

	Work Instruction	Medupi Power Station
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Title: **Medupi Power Station
Refurbishment of Low
Voltage Variable
Frequency Drives and Soft
Starters Works information**

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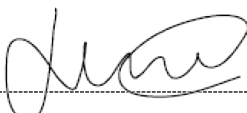
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1. Introduction

Variable Frequency Drives (VFDs) and Soft Starters in Eskom are used to control VFD speed to match it to the process requirements for the application they have been designed and selected for. Other functions include smooth start-ups or soft starting of constant or variable torque applications and energy efficiency improvement. This Work Instruction (WI) provides requirements for the refurbishment of VFDs at Medupi Power Station (PS) to ensure that the design base is maintained.

2. Supporting clauses

2.1 Scope

This WI covers the minimum requirements for the refurbishment of Medupi PS LV VFDs and SS driving electric VFDs with voltage rating less than 1kV.

This WI takes precedence over any other standards mentioned in 2.2 except the Occupational Health and Safety Act.

2.1.1 Purpose

The purpose of this Work Instruction is to define the LV VFD and SSs refurbishment requirements for Medupi PS.

The WI also provides information that should be agreed upon and/or exchanged between Medupi PS (*Employer*) and the *Contractor*. Such information includes:

- Scope of Work at various stages of refurbishment,
- QCP and ITPs,
- Assessment reports, Tests reports and Data packs.

2.1.2 Applicability

This document is applicable to all LV VFDs at Medupi PS.

2.1.3 Effective date

This document shall be effective from the date of the last signature.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] 200 – 1689 Specification Quality management

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- [3] Occupational Health and Safety Act, 85 of 1993.
- [4] 240-50237146 Medium Voltage AC Variable Frequency Drives Standard rev 1.
- [5] 240-54819241 Identify Items for Repair Work Instruction
- [6] SANS 61800-2 General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems.

2.2.2 Informative

- [7] Sinamics G120 &G120P Low voltage converters built-in and wall mounting units with CU230P-2 control units
- [8] Sinamics G130 converters built-in units 75kW – 800kW. Edition 12/2018.
- [9] Siemens Sirius Soft Started 3RW44 Manual, Issue 10/2010
- [10] Siemens Soft starters and solid-state switching devices 3RW44 soft starters, issue 02/2020
- [11] Sinamics G150 converters cabinet units 75kW – 800kW. Edition 12/2018.
- [12] Vacon NXS/P ac (DPD00910) drives user manual wall-mounted drives standalone drives.
- [13] Vacon NXS/P ac drives enclosures IP21 and IP54 user's manual
- [14] Weg CFW-09 frequency inverter manual, 0899.5306 / 12.
- [15] Weg CFW-11 frequency inverter manual, 10000063093 / 06.
- [16] Variable speed drives Altivar 71 and Altivar 71 Plus, Catalogue April 2014,
- [17] Operating Instruction VLT Soft Starter - MCD 500, Rev. 2012–03–05, 175R0549/ MG17K802.

2.3 Definitions

Definition	Description
Variable Frequency Drive	A device consisting of power equipment (converter, transformer and filters), control, protection and auxiliaries to vary the speed of the VFD
Soft Starter	A electronic device that regulates the voltage to the motor and provides a smooth transition from standstill to full speed operation of the application
Employer	Company that is a recipient of goods or services provided by a Contractor under a purchase order or contract of sale. For the purpose of this Works Information, the Employer is Eskom Holdings SOC Medupi Power Station or representative thereof.
Contractor	An enterprise that provides goods and/or services. For the purpose of this Works Information/document, the Contractor may refer to the OEM, OEM approved distributor or Contractor appointed to implement the works herein.
Refurbishment	It is a total process of restoring the machine or, components of that machine, which has become inadequate (or has failed or need overhaul) for continued use for the application; it has been designed for thereby making it suitable for use for an extended period of service.

