ANNEXURE A: DETAILED SPECIFICATION

1 PURPOSE OF THIS DOCUMENT

The aim of this motivation is to upgrade Rotating Machines Motor Testing laboratory power supply to gain capabilities to fully test and evaluate electric motors to the new regulatory VC spec “Efficiency requirements for Electric Motors”.
Rotating Machines Laboratory is accredited to test electric motors according to IEC 60034 and SANS 1804 which covers performance, safety, and reliability of electric motors. Rotating Machines. Laboratory guided by IEC 60034 standard provides a comprehensive set of guidelines and procedures for testing electric motors which help industry and Certification to ensure that the motors are fit for their intended purpose and to meet energy efficiency requirements. The project seeks to improve testing operations by integrating a new transformer/power supply with the existing Dynamometer to provide accuracy in measurements and reduced testing turnaround time (TAT), as well as provide more accurate automating testing and data acquisition. Rotating Machines can test motors from 0.12kW to 80 kW, while VC requires testing up to 375 kW. The specification SANS 60034-1 requires testing capabilities up to 1.5 kV rated voltage, and rated current of 3000 A. The current equipment is outdated and has been damaged and cannot be repaired. Rotating Machines needs to prepare the Lab as there is potential revenue stream and capacity expansion from the new VC. Interest from the industry to test large motors has increased due to the new VC.

