring method.*

ASTM D1275, *Standard test method for corrosive sulfur in electrical insulating oils.*

ASTM D1533, *Standard test method for water in insulating liquids by coulometric Karl Fischer titration.*

ASTM D4052, *Standard test method for density and relative density of liquids by digital density meter.*

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DIN 51353, *Testing of insulating oils; detection of corrosive sulfur; silver strip test.*

EN 14210, *Surface active agents – Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method.*

IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method.*

IEC 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity.*

IEC 60422, *Mineral insulating oils in electrical equipment – Supervision and maintenance guidance.*

IEC 60475, *Method of sampling insulating liquids.*

IEC 60628:1985, *Gassing of insulating liquids under electrical stress and ionization.*

IEC 60666, *Detection and determination of specified additives in mineral insulating oils.*

IEC 60814, *Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration.*

IEC 60970, *Insulating liquids – Methods for counting and sizing particles.*

IEC 61125:1992, *Unused hydrocarbon based insulating liquids – Test methods for evaluating the oxidation stability.*

IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds.*

IEC 61619, *Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography.*

IEC 61620, *Insulating liquids – Determination of the dielectric dissipation factor by measurement of the conductance and capacitance – Test method.*

IEC 62021-1, *Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration.*

IEC 62021-2, *Insulating liquids – Determination of acidity – Part 2: Colourimetric titration.*

IEC 62535, *Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oil.*

IEC 62697-1, *Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids – Part 1: Test method for quantitative determination of dibenzyl disulfide (DBDS).*

IP 346, *Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions – Dimethyl sulphoxide extraction refractive index method.*

IP 373, *Determination of sulfur content – Oxidative microcoulometry method.*

ISO 2719, *Determination of flash point – Pensky-Martens closed cup method.*

ISO 3016, *Petroleum products – Determination of pour point.*

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ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 3675, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.*

ISO 12185, *Crude petroleum and petroleum products – Determination of density – Oscillating U-tube method.*

ISO 14596, *Petroleum products – Determination of sulfur content – Wavelength-dispersive X-ray fluorescence spectrometry.*

SANS 290, *Mineral insulating oils – Management of polychlorinated biphenyls (PCBs).*

3 Definitions

For the purposes of this document, the following definitions apply.

3.1

acceptable

acceptable to the authority administering this part of SANS 555, or to the parties concluding the purchase contract, as relevant

3.2

additive

chemical substance that is added to mineral insulating oil in order to improve certain characteristics

3.3

antioxidant additive

NOTE A large number of additives which improves oxidation stability, including inhibitors, peroxide decomposers, metal passivators and metal deactivators is available and may be used in oils if declared (see 6.12.1 and 6.12.2).

3.3.1

inhibitor

antioxidant additives of the phenolic- or amine type, such as DBPC and DBP described in IEC 60666

NOTE 1 DBPC is 2,6-di-tert-butyl-para-cresol; and DBP is 2,6-di-tert-butyl-phenol.

NOTE 2 DBDS (dibenzyl disulfide) should not be used.

3.3.2

other antioxidant additive

antioxidant additive of the sulfur or phosphorous type

3.3.3

passivator

metal passivator additive used primarily as electrostatic charging depressant, but which may also improve oxidation stability

NOTE Metal passivators are sometimes described as metal deactivators or corrosion inhibitors.

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3.4

inhibited oil

mineral insulating oil containing a minimum of 0,30 % and a maximum of 0,40 % of total inhibitor content as measured by IEC 60666

3.5

mineral insulating oil

insulating oil obtained by refining, modifying or blending of petroleum products (or both) and other hydrocarbons

NOTE This does not include insulating liquids such as esters, synthetic aromatics or silicone fluids.

3.6

transformer oil

mineral insulating oil for transformers and similar electrical equipment

3.7

uninhibited oil

mineral insulating oil containing no inhibitor

NOTE No inhibitor means that the total inhibitor content is below the detection limit of 0,01 % indicated in IEC 60666.

3.8

unused mineral insulating oil

mineral insulating oil not re-cycled as delivered by the supplier

NOTE 1 Such an oil has not been used in, nor been in contact with electrical equipment or other equipment not required for manufacture, storage or transport. The manufacturer and supplier of unused oil will have taken all reasonable precautions to ensure that there is no contamination with polychlorinated biphenyls (PCB) or terphenyls (PCT), used, recycled or dechlorinated oil or other contaminants.

NOTE 2 A blend of unused and recycled oil in any proportion is regarded as being recycled.

4 Requirements

4.1 General requirements

4.1.1 General requirements of this part of SANS 555 are given in table 2.

4.1.2 Specific requirements are defined under 4.5.

NOTE Oil characteristics are listed in table 2 and in clause 6.

4.1.3 The manufacturer and supplier of unused oil shall have taken all reasonable precautions to ensure that there is no contamination with polychlorinated biphenyls (PCB) or terphenyls (PCT), used, recycled or dechlorinated oil or other contaminants.

4.1.4 Functional properties of oil that have an impact on its function as an insulating and cooling liquid are listed in table 2.

NOTE Functional properties include viscosity, density, pour point, water content, breakdown voltage and dielectric dissipation factor.

4.1.5 Refining and stability properties of oil that are influenced by quality and type of refining and additives, are listed in table 2.

NOTE These can include appearance, interfacial tension, sulfur content, acidity, corrosive sulfur, 2-furfural and related compounds content and stray gassing.

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4.1.6 Performance properties that are related to the long-term behaviour of oil in service or its reaction to high electric stress (or both) and temperature are listed in table 2.

NOTE Examples include oxidation stability, gassing tendency and electrostatic charging tendency (ECT).

4.1.7 Requirements for health, safety and environmental (HSE) properties, are listed in table 2. The mineral insulating oils shall be handled with due regard to personal hygiene. Direct contact with the eyes may cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice sought. Some of the tests specified in this part of SANS 555 involve the use of processes that could lead to a hazardous situation.

4.1.8 The disposal of these items shall be carried out in accordance with the relevant national legislation (see foreword) with regard to their impact on the environment. Every precaution shall be taken to prevent release of mineral insulating oil into the environment.

NOTE Examples can include flash point, density, polycyclic aromatics (PCA) and polychlorinated biphenyls/terphenyls (PCB/PCT).

4.2 Classification, identification, and general delivery requirements

4.2.1 Classification

4.2.1.1 Classes

For the purposes of this part of SANS 555, mineral insulating oils shall be classified into two classes, as follows:

- a) transformer oils; and
- b) low temperature switchgear oils.

4.2.1.2 Antioxidant additive (inhibitor) content

Transformer oils shall be classified into two groups, in accordance with their content of antioxidant additive, as follows:

- a) uninhibited transformer oils: marked with U; and
- b) inhibited transformer oils: marked with I.

4.2.1.3 Lowest cold start energizing temperature (LCSET)

After the inhibitor marking, the LCSET shall then be indicated. The standard LCSET in this part of SANS 555 is $-30\text{ }^{\circ}\text{C}$; optionally, other LCSET can be selected in accordance with table 1.

4.3 Miscibility

Unused mineral insulating oils of the same class (see 4.2.1.1), the same group (see 4.2.1.2), viscosity and pour point as well as containing the same types of additives are considered to be miscible and compatible with each other (see IEC 60422).

4.4 Identification and general delivery requirements

Identification and general delivery requirements are as follows:

- a) Oil shall be delivered in bulk, rail tank cars, tank containers or packed in new drums or IBCs (intermediate bulk containers). These shall be clean and suitable for this purpose to avoid any contamination.

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b) Oil drums and sample containers shall carry at least the following markings:

- 1) supplier's designation;
- 2) classification (see 4.2.1);
- 3) oil quantity; and
- 4) batch number.

c) As agreed between the supplier and purchaser each oil delivery may be accompanied by a document specifying the supplier's designation, oil classification, oil compliance certificate and cleanliness certificate.

NOTE This part of SANS 555 may be traceable to a specific batch of oil processed.

d) The supplier shall declare the generic type of all additives, and their concentrations in the cases of inhibitors and passivators.

4.5 Specific requirements for special applications

4.5.1 Higher oxidation stability and low sulfur content

For transformers with higher operating temperatures or designed for extended service life, there may exist restricted limits after oxidation test (see IEC 61125:1992, method C). Mostly, such oil is inhibited. These limits are as follows:

- a) total acidity (max. 0,3 mg KOH/g);
- b) sludge (max. 0,05 %);
- c) DDF at 90 °C (max. 0,050); and
- d) total sulfur content (max. 0,05 % (before oxidation test)).

4.5.2 Electrostatic charging tendency (ECT)

For equipment with high oil circulation speed (OF- or OD-cooled power transformers (see SANS 60076-2)), for example HV/DC transformers, a limit may be agreed on between purchaser and manufacturer.

4.5.3 Gassing tendency

For equipment with high electrical field stress or special design, gases formed when subjected to corona partial discharges (see 6.14) are absorbed by the oil. Therefore the gassing tendency in accordance with IEC 60628 shall be agreed upon between the supplier and purchaser of the oil for such equipment.

5 Sampling

Sampling (for identification and general delivery requirements) shall be carried out in accordance with the procedure described in IEC 60475.

6 Properties and methods of test

6.1 General requirements

Requirements for properties, their significance and methods of test, are listed in table 2.

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6.2 Viscosity

6.2.1 Viscosity influences heat transfer and therefore the temperature rise of the equipment. The lower the viscosity, the easier the oil circulates leading to improved heat transfer. At low temperatures, the resulting higher viscosity of oil is a critical factor for the cold start of transformers with poor or no circulation of oil and therefore possible overheating at the hot spots, and negatively influences the speed of moving parts such as in power circuit breakers, switchgear, on-load tap changer mechanisms, pumps and regulators.