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Repairable Materials	Plant items that can be repaired cheaper than purchasing a new item should be changed to RF-Items and managed accordingly through the Rotable Process. The item must be repairable at least 3-times. The cost of repair of the material must be equal to or less than 70% of the cost of a new item. The condition of the material after repair must be "as good as new", e.g. must be back to its original specification and capable of the same performance as a new item. Lead-time is a factor that needs to be considered, if the repair lead-time is considerable.
Repair	Steps required to rework or to replace components to restore the VFD to original design specifications.
Overhaul	A basic refurbishment or a refurbishment with limited replacement of components (e.g., Fan, Capacitor or Cards replacements)

2.3.1 Disclosure classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Explanation
FAT	Factory Acceptance Test
IP	Ingress Protection
ISO	International Organization for Standardization
ITP	Inspection Test Plan
LV	Low Voltage
PS	Power Station
QCP	Quality Control Plan
SANS	South African National Standards
SoW	Scope of Work
SS	Soft Starter
VFD	Variable Frequency Drive
WI	Work Instruction

2.5 Roles and Responsibilities

- The Maintenance Manager shall be responsible to ensure that this WI is implemented on new LV VFD and SS refurbishment contracts.
- The System Engineer shall check compliance to this WI during the various stages of review as part of the project lifecycle model (PLCM). The System Engineer is responsible for reviewing and updating this WI.

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2.6 Process for Monitoring

This WI will form the basis of the spares refurbishment contract's SoW of Medupi VFDs. It will then be monitored using applicable contracts monitoring and auditing processes. It shall remain subjected to an auditable process to ensure full compliance to the procurement policy.

2.7 Related/supporting documents

N/A

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3. Refurbishment requirements

3.1 VFD Technology Scope

- a) Table 1 shows a list of LV VFDs and SS that forms part of the *Employer's* refurbishment programme for the life of Medupi PS. The requirements in this WI are also applicable to other Medupi LV VFDs and SS not included in Table 1.
- b) The actual contracted list of VFDs for refurbishment will be as per respective contract document that will be set up by the *Employer* on "as-and-when" required.
- c) When a LV VFD is not economically repairable, the latest Eskom's Technical Schedule A&B Template, Eskom and SANS61800 standards shall be used to procure new LV VFDs.

Table 1: Types of LV VFDs at Medupi PS

Type	kW	OEM
Sinamics G120	15 – 132	Siemens
Sinamics G130	132 - 400	Siemens
Sinamics G150	132 - 315	Siemens
Micromaster 430	75kW	Siemens
3RW44/30	1 – 250 kW	Siemens
CFW-11	55 - 160	Zest/Weg
CFW-09	160	Zest/Weg
ATV71	15 - 110	Schneider Electric
Vacon NXP/NXS	7.5 - 250	Vacon/Danfoss
MCD 500	1 – 250 kW	Danfoss