2 APPLICABLE AND REFERENCE DOCUMENTS

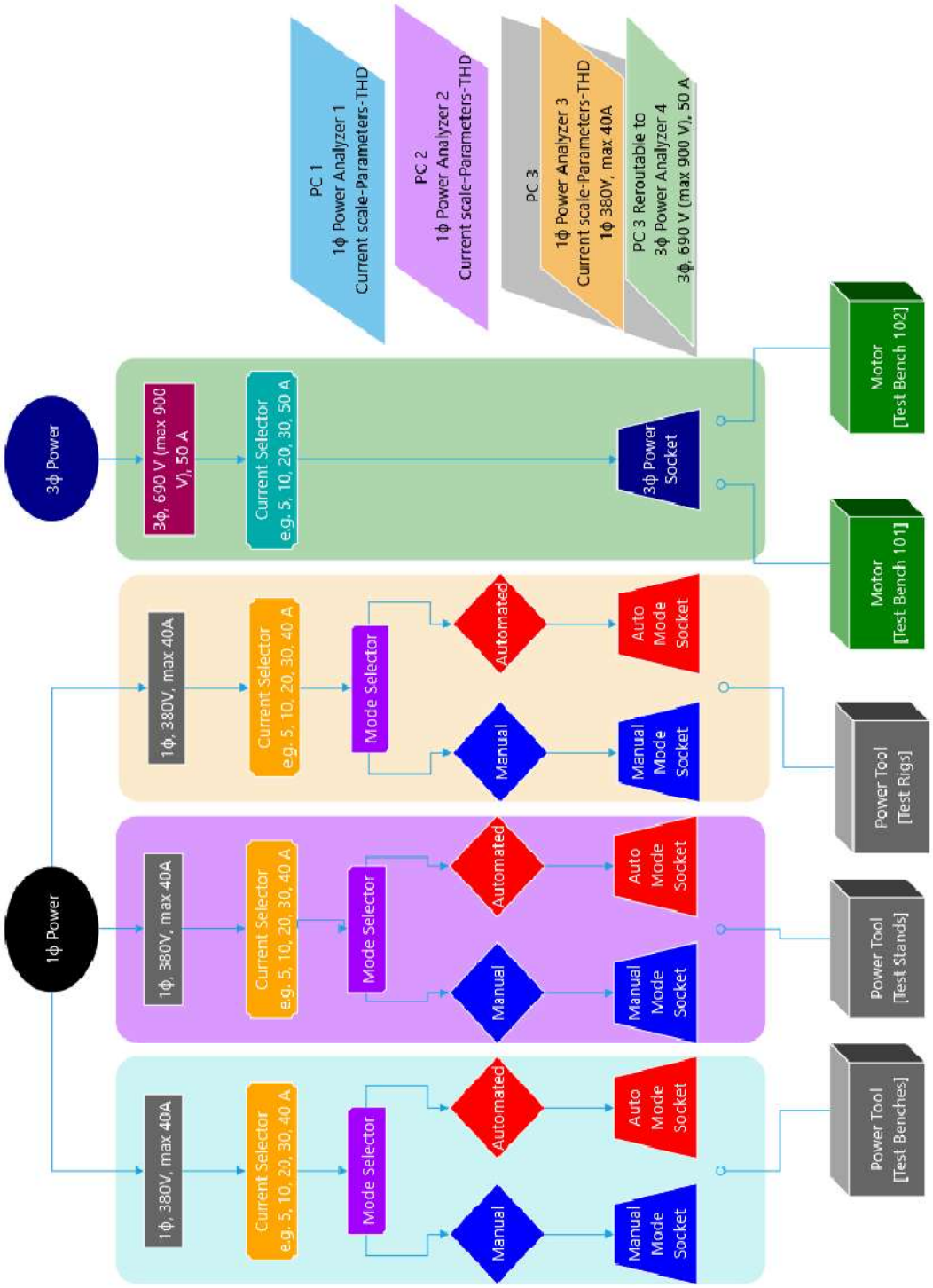
1. SANS 1804
2. SANS 60034
3. VC 9113

3 REQUIREMENTS

No	Requirement	Detailed description
1.	**SECTION 1: Power Tool Lab Power Supply System:** a. Available Input V: 11,5 kV, 400 A [Plant Room] b. Maximum: Output V: 380 V. Output A: 40 A c. Panel Height: ±2 m (Max: 2,15 m) – Installer’s responsibility to verify d. Power supply Efficiency: 90% + IECEE Requirements *(Reference: IECEE OD 5010):* e. Supply operation (e.g. autotransformer): 0 kV up to 380 V, increments of 1 V or lower. f. Voltage stability: ± 3 % Max	

No	Requirement	Detailed description
	g. Frequency stability: ± 2 % Max h. Total Harmonic Distortion (THD): 5 % max	
	(Reference use only: IECEE OD 5010): **8.3** Voltage regulation may be achieved by: 8.3.1 Robust source Acceptable for all situations. 8.3.2 Automatic Adjustment Acceptable for all normal operating conditions. May be used for varying load conditions if regulator is sufficiently robust and fast acting to handle the load change. 8.3.3 Manual adjustment Such as auto-transformer in conjunction with periodic voltage monitoring and adjustment (for example every 15 minutes minimum) to ensure voltage is constant.	
	SECTION 1: Power Tool Lab Power Supply System: 3 single-phase power analyzers, 3 high performance PCs *3 Connections points:* 1ϕ, 380V, max 40A | Selectable CT ratios: 5A-40A (e.g. 5, 10, 20, 30, 40) *Benchmarked: SANS 62841, and IECEE OD 5010* Research: Why 380V Single phase voltage? See SANS 62841-1 clause 18.3. Rated voltage x1.3 [For a 230V tool=299V is required and for a 240V tool=312V is required] Cables: 3 Distinct 3 pin plug extension cords for low current connection points. Power connector and suitable cable for current exceeding 10 A. Trunking. Automation Timer Mode / Manual Mode Selectable, On/Off settings, Number of Cycles, Auto shutdown after completion of cycles Selector: Direct on Line *1 Additional connection point:* 3ϕ, 690 V (max 900 V), 50 A | Current Selector (e.g. 5, 10, 20, 30, 50 A) Power connector and suitable cable for current exceeding 10 A. Trunking. 3 pin sockets at each wall in Power Tools Lab for Instruments (existing sockets may be re-wired). Trunking. Selector: Direct on Line or Soft starter	

SECTION 1: Power Tool Lab Power Supply System:



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SEE SECTION 2 BELOW:

SECTION 2: Standard Electric Motor Lab Power Supply System:

SECTION 2: Standard Electric Motor Lab Power Supply System:

a. Available Input V: 11,5 kV, 400 A [Plant Room]

b. Maximum Output V: Up to 1,5 kV. Maximum Output A: 3000 A
c. Display: All Output Parameters
d. Supply operation (e.g. autotransformer): 0 kV up to 1,5 kV, increments of 1 V or lower.
e. Voltage stability: Allowable variation: Supply at ±0,5 rated voltage of the machine. E.g. for 400 V machine, allowable variation: 398 V – 402 V
f. Harmonic voltage factor (HVF) not exceeding: 0.015.
g. Supply frequency: ±0.1 %
h. The negative-sequence component of the system of voltages shall be less than 0,5 % of the positive-sequence component
a. Power supply Efficiency: 90% +
b. Height clearance: 2 m (Max: 2,15 m)