6.2.2 The viscosity at the lowest cold start energizing temperature (LCSET) shall not exceed 1 800 mm²/s (respectively 2 500 mm²/s at -40 °C, see table 1). This lowest cold start energizing temperature (LCSET) for transformer oils is defined in this part of SANS 555 as being -30 °C (this is 5 K lower than indicated in SANS 60076-2). Other LCSET (see table 1) may be agreed between supplier and purchaser.

6.3.3 Low temperature switchgear oil should have a lower viscosity at LCSET: a maximum of 400 mm²/s. Standard LCSET of low temperature switchgear oil is defined at -40 °C but other LCSET may be agreed between supplier and purchaser.

Table 1 — Maximum viscosity and pour point of transformer oil at lowest cold start energizing temperature (LCSET)

1	2	3
LCSET	Maximum viscosity ^a	Maximum pour point
°C	mm ² /s	°C
0	1 800	-10
-20	1 800	-30
-30	1 800	-40
-40	2 500	-50
^a Viscosity shall be measured in accordance with ISO 3104, and viscosity at very low temperatures in accordance with IEC 61868.		

6.3 Pour point

The pour point of mineral insulating oil is the lowest temperature at which the oil will just flow. It is recommended that the pour point should be at least 10 K below the lowest cold start energizing temperature (LCSET). If a pour point depressant additive is used, this shall be declared by the supplier to the user. Pour point shall be measured in accordance with ISO 3016.

6.4 Water content

A low water content of mineral insulating oil is necessary to achieve adequate breakdown voltage and low dissipation losses. To avoid separation of free water, unused insulating oil should have limited water content. Before filling the electrical equipment, the oil shall be treated to meet the requirements of IEC 60422. Water content shall be measured in accordance with IEC 60814.

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6.5 Breakdown voltage

The breakdown voltage of transformer oil indicates its ability to resist electrical stress in electrical equipment. Breakdown voltage shall be measured in accordance with IEC 60156. The supplier shall demonstrate that after treatment to reduce particles, water and dissolved air by a vacuum procedure, the oil shall have a high dielectric strength (breakdown voltage > 70 kV).

NOTE This treatment consists of filtration of the oil at 60 °C by vacuum (pressure below 2,5 kPa) through a sintered glass filter (with a maximum pore size of 2,5 µm).

6.6 Dielectric dissipation factor (DDF)

DDF is a measure for dielectric losses within the oil. DDF values above requirements of table 2 can indicate contamination of the oil by polar contaminants or poor refining quality. DDF shall be measured in accordance with IEC 60247 or IEC 61620 at 90 °C. In case of dispute, IEC 60247 at 90 °C should be used.

NOTE By agreement between parties, DDF can be measured at temperatures other than 90 °C. In such cases the temperature of measurement can be stated in the report.

6.7 Appearance

A visual inspection of insulating oil (oil sample in transmitted light under a thickness of approximately 10 cm and at ambient temperature) will indicate the presence of visible contaminants, free water or suspended matter.

6.8 Acidity

Unused mineral insulating oil should be free from any acidic compound. Acidity shall be measured in accordance with IEC 62021-1 or IEC 62021-2.

6.9 Interfacial tension (IFT)

Low IFT sometimes indicates the presence of polar compounds. IFT shall be measured in accordance with EN 14210 or ASTM D971.

6.10 Sulfur content

6.10.1 Different organo-sulfur compounds are present in mineral oils, dependent on the crude oil origin and the degree and type of refining. Refining reduces the content of sulfur and aromatic hydrocarbons. As some naturally present sulfur compounds have an affinity to metals, they may act as natural oxidation inhibitors or they may promote corrosion.

6.10.2 Sulfur content is a specific requirement of 4.5.

6.10.3 Sulfur content shall be measured in accordance with IP 373 or ISO 14596.

6.11 Corrosive and potentially corrosive sulfur

6.11.1 Some sulfur compounds, for example mercaptans, are very corrosive to metal surfaces, i.e. steel, copper and silver (switchgear contacts) and shall not be present in new oil. This type of corrosive sulfur should be detected in accordance with DIN 51353.

6.11.2 Some other sulfur compounds, for example dibenzylsulfide (DBDS), may result in the deposition of copper sulfide (Cu₂S) in paper insulation, reducing its electrical insulation properties (see annex A). This has resulted in several equipment failures in service.

6.11.3 IEC 62535 provides the best currently-available method to detect potentially corrosive sulfur compounds in oil. It applies only to oils that do not contain a metal passivator additive (declared or undeclared).

For passivator-containing oils, see A.3.

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6.12 Additives

6.12.1 General

The generic type of all additives shall be declared in product data sheets and certificates of compliance. For antioxidant additives and passivators, their concentrations shall also be stated.

6.12.2 Antioxidant additives

6.12.2.1 Antioxidants slow down the oxidation of oil and therefore the formation of degradation products such as oil sludge and acidity. It is useful to know whether and in what proportion antioxidant additives have been added in order to monitor additive depletion during service.

6.12.2.2 Additives that slow down the oxidation of mineral insulating oils include the following:

- a) Inhibitors such as phenols and amines (see 3.3.1). The most widely used inhibitors are DBPC and DBP (see 3.3.1). Detection and measurement of DBPC and DBP shall be carried out in accordance with IEC 60666. IEC test methods are not available for other types of inhibitors.
- b) Other antioxidant additives such as sulfur- and phosphorus-containing compounds, for example, organic polysulfides and dithiophosphates (see 3.3.2). An antioxidant additive of this type is DBDS (see 6.11), but it is not accepted as it is known to be corrosive to copper and will likely result in the oil failing the potentially corrosive sulfur test of IEC 62535. IEC test methods are in preparation only for DBDS (see 6.21) and not for the other antioxidant additives of this type.
- c) Metal passivators (see 6.12.3).

6.12.3 Metal passivators

6.12.3.1 Metal passivators have been used in the past to remediate corrosive sulfur activity in some transformers. This may result in contamination of recycled oils. The presence of these metal passivators therefore indicates that the oil is potentially corrosive and may also result in overstated oxidation stability. Some of these additives form thin films on copper, preventing the catalytic effect of copper in oil and the formation of harmful copper sulfide deposits in paper by reaction with corrosive sulfur compounds contained in the oil. Some of them protect the oil from the catalytic action of metals and slow down the rate of oxidation of oil. Passivators therefore slow down the oxidation process described in IEC 61125 as they passivate the surface of the catalysing copper wire, thus leading to an optimistic result of the oxidation stability test. Some of them are also used to reduce the electrostatic charging tendency of oils (see 6.15).

6.12.3.2 Three main types of benzotriazole derivatives are typically used as metal passivator additives: N-bis(2-Ethyl hexyl)-aminomethyl-tolotriazole (TTAA), benzotriazole (BTA) and 5-methyl-1 H-benzotriazole (TTA). Detection and measurement of these additives shall be in accordance with IEC 60666.

6.12.3.3 Several other compounds can be used as metal passivator additives, such as N,N-bis (2-ethylhexyl)-1H-1,2,4-triazole-1 methanamine (TAA), diamino-diphenyldisulfide, nicotinic acid, hydroquinoline and other sulfur-based compounds, for which no IEC test methods are available.

6.12.4 Pour point depressants

These additives are used to improve the viscosity and pour point of oils at very low temperatures. Detection and measurement of the two main types of pour point depressant additives used (polynaphthalenes and polymethacrylates) shall be in accordance with IEC 60666.

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6.13 Oxidation stability

6.13.1 Oxidation of oil gives rise to acidity and sludge formation. This can be reduced by using oils with a high oxidation stability leading to longer service life time by minimizing sludge deposition and maximizing insulation life. Oxidation stability is measured in accordance with method C of IEC 61125:1992. There is an option for stricter limits for special applications. In some countries more stringent limits or additional requirements (or both) and tests may be requested.

6.13.2 Test durations for oils containing inhibitors shall be as indicated in table 2. Test duration for oils containing other antioxidant additives and metal passivators shall be 500 h.

6.13.3 Passivator-containing oils shall be tested for oxidation stability before the passivator additive has been added to the oil (when possible), using the test durations given in table 2.

6.14 Gassing tendency

6.14.1 Gassing tendency of mineral insulating oil, i.e. the gas absorbing property of oil when subjected to corona partial discharges, is only necessary and important for special equipment like HV (high voltage) instrument transformers and bushings. It is a measure of the rate of absorption or evolution of gas into oil under prescribed laboratory conditions. Gas absorption properties could be related to oil aromatic content. Gassing tendency is measured using method A of IEC 60628:1985.

6.14.2 Gassing tendency testing is a specific requirement of 4.5.3.

NOTE Additives such as 1,2,3,4- tetrahydronaphtalene (tetralin), mono- or di-benzyltoluene and others have been proposed to reduce the gassing tendency of some oils, but are not described in IEC 60666. Mono- and di-benzyltoluene are described in IEC 60867.

6.15 Electrostatic charging tendency (ECT)

ECT of oil is an important property for certain designs of HV and EHV transformers which have oil pumping rates that can give rise to the build-up of electrostatic charge. This charge can result in energy discharge causing transformer failure. ECT testing is a specific requirement of 4.5.2.

NOTE A method to measure ECT is proposed by CIGRE Technical Brochure 170. ECT can be reduced by using metal passivator additives such as BTA and TTA.

6.16 Flash point

The safe operation of electrical equipment requires an adequately high flash point that is measured in accordance with ISO 2719 or ASTM D93.