3.2 Repair/refurbishment process

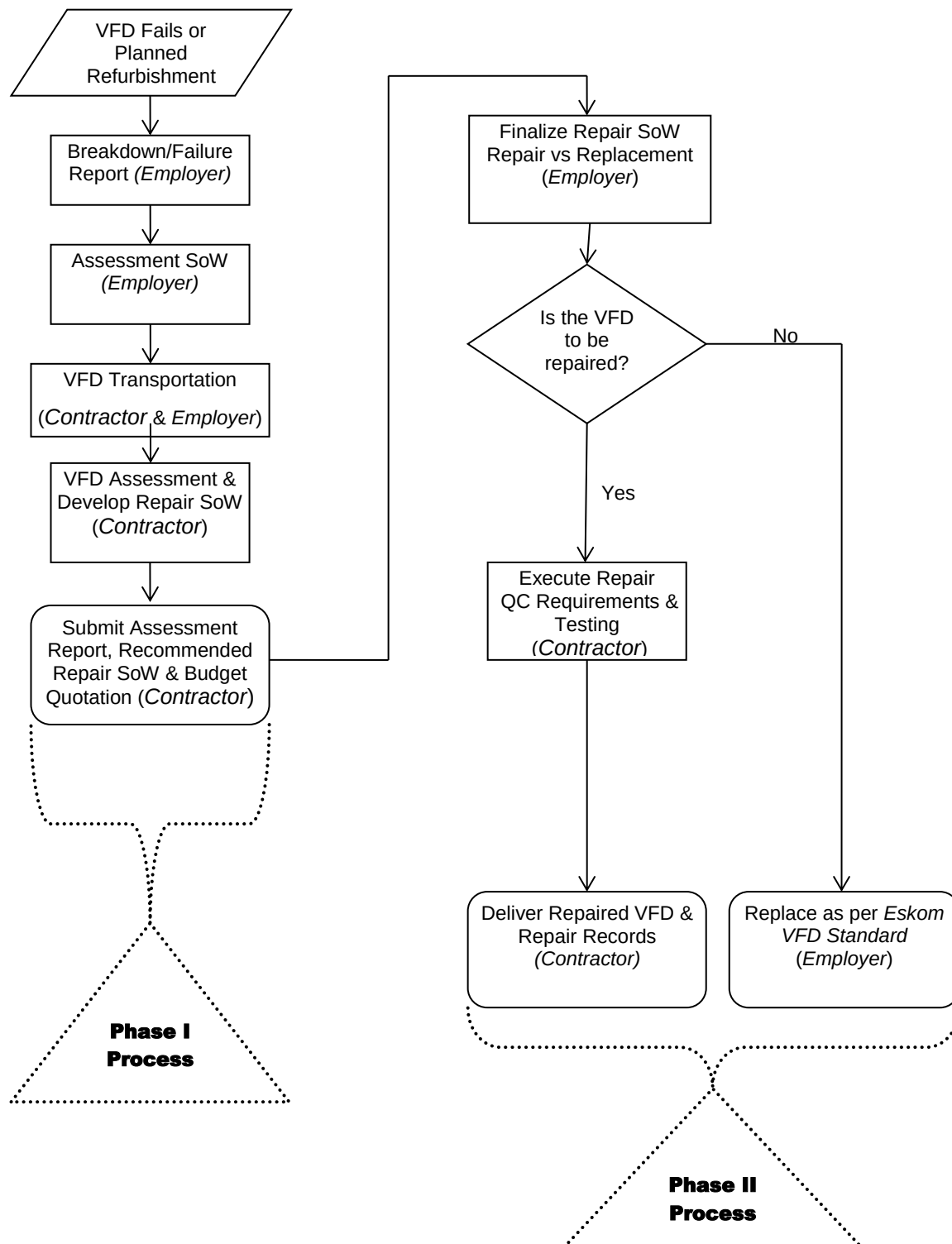
- a) Any LV VFD which is to be sent for refurbishment will either be deemed to have failed or it shall have been scheduled for an overhaul or planned refurbishment by the *Employer*.
- b) There are two phases (Phase I and Phase II) in the refurbishment process of VFDs:
 - B.1. **Phase I:** This commonly referred to as the "collect, strip, and assess" phase. The *Employer* develops an assessment SoW. The *Contractor* conducts detail assessment of the VFD and compiles a repair SoW.
 - B.2. **Phase II:** Once the repair SoW is approved, the VFD is repaired, witness tested and delivered back to site for storage or installation.
- c) The flowchart in Table 2 to describes, in sequence, the process to be undertaken within the two phases in order to reach the VFD assessment and repair or overhaul purpose.

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Table 2: LV VFD Refurbishment Flowchart



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3.2.1 Phase I Requirements

3.2.1.1 VFD Failures and Planned Refurbishments

Once a VFD has failed in service, or once a VFD which is in a serviceable condition has been planned for refurbishment, the following activities shall be conducted in sequence:

3.2.1.1.1 Failure Report

The following requirements shall be performed by the *Employer* and are to be compiled in an internal Failure report.

- a) Upon failure, the VFD assessment (visual inspection and associated tests) shall be conducted while the VFD is in-situ before its removal where all abnormalities are recorded together with photographs.
- b) Further assessments shall be conducted after the VFD is removed and recorded with photographs. The report shall include the event logs (e.g. current, speed, etc.) recorded before and after failure, and provide a high level failure analysis.

3.2.1.1.2 Assessment SoW

- a) The *Employer* shall compile a SoW for the collection and assessment of the failed VFD by the *Contractor* based on the investigations recorded in the failure report.
- b) The *Employer* shall determine if the failed VFD is to be managed under a separate Warranty process or through the refurbishment Contract.
- c) Catastrophic failures beyond repair shall be assessed by the *Employer's* Engineer and separate process shall be followed to procure new VFDs. The Engineer shall also consider the replacement requirements stated in 3.2.2.1.1. before finalizing the assessment SoW.
- d) In the case of planned/overhaul refurbishment (where applicable), the *Employer* shall compile a SoW in the Eskom outage SoW template.
- e) The *Employer's* Engineer shall indicate the work to be done at site (Medupi PS) and at the *Contractor's* premises.
- f) Where applicable, all SoWs shall include witness/hold points for the *Employer* to inspection and review progress and quality of work during Phase I.

