# Part C1:
# Agreement and Contract Data

nec 3

# Contract Data

The Employer is

| | |
|---|---|
| **Name** | **Transnet Limited Trading as Transnet Freight Rail**..... |
| **Address** | **Nzasm Building, Room 210, Corner Paul Kruger and Minnaar Street, Pretoria**..... |
| **Telephone** | **(012) 315 2059** **Fax No. (012) 315-2125**..... |
| **E-mail** | Nhlanhla.Vilakazi@Transnet.net |
| The work is | **Refurbish Transformer at 3kV DC substations and H-frames at various sites under the control of the Depot Engineer, Witbank.** |
| The sites are | Forfar, Witbank and Wapadskloop 3kV DC substation |
| The starting date is | TO BE ADVISED..... |
| The completion date is | TO BE ADVISED..... |
| The reply period is | TWO WEEKS..... weeks |
| The defects date is | 52 Weeks after completion..... |
| The defect correction period is | **immediately after defects date.** |
| The delay damages are | **R4, 000.00**..... per day |
| The assessment day is the | **13th (THIRTEENTH)**..... of each month |
| The retention is | **10% (ten percent) ON THE TOTAL VALUE OF THE CONTRACT...** |
| Does the United Kingdom Housing Grants, Construction and Regeneration Act (1996) applies? | **No**..... |

The Adjudicator is

| | |
|---|---|
| **Name** | **To be advised if disputes arises**..... |
| **Address** | ..... |
| **Telephone** | ..... **Fax No.** ..... |
| **E-mail** | ..... |

# Contract Data

The interest rate on late payment is two percent (2%) per complete week of delay.

The *Contractor* is not liable to the *Employer* for loss of or damage to the *Employer*'s property in excess of...R2,000,000.00 (two million Rand) for any one event.

The *Employer* provides this: **Insurance Transnet Principal Control Insurance**

The minimum amount of cover for the third insurance stated in the Insurance Table is:
**> R25, 000.00 (Limited to R10, 000,000.00. for any one event)**

The minimum amount of cover for the fourth insurance stated in the Insurance Table is:

**Not applicable**.....

The adjudicator nominating body is: **The Chairman of the Association of Arbitrators (Southern Africa)**

The tribunal is: **Arbitration**.....

If the tribunal is arbitration, the arbitration procedure is: **The rules for the Conduct of Arbitrators of the Association of Arbitrators (Southern Africa)**.....

The *conditions of contract* are the NEC3 Engineering and Construction Short Contract (June 2005) and the following additional conditions:

**As mentioned in paragraph 1.0 (Contractual obligations)**

**1.1 CONTRACTUAL OBLIGATIONS**

**A:**

1.1 This project specification covers Transnet freight rail's requirements for the Refurbishment of Main Traction and Auxiliary Transformers at various substations.

**1.2 Tenders must be deposited to the Tender Box, which will be located in the foyer of....., Transnet freight rail and shall be addressed as follows:**
.....

## 2.0 SITE ESTABLISHMENT

2.1 The Contractor shall be responsible to transport material to site, off-loading, handling, storage and security of all material required for the construction/execution of the works.

2.2 Transportation insurance must be arranged by successful contractor to ensure their handling responsibility while material are in transit to site and during off loading as agreed upon.

2.3 The Contractor shall be responsible for all necessary (as decided by the Transnet Freight Rail Project Manager or Technical Officer) connections between the equipment as found before site establishment and other components in the substation including connections to the earth-mat.

## 3.0 TRANSFORMER REFURBISHMENT

3.1 Oil sampling shall be taken by the contractor prior and after the transformer has been refurbished.

3.1.1 The following oil sampling and testing shall be conducted:

- Dielectric Strength
- Acidity
- Dissolved Gas Analysis
- PCB ( Optional test if unavailable and out dated)

3.2 It is required for the contractor to present PCB certificate to Transnet Freight Rail for his/her oil circulating plant, tanker or rubber bags to be used for the project.

