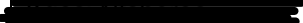
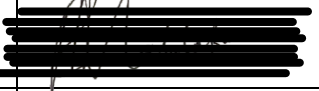
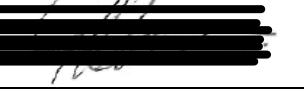


	OUTAGE SCOPE OF WORK FORM/TEMPLATE	Template Identifier	240-98982530 (Rev 1)
		Doc Identifier	EEP0914
		Doc Revision	1
		Effective Date	August 2015
		Eskom	Page 1 of 17

Kriel Power Station Outage Scope of Work
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18 kV Isolated Phase Busbars (IPBs)	High level KKS code:	All Units 1 - 6
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Outage type	GO & MGO and Maintenance Opportunity	Start date	
Department	Electrical Plant Engineering	System	Isolated Phase Busbars (IPBs)
Scope review date			

Details	System Engineer	EMD Line Manager	Engineering Line Manager
Name & Surname			
Signature			
Date	29/05/2025	01.06.2025	29/05/2025

Details	SCOPE APPROVAL	SCOPE ACCEPTANCE	SCOPE ACCEPTANCE
	Engineering Manager	Outage Coordinator	Outage Execution Manager
Name & Surname			
Signature			
Date	02/06/2025		

SCOPE COMPILATION REFERENCES				
SOURCE & Ref No.	Yes	No	N/A	Comments
Previous outage service reports	X			Previous outage reports have been reviewed
Return to service data packages	X			Previous outage data packs have been reviewed
Maintenance Strategy with Rev number	X			All work outlined by the scope is in line with maintenance strategy for the plant
SAP defects (attach list as appendix)	X			Defects checked on SAP
OMS / IIRMS recommendations (Audits Reports)	X			Risk for the plant are attached on the APPENDIX
Risk controls (IRM system)	X			The risk controls are also identified on the table in the APPENDIX
Previous audits and reviews (e.g. ERAP)	X			Previous audit reports were reviewed and all required tasks are outlined in this document
Engineering Change Requests (Projects)			X	No projects will be executed for this plant
LOPP strategy reports	X			The LOPP strategy from PIEC was considered
URS	X			All user requirements were identified
Philosophy (Outage)	X			The philosophy was reviewed
Condition Monitoring Report			X	There is no capability to perform this function
VA/PHD Viewer trends			X	Plant does not have PHD trends capability
Corrective Actions	X			All corrective actions were identified and will be addressed by the work on this document
Grid code requirements	X			The grid code procedure was reviewed, there will be no changes performed on the plant that will affect the grid code requirements
Previous Outage SOW variations	X			Work from previous scope variants has been incorporated
Post Mortems Actions from previous outages	X			No actions were identified
Pre-Outage plant walks	X			Plant walks have been completed
Risk based inspection (RBI) report	X			The RBI report has been reviewed
Simulation, TOIs, OON, SI	X			All Plant deficiencies were checked on FLIP

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1. GOAL

Outage prepares the unit to achieve the following performance targets with respect to the 18 kV Isolated Phase Busbars, Generator VTs and Generator CTs:

- Reduction trips due to unwanted partial discharge in the interior of each Phase busbar
- Prevention of circulating current on the enclosure due to multiple earth points
- Sustained performance of the Generator CT and VTs
- Closing all leaks on the 18kV Breaker IPB's and ducting

2. OBJECTIVES

2.1 TECHNICAL CRITERIA

- Earthing of busbars must be confirmed with minimum insulation of 20kΩ when 500V DC is applied
- Busbars must be cleaned, free of dust that might cause partial discharge
- Zero forced shut down for rework after the outage
- Zero trips as a result of outage poor workmanship

2.2 SCOPE VARIATIONS

- The aim is to have no scope variation

2.3 FINANCIAL PERFORMANCE

- To achieve high quality work at minimum cost

2.4 TIME MANAGEMENT

- To complete the all tasks within scheduled time lines

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3. SUMMARY OF THE SCOPE

- Clean 18 kV busbars, and busbar enclosure
- Disconnect all flexible connections
- Remove and clean all copper and aluminium plates.
- Supply and replace all cup/spring washers.
- Supply and replace transition washers on all copper to aluminium connections.
- Supply and replace defective stainless steel bolts for flexible connections
- Supply and install spare bellows and seals
- Clean voltage and current transformer cubicles and assure correct insulation and earthing on panels.
- Check earthing on busbar enclosure system (Megger/Insulation Resistance test on IPB enclosure)
- Commission pressurization system back on line and seal all holes on the IPB's

3.1 BATTERY LIMITS

PLANT	START	END	EXCLUSIONS	INCLUSIONS	DRAWINGS
Generator side Isolated Phase Busbars	Generator star point	Generator Circuit Breaker Interrupter side	None	Excitation transformers IPBs	0.45/815
Generator Transformer side Isolated Phase Busbars	Generator Circuit Breaker Isolator side	Generator Transformer and 18/11 kV Unit transformers	None	Generator transformer VTs IPBs	0.45/815