6.17 Density

In cold climates, density of oil shall be low enough to avoid the ice that results from the freezing of free water to float to the oil surface and possibly lead to fault conditions developing such as flashover of conductors. Density shall be measured in accordance with ASTM D4052, ISO 3675 (reference method) but ISO 12185 as well is accepted.

6.18 Polycyclic aromatic content (PCAs)

Some PCAs are classified to be carcinogens and therefore need to be controlled to an acceptable level in mineral insulating oil. The total amount of PCAs can be measured by extraction with DMSO (dimethylsulfoxide) under the conditions of IP 346.

NOTE Acceptable limits of total or individual PCAs are specified in relevant national legislation (see foreword).

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6.19 Polychlorinated biphenyl content (PCBs)

Unused mineral insulating oil shall be free from PCBs. The reference test method is IEC 61619 or alternatives as listed in SANS 290.

NOTE Acceptable limits of total or individual PCBs are specified in relevant national legislation (see foreword).

6.20 2-Furfural (2-FAL) and related compounds content

6.20.1 2-FAL and related compounds in unused mineral insulating oils can result either from improper re-distillation after solvent extraction during refining or from contamination with used oil.

6.20.2 Unused mineral insulating oils should have a low level of 2-FAL and related compounds. Measurement should be carried out in accordance with IEC 61198.

NOTE "Related compounds" are: 5-hydroxymethyl-2-furfural (5HMF), 2-furfuryl alcohol (2FOL), 2-acetylfuran (2ACF) and 5-methyl-2-furfural (5MEF).

6.21 Particle content

Particles in unused mineral insulating oil may result from manufacturing, storage or handling of the oil, and may affect its breakdown voltage (see 6.5).

6.22 DBDS content

This compound is corrosive at normal transformer operating temperatures and can produce copper sulfide. It therefore shall not be present in insulating oil (see 6.11). For the test method for measuring DBDS, see IEC 62697-1.

6.23 Stray gassing of oil

Some oils can produce gases such as hydrogen, hydrocarbons and carbon oxides at low temperatures (< 120 °C) without thermal or electrical faults in a transformer, sometimes even without operational stress. This phenomenon could result in a high production of gases and a misinterpretation of DGA results.

NOTE Methods to measure stray gassing are described in CIGRE Technical Brochure 296 and ASTM D7150. Inhibited grades typically produce less stray gassing than uninhibited ones.

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Table 2 — General requirements for properties, their significance and methods of test

1	2	3	4
Property	Test method	Limits	
		Transformer oil	Low temperature switchgear oil
Functional			
Viscosity at 40 °C	ASTM D445	Max. 12 mm ² /s	Max. 3,4 mm ² /s
Viscosity at –30 °C	ASTM D445	Max. 1 800 mm ² /s	–
Pour point	ASTM D93	Max. –40 °C	–
Water content	IEC 60814/ASTM D1533	Max. 20 mg/kg ^a /30 mg/kg ^b /13 mg/kg ^c	
Breakdown voltage	IEC 60156	Min. 60 kV ^a /50 kV ^b /70 kV ^c	
Density at 20 °C	ASTM D4052	Max. 0,895 g/mL	
DDF at 90 °C	IEC 60247/IEC 61620	Max. 0,005	
Particle content	IEC 60970	No general requirement ^g	
Refining and stability			
Appearance	–	Clear, free from sediment and suspended matter	
Acidity	IEC 62021-1/IEC 62021-2	Max. 0,01 mg KOH/g	
Interfacial tension	EN 14210/ASTM D971	≥ 40 mN/m (35 for recycled)	
Total sulfur content	IP 373/ISO 14596	No general requirement	
Corrosive sulfur	DIN 51353	Not corrosive	
Potentially corrosive sulfur	IEC 62535/ASTM D1275	Not corrosive	
DBDS	IEC 62697-1	Not detectable (< 5 mg/kg)	
Inhibitors of IEC 60666	IEC 60666	(U) uninhibited oil: not detectable (< 0,01%)	
Metal passivator additives of IEC 60666	IEC 60666	Not detectable (< 5 mg/kg), or as agreed upon with the purchaser	
Other additives	–	See footnote ^d	
2-Furfural and related compounds content	IEC 61198	Not detectable (< 0,05 mg/kg) for each individual compound	
Stray gassing	See 6.23	No general requirement ^e	
Performance			
Oxidation stability	IEC 61125:1992, method C Test duration (U) Uninhibited oil: 164 h	For oils with other antioxidant additives and metal passivator additives, see 6.13.	
Total acidity [†]	1.9.4 of IEC 61125:1992	Max. 1,2 mg KOH/g	
Sludge [†]	1.9.1 of IEC 61125:1992	Max. 0,8	
DDF at 90 °C ^{f,h}	1.9.6 of IEC 61125:1992, and IEC 60247	Max. 0,500	
Gassing tendency	IEC 60628:1985, method A	± 5	
ECT	See 6.15	No general requirement	

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Table 2 (concluded)

1	2	3	4
Property	Test method	Limits	
		Transformer oil	Low temperature switchgear oil
Health, safety and environment (HSE)			
Flash point	ASTM D93	Min. 135 °C	Min. 100 °C
PCA content	IP 346	Max. 3 %	
PCB content	IEC 61619	Not detectable (< 2 mg/kg)	
^a For bulk supply.			
^b For delivery in drums and IBC.			
^c After laboratory treatment (see 6.4).			
^d The supplier shall declare the generic type of all additives, and their concentrations in the case of antioxidant additives.			
^e To be agreed upon between supplier and purchaser.			
^f At the end of oxidation stability tests.			
^g Particle content in drums at delivery of oil can be agreed between supplier and customer, based on a statistical reference at delivery.			
^h A DDF of max. 0,020 after 2 h of oxidation (see IEC 61125:1992, method C) can be used for application in EHV instrument transformers and bushings.			

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Annex A
(informative)

Potentially corrosive sulfur

A.1 Mechanism of copper sulfide deposition

A.1.1 The mechanism of copper sulfide (Cu_2S) deposition is still not fully elucidated, but it may involve dissolution and transport of copper by sulfur containing species forming complexes with copper. These complexes can then be absorbed by cellulosic insulation where they decompose into Cu_2S .

A.1.2 The strong influence of temperature and oxygen on this process indicates that some oxidized sulfur species may be more active than those originally present in oil, or that other oxidation products are important as co-complexing agents (see CIGRE Technical Brochure 378). Cu_2S deposition occurs preferentially in equipment where corrosive sulfur compounds are present in oil, unvarnished or unprotected copper is used, operating temperatures are high and the amount of oxygen in oil is limited. The optimal oxygen content for copper transport seems to be relatively low, probably in the region of a few thousand $\mu\text{L/L}$, but deposition may occur over a wide range of oxygen contents.

A.2 Corrosive sulfur compounds in oil

Although many sulfur compounds are known to be corrosive for copper, few have been identified as components of insulating oil. The only compound shown so far to be a potent Cu_2S forming agent and to be present in significant amounts in transformer oil is dibenzyl disulfide (DBDS). Most oils found to be forming Cu_2S contain this substance. However, refining processes using severe hydrotreatment can easily remove this reactive compound from oil. Several other substances (including disulfides, thioethers, various oxidized sulfur compounds and elemental sulfur) have been shown to cause Cu_2S formation in the IEC 62535 test, when added to originally non-corrosive oils.

A.3 Detection of corrosive sulfur compounds in passivator-containing oils

A.3.1 General

A.3.1.1 When oil in a transformer contains a metal passivator additive, a thin protective layer of passivator is formed on copper surfaces, preventing copper from dissolving in oil, reacting with corrosive sulfur compounds present in oil, and depositing in paper insulation as harmful copper sulfide (Cu_2S).

A.3.1.2 The same occurs when testing passivator-containing oils in accordance with IEC 62535. This test method therefore cannot detect corrosive sulfur compounds present in passivating oils and may provide "false negative" results for such oils. Passivator-containing oils testing negative as new oils may then test positive and start depositing harmful Cu_2S after the additive has been consumed by aging in transformers service.

A.3.1.3 In order to detect corrosive sulfur compounds in oil containing a metal passivator additive (declared or suspected), the passivator additive has to be removed first from the oil. The two procedures given in A.3.2 can be used for that purpose. Both are intended for newly available types of oils only, not for normal deliveries of oil.

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A.3.2 Procedure 1

This procedure is as follows:

- a) stir 100 mL of passivator-containing oil with 500 mg of a suitable adsorbent (a strong, mixed-mode, polymer-based cation exchanger for basic analytes), for 1 h, then filter out the adsorbent;

or

- b) extract 60 mL of oil under a slight vacuum on a 3 mL column containing 200 mg of the adsorbent, if the initial concentration of passivator was < 200 mg/kg.

A.3.3 Procedure 2

This procedure is based on the observation that metal passivator additives in oil are consumed by oxidation aging (in accelerated tests in the laboratory and in transformers in service), and is carried out as follows:

- a) Run the passivator-containing oil in the test cell used in method C of IEC 61125:1992 at 120 °C for 164 h with an air flow of 0,15 L/h to ensure that the passivator has been consumed by oxidation.
- b) Test the aged oil for corrosive sulfur in the test cell of IEC 62535 with new paper-wrapped conductor.
- c) To avoid false positives with the aged oil (i.e. where oxidation aging compounds of oil are mistakenly interpreted as Cu_2S), confirm Cu_2S deposition with SEM/EDX or other techniques (in accordance with IEC 62535). False positives can also be avoided by carrying out a second IEC 62535 test without copper strip and with paper only, and comparing the appearance of papers after both tests with and without copper.