3.3 Oil samples report shall be submitted to Project Manager for analysis prior and after work execution.

3.4 Proper precaution should be exercised to ensure control of loose material/equipment during repairs e.g. ( Falling spanners, nuts and bolts into the transformer)

3.5 Contractor is liable to protect the transformer during rainy and moist weather condition.

3.6 It is recommended by Transnet Freight Rail that transformers should be regasketed making use of nebar material. Type material (gasket) sample should be presented to Project Manager prior project commencement.

3.7 Transformer shall be topped up with virgin oil.

3.8 Transformer oil shall be filtered making use of proper calibrated and PCB-free tested plant to meet Transnet recommended transformer oil regenerated standards.

3.9 Soil contamination due to oil spillages shall be rehabilitated to ensure oil free environment.

3.10 Contractor shall be liable to re-torque re-gasketed areas after 3 month from work completion during maintenance period without any additional costs.

3.11 Supply and install GOB bushings complete in accordance with SANS 60137. The Contractor shall make provision for any adaptors, modifications required to install the bushings on the existing transformer. All the gaskets that have been opened shall be replaced.

3.12 Pack the existing bushings in suitable crates and transport them to the respective Depot.

# Contract Data

## The *Contractor*'s Offer

The Contractor is

**Name** .....

**Address** .....

.....

**Telephone** ..... **Fax No.** .....

**E-mail** .....

The percentage for overheads and profit added to the Defined Cost for people is.....%.

The percentage for overheads and profit added to other Defined Cost is..... %.

The *Contractor* offers to provide the Works in accordance with the *conditions of contract* for an amount to be determined in accordance with the *conditions of contract.*

The offered total of the prices is: (***Amount in words, VAT inclusive***)

.....

.....

***Total price in numbers*** (VAT inclusive): R.....

Signed on behalf of the Contractor

Name .....

Position .....

Signature ..... Date .....



## The *Employer*'s Acceptance

The *Employer* accepts the *Contractor*'s Offer to Provide the Works

Signed on behalf of the *Employer*

Name .....

Position .....

Signature ..... Date .....

# Part C2.1: Pricing Data
# Price Instructions

## 2.0 PRICING INSTRUCTIONS

1. The agreement is based on the NEC Engineering and Construction Short Contract 3. The contract specific variables are as stated in the contract data. Only the headings and clause numbers for which allowance must be made in the Price list are recited.

2. Preliminary and General Requirements are based on part 1 of SANS 1921, 'Construction and Management Requirements for Works Contracts'. The additions, deletions and alterations to SANS 1921 as well as the contract specific variables are as stated in the contract data. Only the headings and clause numbers for which allowance must be made in the Price list are recited.

3. It will be assumed that prices included in the Price list are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders.

4. Reference to any particular trademark, name, patent, design, type, specific origin or producer is purely to establish a standard for requirements. Products or articles of an equivalent standard may be substituted.

5. The Price list is not intended for the ordering of materials. Any ordering of materials, based only on the Price list, is at the Contractor's risk.

6. The amount of the Preliminaries to be included in each monthly payment certificate shall be assessed as an amount prorated to the value of the work duly executed in the same ratio as the preliminaries bears to the total of prices excluding any contingency sum, the amount of the Preliminaries and any amount in respect of contract price adjustment provided for in the contract.

7. The amount or items of the Preliminaries shall be adjusted to take account of the theoretical financial effect which changes in time or value (or both) have on this section. Such adjustments shall be based on adjustments in the following categories as recorded in the Price list:

   a) An amount which is not to be varied, namely Fixed (F).
   b) An amount which is to be varied in proportion to the contract value, namely Value Related (V).
   c) An amount which is to be varied in proportion to the contract period as compared to the initial construction period, excluding revisions to the construction period for which no adjustment the Contractor is entitled to in terms of the contract, namely Time Related (T).

8. The following abbreviations are used in the Price list:

| | | |
|---|---|---|
| Hr | = | Hour |
| Ea | = | Each |
| Quant | = | Quantity |
| OCB | = | Oil circuit breaker |
| GCB | = | Gas circuit breaker |

9 The prices and rates in these Price list are fully inclusive prices for the work described under the items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the work described in accordance with the provisions of the scope of work and shall cover liabilities and obligations set forth or implied in the Contract data, as well as profit.