3.2 GENERAL ARRANGEMENT AND LOCATION DRAWINGS

Nº	DRAWING NUMBER	TITLE
1	0.45/815	Kriel Auxiliary Busbars
2	0/45/11028	Busbar supports
3	5022/1	Generator Connection Phases side

4. APPLICABLE CORPORATE/GENERATION/INTERNATIONAL GUIDELINES AND STANDARDS

Nº	REFERENCE NUMBER	DOCUMENT TITLE
1	240-56227522	High Current Phase Isolated Generator Circuit-Breakers, Disconnectors and Generator Earthing Switches at Power Stations
2	240-56356401	Eskom Generator Protection Philosophy for Large Fossil Fuel Power Stations with Generator Circuit Breaker
3	474-11594	Generation Plant Engineering Life Cycle Planning/Strategic Report for Generator Circuit Breaker Plant for 2018
4	240-56357413	Management of Generator Circuit Breaker and Generator Circuit Breaker Auxiliary Plant Health

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5. APPLICABLE KRIEL POWERSTATION STANDARDS AND PROCEDURES

No	REFERENCE NUMBER	DOCUMENT TITLE
1	32-4	Outage Philosophy for Kriel Power Station

6. GENERAL CONSIDERATIONS

ACTIVITIES	SPECIFICATIONS
PRE-REQUISITES / PRE-CONDITIONS	
Provision of lights	Lights must be made available for work inside the IPBs
Scaffolding	Scaffolding to be erected on the generator transformer IPBs
SAFETY	
Induction and permit to work process	The contractor must ensure that the lifesaving rules are adhered to by his staff. Safety tool box tools should be carried out and all employees taken through and induction. All procedures for entry into confined spaces and working at heights to be used and applied.
PPE	The workforce must be provided with safety glasses, welding PPE, gloves, overalls, safety boots, helmets (with chinstraps) and safety harnesses (where required) as a minimum.
Compliance to basic conditions of employment	The basic conditions of employment must be adhered to as specified in the labour act.
Safety Files	The safety files must be submitted and approved by Eskom safety department before the start of work
ENVIRONMENT	
Kriel Power Station Waste Management Procedure (RER 0221)	Contractor to adhere to Station's environmental procedure. The scrap metal and human waste shall be stored in the correct colour coded skips provided by the employer. This will collected by employer and handled accordingly
Waste Management	The water for the outage shall be provided by the employer and attempts should be made not to utilise the fire hydrants.
Pollution and Emission Control	The noise levels of the works are to be kept with the provisions made for that area of the plant
QUALITY	
Process Quality Process/Procedure (PQP/QCP)	Work on the turbine shall be carried out in accordance with the relevant approved PQP. The PQP shall be compiled by the contractor based on this scope of work and submitted to Outage documentation centre at least 2 months before the outage for review and approval. The QCP shall include the work that will be performed both outside the Power Station as well as on site

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Hold and witness points	H&W points that form part of the QCP and have been approved prior to the start date, shall not be by-passed under any circumstances without the written concession of an authorised member of the Engineering Department. It is the Contractors responsibility to inform the Plant Engineer or his representative at the daily progress meetings when an activity will be ready for QC.
Check Sheets	OEM requirements specifications to be used on specifications unless approval to be obtained from Engineering. Inspections to be carried out in accordance with check sheets as attached in master quality plan (QCP). All disassembly and assembly values to be recorded in relevant check sheets. No incomplete check sheets will be accepted unless the prior exemption in terms of the technical notification is obtained from Engineering. NCR will be issued for incomplete check sheets. Repair or replace all damaged/worn components out of specification or obtain a concession from engineering staff. All abnormalities to be recorded and reported with technical notifications.
Quality technicians	QC Technicians will be delegated by Plant Engineers to ensure quality standards and quality assurance is exercised during the repairs, replacement or refurbishment.
Experience of staff	Short CV's of all supervisors, quality technicians, and artisans stating qualifications and relevant experience must be provided at least two weeks before commencement of outage. All Engineers, technicians, supervisors and quality assurance related staff should have adequate experience to work on specified activities. All artisans should have adequate experience on specified activities and it is the responsibility of the contractor to provide assurance to Eskom that the artisan has the required experience to perform work at Kriel Power Station.
General Requirements	

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Spares	The importance of correct equipment spares and procedures should be included in structured toolbox talk sessions with all contractors. It should be kept in mind that lead time of turbine spares required during major overhauls can be as much as 12 months. Therefore all the spares required will be ordered in time. Spares ordered and used will be reported by always quoting the ESKOM stock number (if applicable) as well as the Group and item number from the spares manuals. Spares to be transported according OEM requirements.
Documentation	Full service reports must be compiled and submitted to the outage documentation centre for safe keeping and approval in accordance with the accepted documentation submittal schedule but no later than 30 days after unit is synchronised on load.
Equipment	Lifting equipment: An up to date test certificate will be available for all lifting equipment that will be used. Measuring equipment: An up to date calibration certificate must be available for all measuring equipment that will be used. Special tools will be serviced before the outage, will be available on site and will be on good working condition. A list of all special tools must be compiled before the outage and submitted to Engineering. The special tools must be readily available for inspection by QC and Engineering.
Use of SAP PM to record history and costs	SAP PM will be used to record history of work done and the related costs to at least the second level of headings as listed in this document.
EXISTING DEFECTS	
Plant defects	A list of all defects loaded before the submission of this SOW are attached