NOTE 1 The protective layer of passivator on copper has been observed to remain on copper after aging tests in the laboratory, but there is little knowledge on whether and how long it will remain on copper in transformers in service.

NOTE 2 As a complement to IEC 62535 and procedures 1 and 2 for passivator-containing oils, the quantification of corrosive sulfur compounds in oil (for example, dibenzyl disulfide (DBDS) and total disulfide) can be used to ensure that none of these potentially harmful compounds are present in oil.

A.4 Contamination of oils

Mineral insulating oils suspected of having been accidentally contaminated with silicone oils, phthalates or other surface-active chemicals or oils should not be introduced in transformers, since these compounds can produce foaming in oil when trying to degas the transformer, thus making it difficult or impossible to fully degas the transformer oil. The foaming tendency test of ISO 6247 can be used to detect such a contamination.

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Bibliography

Standards

ASTM D97, *Standard test method for pour point of petroleum products.*

ASTM D2112, *Standard test method for oxidation stability of inhibited mineral insulating oil by pressure vessel.*

ASTM D7150, *Standard test method for the determination of gassing characteristics of insulating liquids under thermal stress at low temperature.*

IEC 60296:2012, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear.*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons.*

IEC 62697-1, *Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids – Part 1: Test method for quantitative determination of dibenzylidene disulfide (DBDS).*

IEC 62701, *Fluids for electrotechnical applications – Recycled mineral insulating oils for transformers and switchgear.*

ISO 6247, *Petroleum products – Determination of foaming characteristics of lubricating oils.*

SANS 1518, *Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks.*

SANS 10229-1, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging.*

SANS 10232-1, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transportation.*

SANS 10233, *Transport of dangerous goods – Intermediate bulk containers for road and rail transport.*

SANS 10368, *Transport of low-hazard goods in bulk – Emergency information for road vehicles.*

SANS 60076-2/IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers.*

Other publications

CIGRE Technical Brochure 170, *Static electrification.*

CIGRE Technical Brochure 296, *Recent developments in DGA interpretation.*

CIGRE Technical Brochure 378, *Copper sulphide in transformer insulation.*

European Council Directive (96/59/EC) of 16 September 1996 – *Disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCTs).*

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Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Fluids for electrotechnical applications

Part 4: Recycled uninhibited mineral insulating oils for transformers and switchgear

WARNING

This document references other
documents normatively.

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was prepared by National Committee SABS/TC 028/SC 02, *Petroleum products, biofuels and lubricants – Lubricants*, in accordance with procedures of the SABS, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in March 2017.

Reference is made in 4.1.4, the note 1 to 6.6, and the note to 6.7 to "relevant national legislation". In South Africa this means the National Environmental Management Act, 1998 (Act No. 107 of 1998).

SANS 555 consists of the following parts, under the general title *Fluids for electrotechnical applications*:

Part 1: Unused inhibited mineral insulating oils for transformers and switchgear.

Part 2: Unused uninhibited mineral insulating oils for transformers and switchgear.

Part 3: Recycled inhibited mineral insulating oils for transformers and switchgear.

Part 4: Recycled uninhibited mineral insulating oils for transformers and switchgear.

Annex A is for information only.

Compliance with this document cannot confer immunity from legal obligations.

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Fluids for electrotechnical applications

Part 4:

Recycled uninhibited mineral insulating oils for transformers and switchgear

1 Scope

1.1 This part of SANS 555 specifies requirements and test methods for recycled mineral insulating oils for use in transformers, switchgear, and similar electrical equipment in which oil is required for insulation and heat transfer.

1.2 This part of SANS 555 applies to oils with and without additives, and applies only to recycled uninhibited insulating oils.

1.3 This part of SANS 555 does not cover unused oils.

1.4 This part of SANS 555 does not differentiate between the methods used to recycle mineral insulating oil.

1.5 This part of SANS 555 does not apply to mineral insulating oils used as impregnates in cables or capacitors.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS.

ASTM D93, *Standard test methods for flash point by Pensky-Martens closed cup tester.*

ASTM D445, *Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity).*

ASTM D971, *Standard test method for interfacial tension of oil against water by the ring method.*

ASTM D1533, *Standard test method for water in insulating liquids by coulometric Karl Fischer titration.*

DIN 51353, *Testing of insulating oils; detection of corrosive sulfur; silver strip test.*

EN 14210, *Surface active agents – Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method.*

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IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method.*

IEC 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity.*

IEC 60296:2012, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear.*

IEC 60422, *Mineral insulating oils in electrical equipment – Supervision and maintenance guidance.*

IEC 60475, *Method of sampling insulating liquids.*

IEC 60628:1985, *Gassing of insulating liquids under electrical stress and ionization.*

IEC 60666, *Detection and determination of specified additives in mineral insulating oils.*

IEC 60814, *Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration.*

IEC 60970, *Insulating liquids – Methods for counting and sizing particles.*

IEC 61125:1992, *Unused hydrocarbon based insulating liquids – Test methods for evaluating the oxidation stability.*

IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds.*

IEC 61619, *Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography.*

IEC 61620, *Insulating liquids – Determination of the dielectric dissipation factor by measurement of the conductance and capacitance – Test method.*

IEC 62021-1, *Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration.*

IEC 62021-2, *Insulating liquids – Determination of acidity – Part 2: Colourimetric titration.*

IEC 62535, *Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oils.*

IEC 62697-1, *Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids – Part 1: Test method for quantitative determination of dibenzyl disulfide (DBDS).*

IP 346, *Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions – Dimethylsulfoxide extraction refractive index method.*

IP 373, *Petroleum products – Determination of sulfur content – Oxidative microcoulometry method.*

ISO 2719, *Determination of flash point – Pensky-Martens closed cup method.*

ISO 3016, *Petroleum products – Determination of pour point.*

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ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 3675, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.*

ISO 12185, *Crude petroleum and petroleum products – Determination of density – Oscillating U-tube method.*

ISO 14596, *Petroleum products – Determination of sulfur content – Wavelength-dispersive X-ray fluorescence spectrometry.*

SANS 290, *Mineral insulating oils – Management and handling of polychlorinated biphenyls (PCBs).*

3 Definitions

For the purposes of this document, the terms and definitions given in IEC 60296:2012 and the following apply.

recycled mineral insulating oil

mineral insulating oil previously used in electrical equipment that has been subjected to re-refining, reclaiming, or regeneration off-site

NOTE 1 The characteristics of recycled oil are heavily dependent on the crude from which it was refined, the original refining technique, the service history and the type of recycling process. Natural antioxidants originally present in the oil might have been depleted in service or removed by the recycling process.

NOTE 2 Recycled oil is not appropriate for use in all applications.

NOTE 3 Such recycled oils are often produced from mixtures of mineral insulating oils of different origin.

NOTE 4 A blend of unused and recycled oils in any proportion is regarded as being recycled oil.

NOTE 5 Due to local legislation, in some countries, it is advisable to categorize used electrical oil as waste oil and complete separation of handling of unused and used oil is required.

4 Requirements

4.1 General requirements

4.1.1 General requirements of this part of SANS 555 are given in table 1. For the purposes of this part of SANS 555, clause 4, 5.1 and 5.5, clause 6, and 7.1 of IEC 60296:2012 apply.

4.1.2 Properties of oil (refining and stability) that are influenced by quality and type of the original oil refining, used oil recycling and additives, are listed in table 1.

NOTE These properties can include appearance, interfacial tension, sulfur content, acidity, corrosive sulfur, 2-furfural and related compounds content and stray gassing.

4.1.3 Requirements for health, safety and environment (HSE) properties are listed in table 1. The mineral insulating oils which are the subject of this part of SANS 555 should be handled with due regard to personal hygiene. Direct contact with the eyes may cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice sought. Some of the tests specified in this part of SANS 555 involve the use of processes that could lead to a hazardous situation.

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4.1.4 The disposal of these items should be carried out in accordance with relevant national legislation (see foreword) with regard to their impact on the environment. Every precaution should be taken to prevent release of mineral insulating oil into the environment.

4.2 Classification, identification, and general delivery requirements

4.2.1 Classification

For the purposes of this part of SANS 555, recycled mineral insulating oils shall be classified into two classes as follows:

- a) transformer oils; and
- b) low-temperature switchgear oils.

4.2.2 Miscibility

Recycled mineral insulating oils of the same class (see 5.1.1 of IEC 60296:2012), the same group (see 5.1.2 of IEC 60296:2012), the same lowest cold start energizing temperature (LCSET) (see 5.1.3 of IEC 60296:2012) and containing the same types of additives are considered to be miscible and compatible with each other (see also IEC 60422).

4.2.3 Identification and general delivery requirements

4.2.3.1 Identification and general delivery requirements are as follows:

- a) Oil shall be delivered in bulk, rail tank cars, tank containers or packed in drums or IBC (intermediate bulk containers). These shall be clean and suitable for this purpose to avoid any contamination.
- b) Oil drums and IBC containers shall carry at least the following markings:
 - 1) supplier's designation;
 - 2) classification (see 5.1 of IEC 60296:2012);
 - 3) oil quantity; and
 - 4) batch number.
- c) The oil in this container shall be recycled oil meeting the requirements of this part of SANS 555. As agreed between the supplier and purchaser, each oil delivery shall be accompanied by a document specifying the supplier's designation, oil classification and certificate of compliance, and process of recycling.
- d) The supplier shall declare the generic type of all known additives and their concentrations in the cases of inhibitors and passivators.

4.2.3.2 This document specifying the supplier's designation, oil classification and certificate of compliance, and process of recycling shall be traceable to a specific batch of oil produced.

5 Sampling

Sampling (for identification and general delivery requirements) shall be carried out in accordance with the procedure described in IEC 60475.