3.2.1.2 VFD Collections, Transportation and Storage

- a) The *Employer* shall inform the *Contractor* of specific Medupi PS requirements such as security requirements, collection times and details of the VFDs as per Assessment SoW in 3.2.1.1.2.
- b) The VFD collection point and lifting requirements shall be managed by the *Employer*.
- c) Only authorised *Employer* personnel shall load the VFD to the *Contractor's* transport.
- d) The *Contractor* shall supply standard packaging and tools necessary to clamp the VFD before transport leaves the collection point.
- e) The VFDs shall be transported by the *Contractor* or *Sub-contractor* with the necessary care to prevent further damage as a result of transportation.
- f) The *Contractor's* transportation and storage requirements shall comply with SANS 61800-2, Section 4.

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3.2.1.3 VFD Assessment

The *Contractor* shall implement the approved Assessment SoW, without deviation, as specified in the following sub-sections:

3.2.1.3.1 Inspection and Testing

- a) A visual inspection shall be made to assess the general condition of the VFD exterior for cracks, broken, burnt or missing parts. Photographs are to be taken to document the condition.
- b) If the VFD is in a working condition, the *Contractor* shall download the VFD configuration and parameter settings and save such settings on a USB flash drive/zip folder before work commences. The settings shall be sent back to the *Employer*.
- c) VFDs that involve either warranty or insurance claims shall not be disassembled without the *Employer's* written approval for the *Contractor* to commence with the disassembling. Arrangements shall be made for the *Employer* or *Employer's* representatives to witness the disassembly. The *Employer* Assessment SoW shall have a Hold-Point for such a requirement. The *Contractor* is required to take pictures and records throughout the disassembly.
- d) All components shall be marked with either the VFD manufacturer's serial number or *Contractor's* job number during disassembly. Any new stamp identifications added shall be applied to low stress areas with low stress punches. Old nameplates or stamp identifications of previous refurbishments on the VFD are not to be removed. Bolts and small parts, from the VFD shall be stored in dedicated containers marked with a *Contractor's* job number.
- e) Additional information gathered during disassembly inspections shall be used to support the cause of failure analysis.
- f) The *Contractor* shall perform functionality tests and checks on all power components, control, monitoring and protection circuits, auxiliary inputs and outputs and accessories. The tests are to determine the probable cause of the failure if any, record the findings, and to determine additional work which may be required.
- g) If failed components are identified during the inspection and testing, the *Contractor* shall attempt to verify the cause and reflect the findings in a report. Failure causes shall be discussed with the *Employer* before any repair work proceeds, unless this is waved in the contract.
- h) If cleaning of components or cards is required for further assessment, the components shall be tested before cleaning to determine their condition. All VFDs are to be cleaned properly with appropriate cleaning methods that are not harmful such the use of sandblasting or chemicals.
- i) All components are to be properly stored thereby ensuring storage conditions do not adversely affect the components.

3.2.1.3.2 Assessment Report

- a) When a VFD is received in a failed condition, the *Contractor* shall make all effort to determine the root cause of failure. In the case of uncertainty, all possible root causes are to be listed. Root causes of the failures are to be determined during the various stages of the refurbishment process such as initial visual inspection, disassembly inspections, testing, etc. Abnormalities that could have contributed to the failure are to be properly recorded.

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- b) The *Contractor* shall include a block diagram of the VFD showing connections of the Power Converters, DC link, Control unit and Auxiliary circuit, etc.
- c) The *Contractor* shall submit a report to the *Employer* detailing findings together with photographs identifying the symptoms identified or root cause. Recommendation of corrective and preventative actions shall be provided.