10 Where the scope of work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered for such items.

11 Where no quantity has been provided against an item in the Price list, the Contractor shall use their discretion and provide the quantity.

12 The quantities set out in these Price list are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in these Price list.

13 The short descriptions of the items of payment given in these Price list are only for purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work.

14 Contractor shall ensure that provision (financial as well as time) for excavations in a range of soil types is made for in their tenders.

15 For each item in the Price list, including Preliminaries, the Contractor shall provide in the appropriate column the portion of the tendered sum (inclusive of labour and material) which has been sourced locally (Republic of South Africa).

16 The Contractor shall also arrange forward cover within two weeks after contract award on all imported items.

17 The Contractor shall provide information related to imported content, i.e. equipment to be imported, value and applicable exchange rates. This information shall be provided as an Annexure to the Price list.

18 The total in the Price list shall be exclusive of VAT.

19 Transnet Freight Rail payment terms: 30 days from month end statement.

# Contract Data
# Price List

| Item number | m | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|---|
| | | **Forfar Substation** | | | | |
| **A1** | | **Main Transformer** | | | | |
| 1 | | Oil sampling before and after purification | sum | 1 | | |
| 2 | | Flush and clean transformer | sum | 1 | | |
| 3 | | Re-gasket top cover, primary, secondary and tertiary bushings | sum | 1 | | |
| 4 | | Re-gasket main transformer tap-switch, inspection covers and buchholz relay | sum | 1 | | |
| 5 | | Re-gasket and repair temperature probe pocket. | sum | 1 | | |
| 6 | | Supply & install temperature gauges. | ea | 2 | | |
| 7 | | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 8 | | Supply and install flexible leads | sum | 1 | | |
| 9 | | Re-gasket conservator tank | sum | 1 | | |
| 10 | | Replace conservator sight glass | sum | 1 | | |
| 11 | | Re-gasket conservator & main tank pipe | sum | 1 | | |
| 12 | | Re-gasket breather pipe | sum | 1 | | |
| 13 | | Oil purification | sum | 1 | | |
| 14 | | Clean, treat , paint main transformer tank and radiators grey and conservator tank white | sum | 1 | | |
| **A2** | | **Auxiliary Transformer** | | | | |
| 15 | | Tighten bottom tap | sum | 1 | | |
| **A3** | | **Plinth , surface area & commission** | | | | |
| 16 | | Soil & Stones oil treatment and level surface area | sum | 1 | | |
| 17 | | Paint plinth with red paint | sum | 1 | | |
| 18 | | Ps & G's | sum | 1 | | |
| 19 | | Test and Commissioning | sum | 1 | | |
| **A** | | **Total Price for Forfar =** | | | **R** | |
| **B** | | **VAT (14 % of A ) =** | | | **R** | |
| **C** | | **Gross Total ( A + B) =** | | | **R** | |

# Contract Data
# Price List

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **Witbank Substation** | | | | |
| **A1** | **Main Transformer** | sum | 1 | | |
| 1 | Oil sampling before and after purification | sum | 1 | | |
| 2 | Flush and clean transformer | sum | 1 | | |
| 3 | Re-gasket top cover, primary, secondary and tertiary bushings | sum | 1 | | |
| 4 | Re-gasket main transformer tap-switch, inspection covers and buccholz relay | sum | 1 | | |
| 5 | Re-gasket and repair temperature probe pocket | sum | 1 | | |
| 6 | Supply & install temperature gauges | ea | 2 | | |
| 7 | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 8 | Supply and install flexible leads | sum | 1 | | |
| 9 | Re-gasket conservator tank | ea | 1 | | |
| 10 | Replace conservator sight glass | ea | 1 | | |
| 11 | Re-gasket conservator & main tank pipe | sum | 1 | | |
| 12 | Re-gasket breather pipe | sum | 1 | | |
| 13 | Oil purification and oil sampling | sum | 1 | | |
| 14 | Clean, treat , paint main transformer tank and radiators grey and conservator tank white | sum | 1 | | |
| 15 | Supply and install AC earth leakage current transformer with polycarbonate box | ea. | 1 | | |
| **A2** | **Auxiliary Transformer** | | | | |
| 17 | Oil sampling, flush clean transformer | sum | 1 | | |
| 18 | Re-gasket transformer complete | sum | 1 | | |
| 19 | Replace Breather complete with crystals | sum | 1 | | |
| 20 | Oil sampling, paint ,treat tank & conservator | sum | 1 | | |
| **A3** | **Plinth , surface area & commission** | | | | |
| 21 | Soil & Stones oil treatment and level surface area | sum | 1 | | |
| 22 | Paint plinth with red paint | sum | 1 | | |
| 23 | Ps & G's | sum | 1 | | |
| 24 | Test and Commissioning | sum | 1 | | |