6 Properties and methods of test

6.1 General requirements

Requirements for properties, their significance and methods of test are listed in table 1.

6.2 Water content

A low water content of mineral insulating oil is necessary to achieve adequate breakdown voltage and low dissipation losses. To avoid separation of free water, recycled mineral insulating oil shall have limited water content (see table 1). Before filling the electrical equipment, the oil should be treated to meet the requirements of IEC 60422. Water content shall be measured in accordance with IEC 60814.

6.3 Acidity

Recycled mineral insulating oil should have been treated if necessary to remove acidity and oxidation by-products. Acidity shall be measured in accordance with IEC 62021-1 or IEC 62021-2.

6.4 Antioxidant additives

6.4.1 Antioxidants (see 3.5 of IEC 60296:2012) slow down the oxidation of oil and therefore the formation of degradation products such as oil sludge and acidity. It is necessary to know the concentration of antioxidants for the correct classification of the oil. In addition, the actual concentration is required to monitor ageing of the oil.

6.4.2 Additives that slow down the oxidation of mineral insulating oils include the following:

- a) Inhibitors such as phenols and amines (see 3.5.1 of IEC 60296:2012). The most widely used inhibitors are di-tert-butyl-para-cresol (DBPC) and di-tert-butyl-phenol (DBP) or butylphenol (DBP). Detection and measurement of DBPC and DBP shall be carried out in accordance with IEC 60666. IEC test methods are not available for other types of inhibitors.
- b) Other antioxidant additives such as sulfur- and phosphor-containing compounds, for example, organic polysulfides and dithiophosphates (see 3.5.2 of IEC 60296:2012). An antioxidant additive of this type is DBDS (see 6.10 of IEC 60296:2012), but it is not accepted in recycled oils as it is known to be corrosive to copper and will likely result in the oil failing the potentially corrosive sulfur test IEC 62535. An IEC test method was prepared only for DBDS (see IEC 62697-1) and not for the other antioxidant additives of this type.
- c) Metal passivators (see 6.11.3 of IEC 60296:2012).

6.5 Gassing tendency

Gassing tendency of mineral insulating oil, i.e. the gas absorbing property of oil when subjected to corona partial discharges, is only necessary and important for special equipment like HV (high voltage) instrument transformers and bushings. It is a measure of the rate of absorption or evolution of gas into oil under prescribed laboratory conditions. Gas absorption properties could be related to oil aromatic content. Gassing tendency shall be measured using method A of IEC 60628:1985.

NOTE Additives such as 1,2,3,4 tetrahydronaphtalene (tetralin), mono- or dibenzyltoluene and others have been proposed to reduce the gassing tendency of some oils, but are not described in IEC 60666. Mono- and dibenzyltoluene are described in IEC 60867.

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6.6 Polycyclic aromatics content (PCAs)

Some PCAs are classified to be carcinogens and therefore need to be controlled to an acceptable level in mineral insulating oil. The total amount of PCAs can be measured by extraction with DMSO (dimethylsulfoxide) under the conditions of IP 346.

NOTE 1 Acceptable limits of total or individual PCAs are specified in relevant national legislation (see foreword).

NOTE 2 Values and limits as given in IP 346 are substantiated for virgin base oils only.

6.7 Polychlorinated biphenyl content (PCBs)

Recycled mineral insulating oil shall comply with SANS 290 with respect to PCBs. The reference test method shall be IEC 61619 or alternatives as listed in SANS 290.

NOTE Acceptable limits of total or individual PCBs are specified in relevant national legislation (see foreword) inclusive of SANS 290.

6.8 2-Furfural (2-FAL) and related compounds content

6.8.1 2-FAL and related compounds in recycled mineral insulating oils can result from improper redistillation after solvent extraction, from cellulose degradation within equipment that previously contained the oil or from contamination with used oil.

6.8.2 Recycled mineral insulating oils should have a low level of 2-FAL (see table 1) and related compounds. Measurement shall be carried out in accordance with IEC 61198.

NOTE 1 The "related compounds" are 5-hydroxymethyl-2-furfural (5HMF), 2-furfuryl alcohol (2FOL), 2-acetylfuran (2ACF), and 5-methyl-2-furfural (5MEF).

NOTE 2 Not all recycling processes will be able to eliminate all furanic compounds and some trace may remain.

6.9 Particle content

Particles in recycled mineral insulating oil might result from manufacturing, storage or handling of the oil, and can affect its breakdown voltage (see 6.4 of IEC 60296:2012). Measurement shall be carried out in accordance with IEC 60970.

6.10 DBDS content

This compound is corrosive at normal transformer operating temperatures and can produce copper sulfide. It therefore should not be present in recycled mineral insulating oils (see 6.4(b) of this part of SANS 555). Measurement shall be carried out in accordance with IEC 62697-1.

6.11 Stray gassing of oil

Some oils can produce gases such as hydrogen, light hydrocarbons and carbon oxides at low temperatures (< 120 °C) without thermal stress or electrical faults in a transformer. This phenomenon could result in a high production of gases and a misinterpretation of dissolved gas analysis (DGA) results.

NOTE Methods to measure stray gassing are described in CIGRE Brochure 296 and ASTM D7150. Inhibited grades typically produce less stray gassing than uninhibited ones.

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Table 1 — General requirements for properties, their significance and methods of test

1	2	3	
Property	Test method	Limits	
		Transformer oil	Low temperature switchgear oil
Functional			
Viscosity at 40 °C	ISO 3104, ASTM D445	Max. 12 mm ² /s	Max. 3,5 mm ² /s
Viscosity at –30 °C	ISO 3104, ASTM D445	Max. 1 800 mm ² /s	–
Pour point	ISO 3016	Max. –40 °C	Max. –60 °C
Water content	IEC 60814/ASTM D1533	Max. 20 mg/kg ^a / 30 mg/kg ^b /10 mg/kg ^c	
Breakdown voltage	IEC 60156	Min. 60 kV ^a /50 kV ^b /70 kV ^c	
Density at 20 °C	ISO 3675 or ISO 12185	Max. 0,895 g/mL	
DDF at 90 °C	IEC 60247 or IEC 61620	Max. 0,005	
Particle content	IEC 60970	No general requirement ⁹	
Refining and stability			
Appearance	–	Clear, free from sediment and suspended matter	
Acidity	IEC 62021-1 or 62021-2	Max. 0,01 mg KOH/g	
Interfacial tension	EN 14210 or ASTM D971	≥ 35 mN/m	
Total sulfur content	IP 373 or ISO 14596	No general requirement	
Corrosive sulfur	DIN 51353	Not corrosive	
Potentially corrosive sulfur	IEC 62535	Not corrosive	
DBDS	IEC 62697-1	Not detectable (< 5 mg/kg)	
Inhibitors of IEC 60666	IEC 60666	Not detectable	
Metal passivator additives of IEC 60666	IEC 60666	Not detectable (< 5 mg/kg), or as agreed upon with the purchaser	
Other additives	–	See footnote ^d	
2-Furfural and related compounds content	IEC 61198	Not detectable (< 0,05 mg/kg) for each individual compound	
Stray gassing	See 6.22	No general requirement ^e	
Performance			
Oxidation stability	IEC 61125:1992 (method C) Test duration (U) Uninhibited oil: 164 h	For oils with other antioxidant additives and metal passivator additives, see 6.12 of IEC60296:2012	
Total acidity ^f	1.9.4 of IEC 61125:1992	Max. 1,2 mg KOH/g	
Sludge ^f	1.9.1 of IEC 61125:1992	Max. 0,8	
DDF at 90 °C ^h	1.9.6 of IEC 61125:1992, IEC 60247	Max. 0,500	
Gassing tendency	IEC 60628:1985, method A	± 5	

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Table 1 (concluded)

1	2	3
Property	Test method	Limits
		Transformer oil
Health, safety and environment (HSE)		
Flash point	ISO 2719, ASTM D93	Min. 135 °C
PCA content	IP 346	Max. 3 %
PCB content	IEC 61619	—
^a For bulk supply. ^b For delivery in drums and IBC. ^c After laboratory treatment (see 6.2). ^d The supplier shall declare the generic type of all additives, and their concentrations in the case of antioxidant additives. ^e To be agreed upon between supplier and purchaser. ^f At the end of oxidation stability tests. ^g Particle content in drums at delivery of oil can be agreed between supplier and customer, based on a statistical reference at delivery. ^h A DDF of max. 0,020 after 2 h of oxidation (see IEC 61125:1992, method C) can be used for application in EHV instrument transformers and bushings.		

Annex A (informative)

Potentially corrosive sulfur

A.1 Mechanism of copper sulfide deposition

A.1.1 The mechanism of copper sulfide (Cu_2S) deposition is still not fully elucidated, but it may involve dissolution and transport of copper by sulfur containing species forming complexes with copper. These complexes can then be absorbed by cellulosic insulation where they decompose into Cu_2S .

A.1.2 The strong influence of temperature and oxygen on this process indicates that some oxidized sulfur species may be more active than those originally present in oil, or that other oxidation products are important as co-complexing agents (see CIGRE Technical Brochure 378). Cu_2S deposition occurs preferentially in equipment where corrosive sulfur compounds are present in oil, unvarnished or unprotected copper is used, operating temperatures are high, and the amount of oxygen in oil is limited. The optimal oxygen content for copper transport seems to be relatively low, probably in the region of a few thousand $\mu\text{L/L}$, but deposition may occur over a wide range of oxygen contents.