3.2.1.4 Contractor Repair SoW

- a) The *Contractor* shall provide the *Employer* with a recommended repair SoW based on the analysis of the failure and the need to fulfil the repaired VFD performance requirements.
- b) The SoW shall include itemised prices as per contract price list or budget quotation, and shall also include cost of a new VFD with its lead time.
- c) The SoW shall indicate the repair warranties, component lead times and possible delivery dates.
- d) The SoW shall include testing requirement and preliminary QCP tasks with acceptance criteria.
- e) The recommended SoW shall be e-mailed to the *Employer* for review and influence.
- f) No repair work shall be done before the *Employer's* approval of the repair SoW.

3.2.2 Phase II Requirements

3.2.2.1 Finalizing Repair SoW

The *Employer's* Engineer shall review the recommended SoW considering all documentation provided by the *Contractor* and *Employer's* inspections and shall finalise the SoW considering the following:

3.2.2.1.1 Repair vs Replacement

The *Employer's* Engineer shall technically and economically evaluate the replacement of failed VFD, when one or more of the following conditions are valid.

A. Technical Evaluation:

- a) A.1. The VFD requires the replacement of major components such as all power converters and control Unit. Component design life has to be accounted for.
- b) A.2. The failure analysis identifies the failure to be due to latent design defect.
- c) A.3. The failure analysis and failure rate of similar VFDs show that the VFDs are failing due to ageing, or design unsuitability to application.

B. Economic Evaluation:

The evaluation is to be based on the ratio of cost/benefit analysis using credible and justifiable assumptions. As a basic 'rule of thumb', the recommendation may be based on the costs of the proposed repair work versus the costs accumulated for a new VFD. A rule of thumb analysis ratio would be as follows:

- B.1. If the repair costs are less than 50% of the accumulated costs of a VFD, then the VFD should be repaired.

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- B.2. If the repair costs are in-between 50% and 70%, the *Employer's* Engineer needs to assess the VFD condition based upon the budget and requirement to return the VFD to service.
- B.3. If the cost of repairs is greater than 70% of the accumulated costs, there should be a strong recommendation made to procure a new VFD and, if necessary, devise a contingency plan for the Station to cater for the lead times of the new VFD.

C. Other Replacement Considerations:

- C.1. The *Employer's* Engineer may decide to have the VFD, which is to be replaced, reconditioned as a spare while the delivery of the replacement is awaited. All relevant warranties/guarantees are to be considered to determine *Contractor's* liabilities
- C.2. If the VFD repair history indicates poor reliability of the design or limited to meet certain operating conditions; the Engineer shall conduct an investigation to modify and improve reliability or replace the VFD with a suitable design
- C.3. If the VFD has to be replaced, it shall be scrapped as per applicable scrapping procedures and the replacement VFD procured as per Eskom and SANS 61800 VFD standards.

3.2.2.2 VFD Repair Work Execution

The *Contractor* shall:

- a) Receive an approved repair SoW from the *Employer*.
- b) Compile a QCP with ITP tasks for the *Employer* to influence and approve, and finalise the delivery dates. The QCP tasks shall have acceptance criteria.
- c) Implement the approved repair SoW which includes testing, without deviation, and following the QC requirements below.

3.2.2.2.1 Quality Control Requirements

- a) All materials and parts that are necessary for the VFD repairs shall be new and, including processes, of the best quality and shall be in accordance with the best practice typical to the manufacture of LV VFDs.
- b) Unless otherwise specified or approved by the *Employer*, all materials, parts, and processes shall comply with the most recent the *Employer*, SANS and/or IEC standards and certification applicable. Should conflict occur between the standards, the former should apply, in that sequence.
- c) Test certificates must be submitted indicating the testing authority, method of testing and the test results.
- d) Only OEM certified components (e.g. fans and cooling tunnel) must be used unless otherwise specified by the *Employer*.
- e) New components are to be tested before installing on the VFD power module and/or control unit. The tests results are to be included on the final repair report.
- f) During VFD repairs and assembly, component protection and clean conditions shall be practiced to ensure no foreign materials are left inside the VFD.
- g) Workmanship shall be in accordance with the best practice to ensure satisfactory operation.
- h) Spare parts shall not be swapped between VFDs.

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- i) The original VFD nameplate or other nameplate shall not be removed or damaged.
- j) The refurbishment work shall not reduce the IP rating of the VFD.
- k) Each VFD shall have unique file with test sheets.