Reference: ***IEC 60034-2-1 TESTING AND MEASURING EQUIPMENT***

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting	
5.4.1	Power supply	Appropriate power supply for type and rating of motor. (voltage, frequency, single or polyphase)	R	*
		Appropriate Harmonic Distortion metering equipment	R	*
5.5.3	Shaft Torque	In line torque transducer, or dynamometer, accuracy class 0.2. Minimum torque to be measured to be >=10% of the meter's nominal torque. (corrections may be required with certain equipment and test configurations)	R	
5.5.4	Motor speed	Encoder or suitable device, measurement accuracy to be +/-0.1 RPM.	R	
5.5.4	Input Frequency	Power analyzer or other suitable device, accuracy of 0.1% of full scale, appropriate for rated frequency of motor.	R	*
5.5.5	Temperature Measurement	Suitable instrumentation having total accuracy of +/- 1K	R	
6.1.3.2	Coil Resistance (Coil Temperature via Resistance)	Appropriate ohmmeter for range of coil, accuracy +/-2% of full scale	R	
6.1.3.2	Coil Temperature via Thermocouple or other embedded detector	Appropriate thermocouple junctions, wire, or appropriate detectors	R	
6.1.3.2	Input Voltage	Voltmeter or Power Analyzer, accuracy +/-0.2% of full scale	R	*
6.1.3.2	Current Draw	Ammeter or Power Analyzer, accuracy +/-0.2% of full scale Current Shunts or Current Transducers, +/- 0.3% accuracy (optional, dependant on choice of current measuring equipment)	R	*

SECTION 2: Standard Electric Motor Lab Power Supply System:
4 three-phase power analyzers, 4 high performance PCs, clear real time indication of apparent power value for each panel, safety: local switchgears, connection point lockout boxes

4 Connections points:

3ϕ, 690 V (max 900 V), 50 A	Wired to [Station B], Re-routable to [Station C]
3ϕ, 690 V (max 900 V), 100 A	Wired to [Station B]
3ϕ, 1100 V (max 1500 V), 300 A	Wired to [Station B], Re-routable to [Station C] Max between 300-600A. Non-parallel wiring
3ϕ, 1100 V (max 1500 V), 3000 A	Wired to [Station B] Parallel wiring may be required

Benchmarked: VC 9113, AMG and WEG 2024-2025 Catalogues

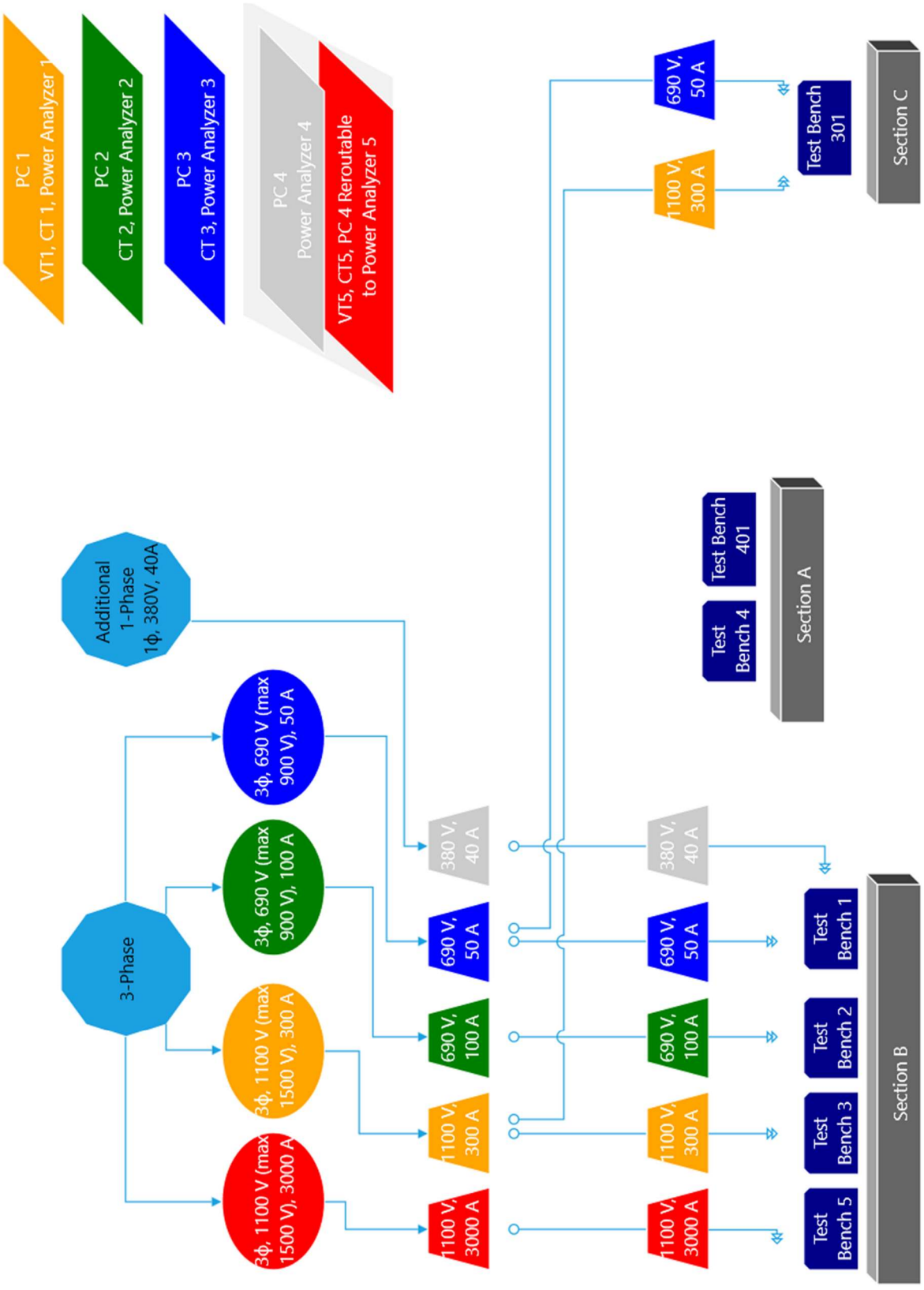
- Suitable soft starter feature for each connection point, panel power connectors, main cabling, test bench power connectors and 5 meter wiring with lugs.