A.2 Corrosive sulfur compounds in oil

Although many sulfur compounds are known to be corrosive for copper, few have been identified as components of insulating oil. The only compound shown so far to be a potent Cu_2S forming agent and to be present in significant amounts in transformer oil is dibenzyl disulfide (DBDS). Most oils found to be forming Cu_2S contain this substance. However, refining processes using severe hydrotreatment can easily remove this reactive compound from oil. Several other substances (including disulfides, thioethers, various oxidized sulfur compounds and elemental sulfur) have been shown to cause Cu_2S formation in the IEC 62535 test, when added to originally non-corrosive oils.

A.3 Detection of corrosive sulfur compounds in passivator-containing oils

A.3.1 General

A.3.1.1 When oil in a transformer contains a metal passivator additive, a thin protective layer of passivator is formed on copper surfaces, preventing copper from dissolving in oil, reacting with corrosive sulfur compounds present in oil, and depositing in paper insulation as harmful copper sulfide (Cu_2S).

A.3.1.2 The same occurs when testing passivator-containing oils in accordance with IEC 62535. This test method therefore cannot detect corrosive sulfur compounds present in passivating oils and may provide "false negative" results for such oils. Passivator-containing oils testing negative as new oils may then test positive and start depositing harmful Cu_2S after the additive has been consumed by aging in transformers service.

A.3.1.3 In order to detect corrosive sulfur compounds in oil containing a metal passivator additive (declared or suspected), the passivator additive has to be removed first from the oil. The two procedures given in A.3.2 and A.3.3 can be used for that purpose. Both are intended for newly available types of oils only, not for normal deliveries of oil.

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A.3.2 Procedure 1

This procedure is as follows:

- a) stir 100 mL of passivator-containing oil with 500 mg of a suitable adsorbent (a strong, mixed-mode, polymer-based cation exchanger for basic analytes), for 1 h, then filter out the adsorbent;
- or
- b) extract 60 mL of oil under a slight vacuum on a 3 mL column containing 200 mg of the adsorbent, if the initial concentration of passivator was < 200 mg/kg.

A.3.3 Procedure 2

This procedure is based on the observation that metal passivator additives in oil are consumed by oxidation aging (in accelerated tests in the laboratory and in transformers in service), and is as follows:

- a) Run the passivator-containing oil in the test cell used in method C of IEC 61125:1992 at 120 °C for 164 h with an air flow of 0,15 L/h to ensure that the passivator has been consumed by oxidation.
- b) Test the aged oil for corrosive sulfur in the test cell of IEC 62535 with new paper wrapped conductor.
- c) To avoid false positives with the aged oil (i.e. where oxidation aging compounds of oil are mistakenly interpreted as Cu₂S), confirm Cu₂S deposition with SEM/EDX or other techniques (in accordance with IEC 62535). False positives can also be avoided by carrying out a second IEC 62535 test without copper strip and with paper only, and comparing the appearance of papers after both tests with and without copper.

NOTE 1 The protective layer of passivator on copper has been observed to remain on copper after aging tests in the laboratory, but there is little knowledge on whether and how long it will remain on copper in transformers in service.

NOTE 2 As a complement to IEC 62535 and procedures 1 and 2 for passivator-containing oils, the quantification of corrosive sulfur compounds in oil (for example, dibenzyl disulfide (DBDS) and total disulfide) can be used to ensure that none of these potentially harmful compounds are present in oil.

A.4 Contamination of oils

Mineral insulating oils suspected of having been accidentally contaminated with silicone oils, phthalates or other surface-active chemicals or oils should not be introduced in transformers, since these compounds can produce foaming in oil when trying to degas the transformer, thus making it difficult or impossible to fully degas the transformer oil. The foaming tendency test of ISO 6247 can be used to detect such a contamination.

Bibliography

Standards

ASTM D4052, *Standard test method for density, relative density and API gravity of liquids by digital density meter.*

ASTM D7150, *Standard test method for the determination of gassing characteristics of insulating liquids under thermal stress at low temperature.*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons.*

ISO 6247, *Petroleum products -- Determination of foaming characteristics of lubricating oils.*

SANS 1518, *Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks.*

SANS 10229-1, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging.*

SANS 10232-1, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transportation.*

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Other publications

CIGRE Technical Brochure 378, *Copper sulfide in transformer insulation, 2009.*

CIGRE Technical Brochure 413, *Insulating oil reclamation and dechlorination, 2010.*

European Council Directive (96/59/EC) of 16 September 1996 – *Disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT).*

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A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT SPECIFICATION

REQUIREMENTS FOR TRACTION TRANSFORMERS FOR 3kV DC TRACTION SUBSTATIONS IN ACCORDANCE WITH SANS 60076

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A handwritten signature in black ink, appearing to read 'B.L. Ngobeni', positioned above a dotted line.

A handwritten signature in black ink, appearing to read 'L.O. Borchard', positioned above a dotted line.

A handwritten signature in black ink, appearing to read 'S.E. Sibande', positioned above a dotted line.

Date: 07 November 2018

Circulation Restricted To:

Transnet Freight Rail – Chief Engineer Infrastructure
- Technology Management

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1.0 SCOPE

- 1.1 This specification covers Transnet freight rail's requirements for the design, manufacture, testing and delivery of traction transformers for 3kV DC traction substations.

2.0 BACKGROUND

- 2.1 Transnet's traction substations consist of single and double units and in exceptional cases a three unit rectifier configurations.
- 2.2 Each rectifier unit comprises of a set of high voltage AC disconnects, primary circuit breaker, two current transformers and a traction transformer connected for twelve-pulse rectification with its control and protection circuitry.

3.0 STANDARDS AND PUBLICATIONS

The transformers shall comply with all relevant requirements of the latest editions of the following publications unless otherwise specified.

3.1 SOUTH AFRICAN NATIONAL STANDARDS

SANS 121:	Hot Dip Galvanized Coatings on Fabricated Iron and Steel articles.
SANS 555:	Unused and reclaimed mineral insulating oils for transformers and switchgear.
SANS 1019:	Standard voltages, currents and insulation levels for electricity supply.
SANS 1091:	National Colour Standards.
SANS 9001:	Quality Management Systems – Requirements.
SANS 10142-1:	The wiring of premises Part 1- Low voltage installations.
SANS 60076-1:	Power Transformers Part 1- General.
SANS 60076-2:	Power Transformers Part 2- Temperature rise for liquid immersed transformers.
SANS 60076-3:	Power Transformers Part 3- Insulation levels, Dielectric tests and External clearances in air.
SANS 60076-5:	Power Transformers Part 5- Ability to withstand short circuit.
SANS 60076-7:	Power Transformers Part 7- Loading Guide for Oil-immersed Power Transformers.
SANS 60137:	Insulated Bushings for Alternating Voltages above 1000V.
SANS 61869-2:	Instrument Transformers Part 2- Current Transformers.

3.2 TRANSNET FREIGHT RAIL'S PUBLICATIONS

CEE 0045:	Painting of Steel Components of Electrical Equipment.
CEE 0224:	Drawings, Catalogues, Instruction manuals and Spare lists for electrical equipment supplied under the contract.

4.0 TENDERING PROCEDURE

- 4.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 4.2 A statement of non-compliance shall be motivated by the tenderer.
- 4.3 Tenderers shall complete Appendix 2. "Information to be provided by tenderers"
- 4.4 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 4.5 Failure to comply with clauses 4.1, 4.2, 4.3 and 4.4 could preclude a tender from consideration.

5.0 APPENDICES

The following appendices form an integral part of this specification and shall be read in conjunction with it.

5.1 Appendix 1 - "Schedule of Requirements"

This appendix details the specific requirements for this application.

5.2 Appendix 2 - "Information to be provided by tenderers"

This appendix calls for specific technical information to be furnished by tenderers.

6.0 SERVICE CONDITIONS

6.1 ATMOSPHERIC CONDITIONS

Altitude:	0 to 1800m above sea level.
Ambient temperature:	-10°C to +55 °C.
Relative humidity:	10% to 90%
Lightning Conditions:	20 ground flashes per square kilometre per annum.
Pollution:	Heavily salt laden or polluted with smoke from industrial sources.

6.2 ELECTRICAL CONDITIONS

6.2.1	Frequency:	The AC high voltage supply will normally be supplied by Eskom. The frequency will be 50 ± 2.5 Hz.
6.2.2	Supply Voltage:	Under normal conditions the system supply voltage will be maintained at ±5% of the nominal voltage over a 24 hour period. Under crippled supply network conditions the voltage can be expected to drop up to 15%.
6.2.3	Fault levels:	A three phase short circuit on the supply will be limited to the following levels:
	Nominal supply voltage	Fault Level
	66kV	20kA
	88kV	25kA
	132kV	40kA

7.0 RECTIFIER TRANSFORMERS

7.1 GENERAL

- 7.1.1 Unless specified the transformers shall be for outdoor use and of the oil natural air natural (ONAN) cooled type and shall comply with specification SANS 60076-1.
- 7.1.2 All components used in the traction transformer shall be free from polychlorinated biphenyls (PCB free)
- 7.1.3 The design of the transformers shall be such that harmonic disturbances are minimised.
- 7.1.4 The primary winding of the main traction transformer shall be star connected.
- 7.1.5 The configuration of the secondary winding shall be two separated delta windings giving 15° phase shift. The total secondary winding shall consist of six phases and the output voltage of each phase shall be approximately 1220V.
- 7.1.6 The secondary windings shall be designed to be compatible with twelve pulse rectifier units.
- 7.1.7 The responsible Senior Electrical Engineer at Transnet freight rail shall be consulted before any transformer design is finalised.

7.1.8 Provision shall be made for a three phase tertiary winding on the secondary side of the transformer to supply the auxiliary transformers. The winding may be tapped off the secondary winding or be separately wound. The tertiary winding shall have separate bushings for connection to the auxiliary transformer.