| | | |
|---|---|---|
| A | Total Price for Witbank = | R |
| B | VAT (14 % of A ) = | R |
| C | Gross Total ( A + B) = | R |

# Contract Data
# Price List

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **Wapadskloof Substation** | | | | |
| **A1** | **Main Transformer** | sum | 1 | | |
| 1 | Oil sampling before and after purification | sum | 1 | | |
| 2 | Flush and clean transformer | sum | 1 | | |
| 3 | Re-gasket top cover, primary, secondary and tertiary bushings | sum | 1 | | |
| 4 | Re-gasket main transformer tap-switch, inspection covers and buccholz relay | sum | 1 | | |
| 5 | Re-gasket and repair temperature probe pocket | sum | 1 | | |
| 6 | Supply & install temperature gauges | ea | 2 | | |
| 7 | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 9 | Supply and install flexible leads | sum | 1 | | |
| 10 | Re-gasket conservator tank | ea | 1 | | |
| 11 | Replace conservator sight glass | ea | 1 | | |
| 12 | Re-gasket conservator & main tank pipe | sum | 1 | | |
| 13 | Re-gasket breather pipe | sum | 1 | | |
| 14 | Oil purification and oil sampling | sum | 1 | | |
| 15 | Clean, treat , paint main transformer tank grey, foundation red, and conservator tank white | sum | 1 | | |
| **A2** | **Auxiliary Transformer** | | | | |
| 16 | Oil sampling, flush clean transformer | sum | 1 | | |
| 17 | Re-gasket transformer complete | sum | 1 | | |
| 18 | Replace Breather complete with crystals | sum | 1 | | |
| 19 | Oil sampling, paint ,treat tank & conservator | sum | 1 | | |
| **A3** | **Plinth , surface area & commission** | | | | |
| 20 | Soil & Stones oil treatment and level surface area | sum | 1 | | |
| 21 | Paint plinth with red paint | sum | 1 | | |
| 22 | Ps & G's | sum | 1 | | |
| 23 | Test and Commissioning | sum | 1 | | |
| | | | | | |

| | | |
|---|---|---|
| A | Total Price for Wapadskloof = | R |
| B | VAT (14 % of A ) = | R |
| C | Gross Total ( A + B) = | R |

# Contract Data
# Price List

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **Middelburg yard** | | | | |
| | **H-Frame Transformer** | sum | 1 | | |
| 1 | Oil sampling before and after purification | sum | 1 | | |
| 2 | Flush and clean transformer | sum | 1 | | |
| 3 | Re-gasket top cover and primary bushings | sum | 1 | | |
| 4 | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 5 | Re-gasket breather pipe | sum | 1 | | |
| 6 | Supply and fill transformer with virgin oil | sum | 1 | | |
| 7 | Paint transformer with grey paint. | sum | 1 | | |
| 8 | Supply and install fuse carriers | | | | |
| 9 | Ps & G's | sum | 1 | | |
| 10 | Commissioning | sum | 1 | | |
| | | | | | |
| **A** | **Total Price for Middelburg hard =** | | **R** | | |
| **B** | **VAT (14 % of A ) =** | | **R** | | |
| **C** | **Gross Total ( A + B) =** | | **R** | | |