- 3 pin sockets at each Section for Instruments. 6 sockets @ Section B, 3 sockets @ Section A and 3 sockets @ Section C.

1 Additional connection point:

1ϕ, 380V, max 40A	Selectable CT ratios: 5A-40A (e.g. 5, 10, 20, 30, 40) [Station A]

SECTION 2: Standard Electric Motor Lab Power Supply System:



3.	Power Supply Meter/Power Analysers (Single Phase and Three Phase) **Electric Motor Lab & Power Tools Lab**	a. Output measurements: Metering equipment (parameters: V, I, W, PF, f, etc.) b. Power quality measurements: Harmonic Distortion metering equipment/THD real time measurement c. Voltage and current transformer units, accessories etc. (Output measurements) d. All meters: Removable and portable for calibration and verification purposes. e. Power Meter Unit accuracy compliance is mandatory for quality system of Rotating Machines Lab. See IEC requirements below.

Power Supply Meter/Power Analysers Accuracy:
Reference: IECEE OD-5014

Instrument Accuracy Limits

Parameter	Range	Instrument accuracy of Range
Voltage		
≤ 1000 V	≤ 1 kHz	± 1,5%
	> 1kHz ≤ 5 kHz	± 2%
	> 5 kHz ≤ 20 kHz	± 3%
	> 20 kHz	± 5%
> 1000 V	dc ≤ 20 kHz	± 3%
	> 20 kHz	± 5%
Current		
≤ 5 A	dc ≤ 60 Hz	± 1,5%
	> 60 Hz ≤ 5 kHz	± 2,5%
	> 5 kHz ≤ 20 kHz	± 3,5%
	> 20 kHz	± 5%
> 5 A	dc ≤ 5 kHz	± 2,5%
	>5 kHz ≤ 20 kHz	± 3,5%
	> 20 kHz	± 5%
Power (50/60 Hz)	≤ 3 kW	± 3%
	> 3 kW	± 5%
Power Factor	50 ≤ 60 Hz	± 0,05
Frequency	≤ 10 kHz	± 0,2%
Resistance	1 mΩ ≤ 100 mΩ	± 5%
	>1 MΩ ≤ 1 TΩ	± 5%
	> 1 TΩ	± 10%
	for all other cases	± 3%