7.1.9 The tertiary winding shall be rated to supply a 50kVA auxiliary transformer unless otherwise specified.

7.2 TEMPERATURE RISE AND RATING.

7.2.1 The temperature rise of the transformer windings after thermal equilibrium and a steady temperature has been reached on continuous full load, shall not exceed 65°C.

7.2.2 The maximum temperature rise of the windings subsequent to the application of any of the following rectifier overloads, after the constant continuous rated full load temperature has been attained are as follows:

- 3 x full load for 1 minute the temperature rise of the windings shall not exceed 70°C.
- 3.5 x full load for 10 seconds the temperature rise of the windings shall not exceed 70°C.
- 2 x full load for 30 minutes the temperature rise of the windings shall not exceed 100°C.

7.2.3 The temperature rise of the windings shall be measured by the increase of resistance method. Standard correction for cooling during the measurement of resistance shall be applied.

7.2.4 The rating of the transformer shall be such that when it is operating in conjunction with the rectifier equipment specified and with an auxiliary transformer connected to the tertiary winding the output of the transformer shall be as follows:

- 2 x full load for 30 minutes
- 3 x full load for 1 minute
- 3.5 X full load for 10 seconds.
- 4.25 x full load instantaneous tripping.

These values shall be proved theoretically.

7.3 VOLTAGE RATIO AND TAPPINGS

7.3.1 The transformer shall be designed to operate at the nominal system voltage as specified in the schedule of requirements.

7.3.2 Tappings shall be provided on the primary windings. (5 tap position)

The tap range shall be $\pm 2,5\%$ and $\pm 5\%$ of the nominal voltages.

7.3.3 The transformers shall supply full load output at all tappings.

7.3.4 The full load regulation of the transformer shall not be more than 5%.

7.3.5 The tap changing gear shall be externally, manually operated, positively locking, off load type. The arrangement shall be such that excessive backlash will not affect the making of proper contact when the tap changing gear is operated in either direction. Rotary type having high-pressure type contacts is preferred.

7.3.5.1 The tap changing switch shall be lockable with provision for a padlock.

7.3.5.2 The positions of the tap changing switch shall be clearly marked.

7.4 BUILT IN CURRENT TRANSFORMERS.

7.4.1 Where build-in current transformers are required, shall be in accordance with SANS 61869-2.

7.5 TRANSFORMER IMPEDANCE

7.5.1 The transformer impedance shall be as high as possible taking into account the voltage regulation as specified in clause 7.3.4 but shall not be less than 8 %.

7.6 MECHANICAL STRENGTH OF TRANSFORMER WINDINGS

7.6.1 The AC supply system can have a fault capacity specified in clause 6.2.3.

- 7.6.2 The transformer windings shall be able to withstand the electromagnetic and mechanical stresses caused by high fault currents.
- 7.6.3 In the adjudication of tenders particular attention will be given to:
- The mechanical design of the solid bolted clamping arrangement of the windings.
 - The coil stacks in order to withstand short circuit forces.
 - The methods employed to ensure thorough pre-shrinking and pre-stressing of the coils.
- 7.6.4 Tenderers shall describe fully with the aid of detailed drawings of the construction of the windings and clamping arrangements.
- 7.6.5 Tenderers shall quote for transformers having the following design features listed below. No alternative to the requirements laid down in the following sub clauses will be considered unless complete details are submitted giving the advantages and improvements that will result.
- 7.6.5.1 Primary and secondary coil stacks shall be provided with solid bolted clamping arrangements which will distribute the clamping force over the whole end periphery of each coil stack.
- 7.6.5.2 Tenderers shall state the actual force anticipated under the worst fault conditions and the effective force applied by the clamping bolts on each winding.
- 7.6.5.3 Round conductor shall not be used for any windings.
- 7.6.5.4 High voltage windings shall be of the continuous disc type while low voltage windings shall be of the helix winding type.
- 7.6.5.5 Reliance shall not be placed on any resin used on the windings for increasing the mechanical stability of the coils, nor shall such resin have any detrimental effect on the transformer oil.
- 7.6.5.6 If laminated insulating material is subjected to mechanical compression forces, the construction shall be such that these forces are normal to the plane of the laminations.
- 7.6.5.7 All spacers and clacks on packing shall be suitably locked in position. Reliance shall not be placed on the pressure applied to the windings, or an adhesive, to keep the packing pieces in position.
- 7.6.5.8 The end frames shall be well braced and be of substantial construction.
- 7.6.5.9 The internal copper connections between the windings and connections to the leads shall be crimped and bolted.
- 7.6.5.10 Only high tensile steel bolts shall be used for the bolted connections.
- 7.6.5.11 The nuts of the bolted connections shall be torqued to the following recommended values to ensure a good stable electrical contact between the mating surfaces:
- | Bolt Size | Torque value |
|-----------|--------------|
| M10 | 35.5NM |
| M12 | 61.3NM |
| M16 | 147 NM |
- 7.6.5.12 Standard machine locknuts or approved locking plates shall be used to lock the nuts of the bolted connections.
- 7.7 INSULATION LEVELS.**
- 7.7.1 Transformer bushings shall comply with SANS 60137.
- 7.7.2 Test voltages and minimum creepage distances for normal and polluted atmospheres shall be in accordance with SANS 60137.
- 7.8 INSULATION OF WINDINGS.**
- 7.8.1 The transformers are required to operate in severe lightning areas. Surge arresters will be connected between the high voltage busbars and the substation earth. The neutral of the primary Star connected windings is not required to be brought out
- 7.8.2 All windings are to be fully insulated. Full and detailed particulars of the insulation and methods employed to reduce the risk of damage by overvoltage caused by system surges and lightning must accompany the tender.

- 7.8.3 The primary and secondary windings shall be insulated to withstand the test pressures referred to in SANS 60076-1. The secondary windings must be insulated for a system highest voltage of 7,2 kV.

7.9 TERMINALS AND BUSHINGS

- 7.9.1 All terminals shall be extended to the top of the transformer tank through suitable outdoor type bushings.
- 7.9.2 The bushings shall conform to the insulation levels as specified in SANS 60137 for the system nominal supply voltage at which the equipment must operate.
- 7.9.3 All bushings, stems and terminals shall be of sufficient size to ensure sufficient mechanical strength of attaching and supporting external connections and shall not be smaller than
a) 19 mm diameter for primary and secondary connections
b) 12 mm diameter for auxiliary supply connections.
- 7.9.4 Provision shall be made for an earthing terminal fitted on the outside of the transformer tank for the connection of a 95 mm² cable.
- 7.9.5 The height of the wall bushings of the substation is 2,8 meters above ground level. Should the design of the transformer offered be such that the total height of the transformer and secondary bushings is less than 2,7 meters, screens must be provided. Tenderers must include the provision of screens in their offer. Details of the screens shall be submitted to Transnet freight rail for approval.
- 7.9.6 The clearance from the lowest, high voltage connection of the transformer to the finished ground level shall not be less than 3,6m for supply voltages up to 88kV, and not less than 4,1m for supply voltages exceeding 88kV.

7.10 TANK AND COOLING RADIATORS

- 7.10.1 The transformer tank shall be constructed of steel plate not less than 6 mm thick.
- 7.10.2 Transformers shall not be fitted with rollers, but be provided with a substantial base, which will enable it to be supported on steel skid rails, which are embedded in a concrete plinth. The spacing between centers of the skid rails is 1000 mm.
- 7.10.3 Provision shall be made on the transformer base for the attachment of a tackle for this purpose.
- 7.10.4 Four jacking lugs shall be provided for lifting the transformer complete with oil. Tenderers shall submit dimensioned drawings showing details of the tank and base construction.
- 7.10.5 Transformers shall be fitted with detachable radiators with drain and filling plugs.
- 7.10.6 Provision shall be made for radiator shut off valves to allow the removal of the radiators without having to drain the oil from the transformer tank.
- 7.10.7 The design of the cooling radiators shall ensure sufficient circulation of cooling oil.
- 7.10.8 Hot dipped galvanized radiators shall be used for coastal areas or were specified. The radiators shall be galvanized in accordance to the requirements of SANS 121.
- 7.10.9 The transformer cover shall be bolted to the tank. For this purpose a flange will be embedded on to the tank. An "O-ring" gasket will be installed between the cover and the tank to prevent oil leaks.
- 7.10.10 All access covers shall be bolted to the transformer tank and shall be provided with "O-rings" to prevent oil leaks. And they shall have handles and lifting lugs.

7.11 FITTINGS ON THE TRANSFORMERS

The following fittings shall be provided:

- 7.11.1 Conservator tank with a silica gel dehydrating breather, oil level gauge and drain cock.
- 7.11.2 The connecting pipe to the conservator shall extend at least 50 mm into it. All pipe connections shall have flange joints.
- 7.11.3 Where specified in Appendix 1 the conservator shall be provided with a sealed oil preservation bag.
- 7.11.3.1 The bag shall not restrict the normal draining of the conservator or the flow of oil to the transformer.