# Contract Data
# Price List

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **Witbank Station** | | | | |
| | **H-Frame Transformer** | sum | 1 | | |
| 1 | Oil sampling before and after purification | sum | 1 | | |
| 2 | Flush and clean transformer | sum | 1 | | |
| 3 | Re-gasket top cover and primary bushings | sum | 1 | | |
| 4 | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 5 | Re-gasket breather pipe | | | | |
| 6 | Supply and fill transformer with virgin oil | sum | 1 | | |
| 7 | Paint transformer with grey paint. | sum | 1 | | |
| 8 | Supply and install palisade fencing ($7m^2$) with gate and new poles | sum | 1 | | |
| 9 | Change fuse holders | sum | 1 | | |
| 10 | Supply and install anti climbing device | sum | 1 | | |
| 11 | Ps & G's | sum | 1 | | |
| 12 | Test and Commissioning | sum | 1 | | |
| | | | | | |
| **A** | **Total Price for Witbank yard =** | **R** | | | |
| **B** | **VAT (14 % of A ) =** | **R** | | | |
| **C** | **Gross Total ( A + B) =** | **R** | | | |

# Contract Data
# Price List

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **Marshalling yard** | | | | |
| **A1** | **H-Frame Transformer** | sum | 1 | | |
| 1 | Oil sampling before and after purification | sum | 1 | | |
| 2 | Flush and clean transformer | sum | 1 | | |
| 3 | Re-gasket top cover and primary bushings | sum | 1 | | |
| 4 | Supply & install breather complete with silica gel crystals | sum | 1 | | |
| 5 | Re-gasket breather pipe | sum | 1 | | |
| 6 | Supply and install palisade fencing with gate and re-use existing poles | sum | 1 | | |
| 7 | Supply and fill transformer with virgin oil | sum | 1 | | |
| 8 | Re-spray transformer with grey paint, foundation red and conservator tank white. | sum | 1 | | |
| 9 | Supply and install palisade fencing (7m2) | sum | 1 | | |
| 10 | Ps & G's | sum | 1 | | |
| 11 | Commissioning | sum | 1 | | |
| | | | | | |
| **A** | **Total Price for Marshalling yard =** | | **R** | | |
| **B** | **VAT (14 % of A ) =** | | **R** | | |
| **C** | **Gross Total ( A + B) =** | | **R** | | |

## 4.0 Description of work

The contractor shall perform the following:

### 4.1 Forfar 3kV DC Substation

**Main Transformer**

4.1.1 Re-gasket main transformer completely.

4.1.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

4.1.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

4.1.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- transformers grey;
- conservator tank white, and
- plinth red;

4.1.5 Clean and treat oil polluted ballast and plinth

4.1.6 Remove oil contaminated soil (500mm deep) and replace it with the new soil

**Auxiliary Transformer**

4.1.7 Tighten bottom tap.

4.1.8 Clean and treat oil polluted insulating stones and plinth.

## 4.2 Witbank 3kV DC Substation

**Main Transformer**

4.2.1 Re-gasket main transformer completely.

4.2.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

4.2.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

4.2.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- transformers grey;
- conservator tank white, and
- plinth red;

4.2.5 Clean and treat oil polluted ballast and plinth

4.2.6 Remove oil contaminated soil (500mm deep) and replace it with the new soil

**Auxiliary Transformer**

4.2.7 Re-gasket auxiliary transformer completely.

4.2.8 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

4.2.9 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

4.2.10 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- transformers grey;
- conservator tank white, and
- plinth red;

4.2.11 Clean and treat oil polluted ballast and plinth.

## 4.3 Wapadskloof 3kV Substation

### Main Transformer

4.3.1 Re-gasket main transformer completely.

4.3.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

4.3.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

4.3.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- transformers grey;
- conservator tank white, and
- plinth red;

4.3.5 Clean and treat oil polluted ballast and plinth

4.3.6 Remove oil contaminated soil (500mm deep) and replace it with the new soil

### Auxiliary Transformer

4.3.7 Re-gasket auxiliary transformer completely.

4.3.8 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

4.3.9 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

4.3.10 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- transformers grey;
- conservator tank white, and
- plinth red;