4.	Power Supply Safety and Regulations (Single Phase and Three Phase) **Electric Motor Lab & Power Tools Lab**	a. Protection: Standard protection as per industry regulations b. Main E-switch: Emergency switch at the main entrance of the lab c. Panel E-switch: Emergency switches for each station/panel. d. Certificate of Compliance (CoC) and the infrastructure compliance with the relevant municipal Electricity Supply By-laws are required before testing and commissioning. e. Wireman's License
5.	**Occupational Health and Safety Act (OHSA)** and **SANS 10142** regulations: Specific Phases *In case of a solution without a transformer, kindly provide the required documentation for each phase depending on the design, equipment, systems, etc.*	a) ENGINEERING DESIGN & PRE-APPROVAL DOCUMENTATION, Approved engineering designs & single-line diagrams (SLDs): Detailed drawings signed off by a Professional Engineer (Pr.Eng). Load Calculations & Fault Level Studies: To justify the size of the transformer, busbars, and protection breakers. Local Authority / Eskom Supply Approval: Written permission. b) CONTRACTOR LEGAL REGISTRATIONS: The contracting company must prove its legal standing. DoL Contractor Registration Certificate: The electrical contractor must be registered annually with the Department of Employment and Labour (DoL) Master Installation Electrician (MIE) License. c) THE SAFETY & PROJECT CONSTRUCTION FILE Baseline Risk Assessment & Safe Work Procedures (SWPs): Material Submittals & Certificates of Conformance: Type-test certificates proving all equipment (transformer, cables, distribution boards) complies with the relevant codes (e.g., SANS 780 for transformers, SANS 150 for PVC cables). d) CLOSE-OUT & COMMISSIONING DOCUMENTS (THE DELIVERABLES): SANS 10142-1 Test Report & Certificate of Compliance (COC): A complete commercial test report Specialized Installation Report: A dedicated sign-off specifically for the transformer and medium-voltage components.

		Transformer Factory & Field Test Reports
6.	Power Supply Cables Connection points **Electric Motor Lab & Power Tools Lab**	a. Appropriate cable set including earth wires to each test bench – pre-connected. b. Motor lab - Connection points: See provided diagrams for number of connection points. (Electric Motor Lab) c. Power tools lab – Connection points: See provided diagrams for number of connection points. (Power Tool Lab) d. Control panels with all necessary controls, e.g. On/Off switch, Voltage varying control/device/buttons e. Indication only displays for each panel f. Emergency switch: See Power Supply Safety above. g. Refer to voltages indicated for each panel/station. h. Refer to current ranges indicated for each panel/station. Each test bench has its own current ranges demand. i. Different samples of different voltage ratings and current ratings require different cable sizes as per regulations. Devices/accessories for easy connections and disconnections of cables and connection points are required for efficient setting up of circuits and samples. j. Provision of trunking and wiring management from power supply to, connection points, to samples.
7.	Additional requirements **Electric Motor Lab & Power Tools Lab**	a. Switch labelling. All labelling to be clear, in English, and very durable. b. Button labelling c. Cable labelling d. Connection point labelling e. Manuals f. Produce Final Brochure of the final power supply system. g. Provide detailed circuit diagrams and simulation. h. Indicator lights (status lights): On, Off, Overload, etc. i. Where applicable, install safety warning signs. j. Where critical and available, only approved items, cables and accessories may be installed in this system(s). Please refer to relevant standards and regulations. k. Where obliged and required, certificate of compliance is mandatory

4 INSTALLATION

Full installation to be done onsite at SABS Groenkloof premises by the service provider.

5 COMMISSIONING

The supplier will be responsible for the commissioning, training and demonstration (short testing of samples for each connection point), and allocate a minimum of 5 days or 5 sessions for testing of different loaded samples. Full commissioning needs to be conducted onsite and report to be accepted and signed off by the responsible SABS Test Officer/s or Technical Lead.

Note: During commissioning the supplier shall demonstrate all material, design, product, or service functionality. This will be compared to the requirements described in this product specification. Compliance will be confirmed by both SABS and the supplier signing off against each requirement.

6 TRAINING

Onsite training during commissioning needs to be provided by the service provider for 3 candidates including samples testing.

7 DOCUMENTATION

Upon award, bidder is expected to submit the following documents:
Instruction manual, electrical compliance certificate, software and safety data sheets will be supplied by the service provider. See block 5 above.

Note: SABS will evaluate each document. SABS can decide at its own discretion if any document is not sufficient. In such a case the supplier will be responsible to update the document to SABS satisfaction.