3.2.2.2.2 Inspections

- a) At any stage during refurbishment process, the *Employer* or its authorised representative reserves the right to inspect VFDs and all their components. By entering into a contract with the *Employer*, the *Contractor* therefore, consents the *Employer* or its authorized representative to unlimited access to the *Contractor's*, including sub-contractors', premises at all reasonable times to the extent necessary to assess compliance with the provisions of this and such other documents as may apply to the procurement of VFDs. Such inspections shall not relieve the *Contractor* of its obligation or responsibilities under the contract.
- b) The *Contractor* is responsible for managing the requirements of the ITP. The *Contractor* shall notify the *Employer* of its intention to conduct inspections and tests listed in the ITP, giving no less than five (5) working days' notice for the *Employer* to witness the ITP task.
- c) The *Employer* reserves the following rights on the QCP and ITP tasks:
 - C.1. Request, which shall not be unduly rejected, performing of the test as per the *Employer's* valid test procedure and/or to *Employer's* reasonable satisfaction,
 - C.2. Conduct tests/inspections not contained in the QCP and ITP agreed to between *Employer's* and *Contractor*. The costs for such additional test/inspection measurements shall be either for *Employer's* account, if the VFD repair and/or performance has not deviated from any contract requirement or the *Contractor's* account if the VFD repair and/or performance has deviated from any contract requirement,
 - C.3. To instruct the *Contractor* to repeat any task conducted without the required inspection by the *Employer*, at the *Contractor's* cost and,
 - C.4. To return, to the *Contractor's* works and at the *Contractor's* cost, VFDs despatched to site without the required inspection/s and dispatched approval.
- d) The *Contractor* shall provide the *Employer* with a complete set of detailed drawings that shall be used to assist in the inspection during refurbishment/repairs and testing of the VFD and its components. These drawings shall be retained by the *Employer* on the document management site and returned to the *Contractor* after the completion of the contract.

3.2.2.2.3 VFD Testing

- a) All VFDs are to be tested by the *Contractor* prior to delivery, and the *Employer* accepts or rejects test results.
- b) Standard routine tests are to be performed on all repaired or overhaul VFDs in accordance to Table 7 of SANS 61800-2. If type tests or special tests are required, it shall be agreed upon in the final repair or overhaul SoW.
- c) Standard type tests are to be performed on all modified VFDs in accordance to Table 7 of SANS 61800-2 in to qualify the changes and establish the design base.

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- d) Tests and checks shall be performed in accordance with applicable sections in the two phases of repair. If certain results are unacceptable, the *Contractor* shall notify the *Employer* to discuss viable solutions.
- e) On completion of work, the VFD shall be inspected and tested by the *Contractor* to the satisfaction and requirements of the *Employer*. Prior to contacting the *Employer* to arrange a date for witness testing, the *Contractor* shall have satisfied the *Employer's* requirements of a successful refurbishment/repair.
- f) Appropriately qualified personnel are to be used for diagnostic testing, inspections and report compilation. The reports are to form part of the quality documentation for the repair.

3.2.2.3 VFD Reports and Delivery

3.2.2.3.1 Test Reports

- a) The *Contractor's* test reports shall include the results of all tests performed, whether the tests are specifically required herein or not.
- b) Each VFD test results shall be recorded on the *Contractor's* standard forms unless the *Employer's* forms are provided.
- c) A Database with full data packs of all LV VFD shall to be kept for period of the contract or 5 years, whichever is greater.

3.2.2.3.2 VFD Delivery

- a) All VFDs shall be prepared for delivered as per the SoW and this WI. If the VFD is to be sent into storage, such shall be in accordance with storage requirements.
- b) VFDs shall be delivered to site after the *Employer's* acceptance that the repair or overhaul SoW has been satisfactorily completed. Any VFD delivered before the *Contractor* receives confirmation of acceptance may, at the *Employer's* discretion, be returned to the *Contractor* without any cost to the *Employer*.
- c) The *Contractor* shall arrange a VFD delivery date, time, and location with the *Employer*.
- d) All documentation regarding work performed on the VFD shall be delivered with the VFD.
- e) The *Employer* reserves the right to inspect the VFD and transport upon delivery and, if the delivery is found not to be in accordance with applicable standard, return the VFD to the *Contractor* without any costs to the *Employer*.
- f) The *Employer* shall provide necessary resources for the VFD to be off-loaded from the *Contractor's* transport.