4.3.11 Clean and treat oil polluted ballast and plinth.

## 8.4 Middelburg Yard

8.4.1 Re-gasket transformer completely.

8.4.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

8.4.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

8.4.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- Transformers grey;
- Plinth red;

**8.5 Marshalling Yard**

8.5.1 Re-gasket transformer completely.

8.5.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

8.5.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

8.5.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- Transformers grey;
- Conservator tank white, and
- Plinth red;

**8.6 Witbank Yard**

8.6.1 Re-gasket transformer completely.

8.6.2 Remove, store, purify, vacuum and test the oil as specified in Spoornet's specification CEE. 0229.95.

8.6.3 Top up transformer with virgin oil which complies with the requirements specified in SABS 555. 1995;

8.6.4 Paint and treat corrosion in accordance with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90. Paint colours are as follows: -

- Transformers grey;
- Plinth red;

4.1 Drawings

4.1.1 CEE-TBD-0007 Earthing arrangement for traction substations.

4.2 **Specifications**

**4.2.1 South African National Standards:**

| | |
|---|---|
| 4.2.1.1 SANS 1091 | National colour standard. |
| 4.2.1.2 SANS 763 | Hot dip galvanised zinc coating. |
| 4.2.1.3 SANS 121 | Hot Dip Galvanised Coating for Fabricated Iron or Steel Article. |
| 4.2.1.4 SANS 0555. 2007 | Unused and reclaimed mineral insulating oil for transformer and switchgear. |
| **4.2.1.5** SANS 8528 | Reciprocating internal combustion engine driven alternating current generating set. |
| 4.2.1.6 SANS 10064. 2005 | Code of Practice for the preparation of steel surfaces for coating. |
| 4.2.1.7 BSS 171. 1987 | Power Transformers. |
| 4.2.1.8 SANS 10142 | Wiring Code. |
| 8.7.1.9 SANS 60137 | Insulated bushings for alternating voltages above 1 000 V. |

**4.2.2 Transnet Freight Rail:**

| | |
|---|---|
| 4.2.2.1 BBB 5452 version 4 | Transnet freight rail requirements for installation of electrical equipment for 3 kV DC substations. |
| 4.2.2.2 CEE. 0229.95 | Dry-out and Regeneration of insulating oil and Reclaiming and de-sludging of transformers. |
| 4.2.2.3 CEE.0045.2002/1 | Painting of steel Components of Electrical equipment. |

**NOTE: Any other specifications referenced in the above mentioned specification, will be for information purposes and may be provided on request.**

4.3 Occupational Health and Safety Act No. 85 of 1993 (Available at depot for referral)

4.4 **Constraints on how the *Contractor* Provides the Works**

4.4.1 The constrains shall be as specified in the specifications of the particular equipment.

4.5 **Requirements for the programme**

| | | |
|---|---|---|
| 4.5.1 | Programme of work | : To be submitted by successful Contractor |
| 4.5.2 | Format | : Gantt chart |
| 4.5.3 | Information | : How work is going to be executed and commissioned |
| 4.5.4 | Submission | : 3 weeks after the award of contract |
| 4.5.5 | Site diary | : Successful Contractor to supply in triplecate carbon copies |
| 4.5.6 | Site instruction book | : Successful Contractor to supply in triplecate carbon Copies |
| 8.8.7 | CIDB | : **2EP** |

4.6 **Services and other things provided by the *Employer***

4.6.1 Transnet Freight Rail shall inspect all equipment before dispatching the equipment to site.

4.6.2 Transnet Freight Rail shall have an electrician available for isolation and the erection of barriers to live electrical equipment and issuing of work permits.

4.6.3 Upon successful completion of the works to the satisfaction of Transnet Freight Rail, Transnet Freight Rail shall perform necessary protection tests and commission the equipment.

4.6.4 The Contractor shall make necessary arrangements for sanitation, water and electricity at these relevant sites during the installation of the equipments.

4.6.5 Transnet Freight Rail will arrange for the reconnecting of telecontrol equipment in the substation and no final energising shall take place without this.

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

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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.

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

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 Spoornet, 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.

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

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)

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 :

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 :

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 :

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 :