- 7.11.3.2 The bag shall allow for expansion without any increase in pressure or the causing of a partial vacuum over the specified temperature range.
- 7.11.4 The transformer shall be fitted with a weatherproof dial type thermometer graduated in °C for registering "top oil" temperature. The instrument shall be fitted with a resettable maximum temperature indicator.
- 7.11.5 Adjustable contacts shall be fitted to the thermometer. The contacts shall normally be set to operate at a temperature of 90°C. The trip contacts shall be liberally rated and adequate for closing 110 volt, 6 Ampere DC circuits. If not suitable, auxiliary relays may be provided.
- 7.11.6 A single—float Buchholz relay fitted with contacts for trip and alarm functions.
- 7.11.7 A thermal type overload relay to protect the transformer windings against sustained overloads. This relay shall have a load—temperature characteristic approximately the same as the transformer winding hot spot. Suitable means for compensation for variation of ambient air temperature shall be provided. Full details shall be submitted.
- 7.11.8 The relay shall be provided with trip contacts. The tenderer is to recommend the temperature setting for these contacts, which are normally set at 115 °C. The trip contacts shall be liberally rated and adequate for closing 110 volt, 6 Ampere DC circuits. If not suitable, auxiliary relays shall be provided.
- 7.11.9 A drain cock, two sampling cocks and thermometer pockets on the main tank.
- 7.11.10 A pipe entering the top of the main tank at the conservator end, with a cock easily accessible from ground level, and one cock on the opposite side of the main tank, at its lowest point, for connecting up to an oil filtering system. The cocks shall be screwed 50mm gas or metric equivalent female thread. If desired, the cock at the lowest point of the tank can be combined with the drain cock required in clause 7.11.9 by the addition of a suitable fitting having a 50mm gas or metric equivalent female thread.
- 7.11.11 A suitable pressure relief device fitted on the main tank if it is considered necessary by the manufacturer. The provision of the pressure relief device shall not affect the efficiency of the Bucholz relay in the event of a transformer fault.
- 7.11.12 Tenderers shall ensure that the pockets for the temperature indication are located in areas where the oil is freely circulating, thus avoiding the possibility of incorrect oil temperature measurement. Ambient temperatures can be very high in summer, and the location of the thermometer pockets must take solar radiation into account.
- 7.11.13 Where a marshalling box is fitted to the transformer the degree of protection shall be IP55 and corrosion protected.
- 7.11.14 All terminals in the marshalling box shall be clearly labeled.

8.0 CORROSION PROTECTION AND PAINTING

8.1 PREPARATION OF TRANSFORMER TANK

- 8.1.1 Rust and millscale shall be removed by shot blasting or acid cleaning. Welds which are not ground smooth shall be shot blasted or otherwise descaled and cleaned.

8.1 PAINTING

- 8.1.1 The outer surface of the transformer tank shall be painted Grey to the colour code G12 in accordance with SANS 1091. The conservator shall be painted white. The total paint thickness shall be at least 75 microns. For coastal or heavily polluted conditions it shall be at least 125 microns.
- 8.1.2 Internal surfaces of the conservator above oil level shall be cleaned and painted with one coat of oil resistant rust inhibiting etch primer. The radiators shall be hot dipped galvanized. It is recommended that galvanized radiators used at heavily polluted areas be painted.

9.0 TRANSFORMER OIL

- 9.1 Only unused mineral insulating oil shall be used.
- 9.2 The transformer oil shall meet with the requirements specified in SANS 555.

- 9.3 The oil shall be readily miscible with the oil supplied in conformity with the above mentioned specification by the major oil companies in South Africa, without detriment to the chemical, physical and electrical properties of the oil.

10.0 RATING PLATES

A non—corrosive metal plate shall be fixed to each transformer tank (not cooling tubes), giving the following information:

- Maker's name
- Maker's serial No.
- Transnet freight rail's serial No. (Left blank)
- Rated output in MVA
- Frequency
- Secondary voltage and current
- Primary voltage and current
- Primary voltage tapplings
- Transformer reactance (%)
- Transformer impedance (%)
- Vector diagram
- Diagram of connections
- Quantity of oil in litres
- Conservator fitted with bag.
- Total mass of transformer inclusive of oil in kg
- Transport mass of transformer in kg.
- Year of manufacture.

11.0 TESTS AND DATA TO BE SUBMITTED BY SUCCESSFUL TENDERERS

- 11.1 Manufacturer's type and routine tests as well as impulse voltage withstand including chopped wave type tests shall be carried out on the transformers in accordance with the current edition of SANS 60076-1.
- 11.2 Heat runs shall be carried on the first transformers of a new or different design.
- 11.3 The rating of the transformer shall be such that when it is operating in conjunction with the rectifier equipment specified and with a auxiliary transformer connected to the tertiary winding the output of the transformer shall be as follows:
- 2 x full load for 30 minutes
 - 3 x full load for 1 minute
 - 3.5 X full load for 10 seconds.
 - 4.25 x full load instantaneous tripping.
- These values shall be proved theoretically.
- 11.4 The temperature rise of the transformer windings after thermal equilibrium and a steady temperature has been reached on continuous full load, shall not exceed 65°C.
- 11.5 The maximum temperature rise of the windings subsequent to the application of any of the following rectifier overloads after the constant continuous rated full load temperature has been attained are as follows:
- 3 x full load for 1 minute the temperature rise of the windings shall not exceed 70°C.
 - 3.5 x full load for 10 seconds the temperature rise of the windings shall not exceed 70°C.
 - 2 x full load for 30 minutes the temperature rise of the windings shall not exceed 100°C.

- 11.6 The temperature rise of the windings shall be measured by the increase of resistance method. Standard correction for cooling during the measurement of resistance shall be applied.
- 11.7 Transnet freight rail shall be provided with type test certificates and two copies of test sheets, which record the values of the routine tests, or special tests that are carried out on the transformers.
- 11.8 Transnet freight rail reserves the right to be present/witness all routine including type tests were required.
- 11.9 Type tests including impulse tests must be quoted for separately.
- 11.10 The Senior Electrical Engineer, Technology Management must be notified timeously for routine or impulse test to be witnessed.

12.0 DRAWINGS AND MAINTENANCE MANUALS

- 12.1 Drawings, instruction manuals and spares lists shall be supplied in accordance with Transnet freight rail's specification CEE.0224.
- 12.2 Three copies of each of the following drawings shall be submitted to the responsible project manager for approval within 7 days of the order being placed.
 - 12.2.1 Dimension drawings showing external arrangements of transformer.
 - 12.2.2 External wiring diagrams for the transformer.
 - 12.2.3 Vector diagram and rating plate.

13.0 GUARANTEE AND DEFECTS

- 13.1 The contractor shall guarantee the transformer and accept liability for maker's defects, which may appear in design, materials and workmanship.
- 13.2 The guarantee period for the transformer shall expire after a period of 12 months commencing on the date of commissioning of the equipment.

14.0 QUALITY ASSURANCE

- 14.1 Tenderers must indicate what steps have been taken to implement a Quality Assurance system in terms of the ISO 9000 series of recommendations.

END

APPENDIX 1

SCHEDULE OF REQUIREMENTS
(To be completed by client)

SYSTEM DETAIL

- 1.0 Transformer required for: _____ substation/location
 2.0 Nominal system voltage: _____ kV
 3.0 Frequency: _____ Hz

TRANSFORMER DETAIL

- 1.0 Number of phases: Primary winding: _____ Secondary winding: _____
 2.0 Secondary winding configuration: _____
 3.0 Rated power: _____ MVA
 4.0 Impedance %: _____
 5.0 Primary voltage rating: _____ kV
 6.0 Secondary voltage rating: _____ kV
 7.0 Vector group: _____

CURRENT TRANSFORMERS

- 1.0 Built in current transformers required: _____ Yes/No.
 2.0 Current transformer data:

	Protection	Metering
Ratio:	_____	_____
Class:	_____	_____
VA Rating	_____ VA	_____ VA

OFF CIRCUIT TAPPING SWITCH

- 1.0 No of positions: _____ %Steps: _____

TRANSFORMER DIMENSIONS

- 1.0 Dimensions (if critical)
 Length: _____ mm. Breadth: _____ mm. Height: _____ mm

SPECIAL REQUIREMENTS

- 1.0 Conservator to be fitted with oil preservation bag. _____ Yes / No
 2.0 Radiators galvanised. _____ Yes / No
 3.0 Other special requirements: _____

END

APPENDIX 2**INFORMATION TO BE PROVIDED BY TENDERERS****GENERAL**

1.0 Manufacturers name _____

TRANSFORMER DETAIL

1.0 Primary voltage rating: _____ kV

2.0 Secondary voltage rating: _____ kV

3.0 Rated power: _____ MVA

4.0 Impedance %: _____

5.0 Off Circuit Tap Switch.

No of positions: _____ %Steps: _____

6.0 Vector group: _____

TANK AND TANK COVER

1.0 Free-breathing: Yes/No

2.0 Tank cover bolted to tank: Yes/No

3.0 Radiators galvanised. Yes/No

4.0 Method of Cooling: _____

5.0 Overall dimensions: Length _____ mm. Breadth _____ mm. Height _____ mm.

6.0 Winding material: HV _____ LV _____

7.0 Mass of core and windings: _____ kg

8.0 Oil capacity: _____ (Litres)

9.0 Mass of transformer complete with oil: _____ kg

10.0 Adjustable axial coils provided: Yes/No

11.0 Type of breather and dehydrating agent _____

12.0 The following information refers to the transformer when connected on the principal tapping and appropriate reference temperature for the class of insulation used.

13.0 Iron loss (Watts): _____

14.0 Copper loss at full load: _____ at _____ °C

15.0 Total load losses (Watts): _____ at _____ °C

16.0 Impedance at full load (%Z): _____

17.0 Reactance (% X): _____;

18.0 Regulation at full load at: 1.0 PF _____ Percent, 0.8 PF _____ Percent at _____ °C

19.0 Efficiency at full load at: 1.0 PF _____ Percent, 0.8 PF _____ Percent at _____ °C

20.0 Temperature rise at rated voltage and power of:

Windings: _____ °C

Top oil: _____ °C

END