4. Management Requirements

4.1 Contractor eligibility

- a) VFDs are highly specialised equipment which required detail knowledge and skills, and shall only be refurbished, repaired or overhauled by a qualified Contractor in order to maintain the design base.

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- b) The *Contractor* shall have a minimum of 5-years refurbishing experience for the power converters and controllers of the VFDs in Table 1 or in the contracted list.
- c) The *Contractor* must have the following as minimum:
 - 1. Diagnostic tools i.e. software and cables to communicate with the VSDs,
 - 2. Relevant documentation and access SANS61800 standards and,
 - 3. Qualified personnel for repair or overhaul and testing.
 - 4. Facilities to store, repair and test and test equipment for routine test
- d) The *Contractor* must be able to source the specific components and cards for a particular VFDs and each component must have a test certificate and traceable.
- e) The *Contractor* shall be ISO: 9001 and ISO: 14001 certified and hold valid formal certifications confirming full compliance which shall be verified by the *Employer* on a continuous base.
- f) The *Contractor* shall maintain an Eskom-approved quality control and inspection program. This program shall include, but not limited to, the requirements for a QCP that covers all component inspections, tests, manufacturing procedures, and hold points for the VFD contract. An addendum to the ITP, which only shows items/tasks that require input by the *Employer*, e.g. acceptance, approval, inspection, witnessing, and hold point. Repairs of the VFDs shall not start until the *Contractor* receives the *Employer's* acceptance of the QCP and ITP.
- g) The *Employer* reserves the right to inspect and technically qualify the facilities before awarding the contract.
- h) All *Sub-contractors* utilised by the *Contractor* are to be approved by the *Employer* prior to the *Contractor* utilising such *Sub-contractors*.

4.2 Information Exchange

- a) All documentation submitted between the *Employer* and *Contractor* shall be in English and preferable in PDF format.
- b) Timely review and acceptance/approval of submitted documentation that requires the *Employer* acceptance or approval

4.2.1 Employer Data

The following records to be kept by the *Employer* for the life of the Medupi PS shall include;

- a) Internal VFD Failure Assessment report,
- b) Assessment reports from the *Contractor*,
- c) The final repair Scope of Work, including cost thereof,
- d) All tests and check reports received from the *Contractor*,
- e) Repair vs Replacement Analysis and recommendations, where applicable.
- f) A copy of Quality records.

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4.2.2 Contractor Data

The *Contractor* shall keep the following records, which shall be submitted to the *Employer* upon completion of the assessment and/or repair contract, for a minimum of five years.

- A) Assessment Report, received from the *Employer*,
- B) *Contractor* Assessment Sheet,
- C) Repair scope of work,
- D) Quality records,
- E) All tests and check reports
- F) Material certificates
- G) Drawings

4.3 Emergency Repairs

- a) The requirements of the normal repair procedure are applicable to emergency repairs, the difference being the duration for the requirements to be fulfilled.
- b) The *Employer* may classify the VFD to require emergency repairs. Having classified that the VFD requires emergency repairs, the VFD repair/ refurbishment strategy to be utilised shall be determined by the relevant Business Unit and shall be agreed upon by the relevant technical personnel, the end users and the respective commercial departments.

5. Acceptance

This document has been seen and accepted by:

Name	Designation
Portia Lutumbu	Electrical maintenance Manager
Sandra Shuma	Turbine Engineering Manager
Kevin Rabbolini	PTM Manager
Mbongeni Mqadi	Maintenance Manager
Luvuyo Mgolodela	Procurement Manager
Moshoeu Mailula	Auxiliary Engineering
Pamela Pretorius	Maintenance Manager
Mpho Ramunenyiwa	Snr Professional Engineer (Group Capital Electrical Discipline Engineer)

6. Revisions

Date	Rev.	Compiler	Remarks
May 2020	1	NG Mbatha	First development of the document
March 2020	0	NG Mbatha	First draft for LV VFD refurbishment

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7. Development Team

The following people were involved in the development of this document:

- Ntando Mbatha
- Marubini Manyage

8. Acknowledgements

- Nkosinathi Mahlangu
- Moses Nonyane

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