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7. DETAIL SCOPE OF WORK: DECOMMISSIONING AND PRESERVATION SCOPE

SUBSYSTEM		ISOLATED PHASE BUSBAR INSPECTIONS AND REPAIR SCOPE				
COMPONENT ACTIVITIES					GOVERNING DOCUMENTS	
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
1	05-01AP	Generator side to Generator Circuit Breaker Interrupter side IPBs	Refurbish busbar flexibles	- Refurbish Generator bushing flexibles, current transformer side - Refurbish Generator to generator breaker busbar flexibles - Close and seal generator transformer flexibles box.		W
2	05-01CY	Excitation transformer IPBs	Refurbish busbar flexibles and replace damaged bellows	- Disconnect and reconnect bellows on excitation transformer, IPB side. - Disconnect and reconnect bellows on AVR side of excitation transformer. - Seal IPBs as per drawings		W
3	05-01AT	Generator Transformers VTs IPBs	Refurbish busbar flexibles	- Flexible connection at VT cubicles - Check earthing on busbar enclosure system (EMD/PTM)		W
4	05-01AB	Generator CTs Cubicle	Check fan motor (EMD & Contractor)	Verify that the both fan motors are running		W
	05-01BT	Generator CTs	CT loop resistance test (PTM and the contractor)	- Perform loop resistance test on the CTs to verify that the CT secondary is not open circuited - Test line and star side CTs - Perform insulation resistance test of the CTs		W
5	05-01AT	Generator Circuit Breaker Isolator side to Generator	Refurbish busbar flexibles and replace damaged bellows (ACTOM)	- Refurbish Generator breaker flexibles to Generator transformer side - Refurbish flexibles on Unit Transformer “A” primary side		W

SUBSYSTEM		ISOLATED PHASE BUSBAR INSPECTIONS AND REPAIR SCOPE					
COMPONENT ACTIVITIES					GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)	
		Transformer and Unit Transformers IPBs		- Refurbish flexibles on Unit Transformer “B” primary side - Disconnect and reconnect bellows on Unit Transformer “A” primary side - Disconnect and reconnect bellows on Unit Transformer “B” primary side			
6	05-01AP 05-01SP 05-01CY	Bus bar enclosure	Test busbar enclosure earthing to confirm single point of earthing (Contractor &PTM)	With the busbar enclosure floating (disconnected from earth, generator and transformers, voltage transformers, arrestors and the secondary’s of the current transformer short-circuited and earthed) the minimum insulation should be 20kΩ with 500V applied		H	
7	05-01SP	CT chamber	Testing and replacement of damage trucking and thermistor (Contractor & C&I)	- Check the CT chamber if all the trucking are still in place and all cables are secured - Confirmation of thermometer settings and functionality - Confirm functional operation of CT fans		H	
8	05-01AT	Generator Transformers VTs	Clean VT Cubicle by the contractor, PTM to witness	Open the VT and clean the interior		H	

8. BUDGET BILLS OF MATERIAL

(SOW OF WORK VARIATION WILL BE ISSUED ONLY IF REFURBISHMENT OR REPLACEMENT COMPONENTS EXCEED BUDGET.
OTHERWISE CUTTING INSTRUCTION WILL BE USED TO COMMUNICATE WHICH COMPONENTS MUST BE REPLACED OR REFURBISHED)

SUBSYSTEM							
№	REPLACE/ REFURBISH	COMPONENT DESCRIPTION	COMPONENT / MATERIAL SPECIFICATION	OPERATING PARAMETERS	PART / NUMBER	STOCK NUMBER	DESIGN QUANTITY
1.	Replace	M16 Transition washers				N/A	1672
2.	Replace	M16 Solon washers				N/A	1656
3.	Replace	M12 DIN washers				N/A	290
4.	Replace	Synthetic gasket seal (50m rolls)			PG 40208	0527982	1
5.	Replace	Synthetic gasket seal (50m rolls)			PG 41054	256217	1
6.	Replace	Generator Transformer bellow			G3077-1230	256220	3
7.	Replace	Unit transformer bellows			G 30376-650	256213	6
8.	Replace	VT Cubicle bellow			G30553-640	256218	3
9.	Replace	Circuit breaker bellow			G3077-1250	256215	6
10.	Replace	Excitation transformer bellow			G30376-650	256213	6
11.	Replace	Generator connection external bellow			G30383-1230	256216	3
12.	Replace	Generator connection internal bellow			G30235-720	256214	3
13.	Replace	Earth Switch bellow			B 70581-158	256219	3

9. APPENDIX A

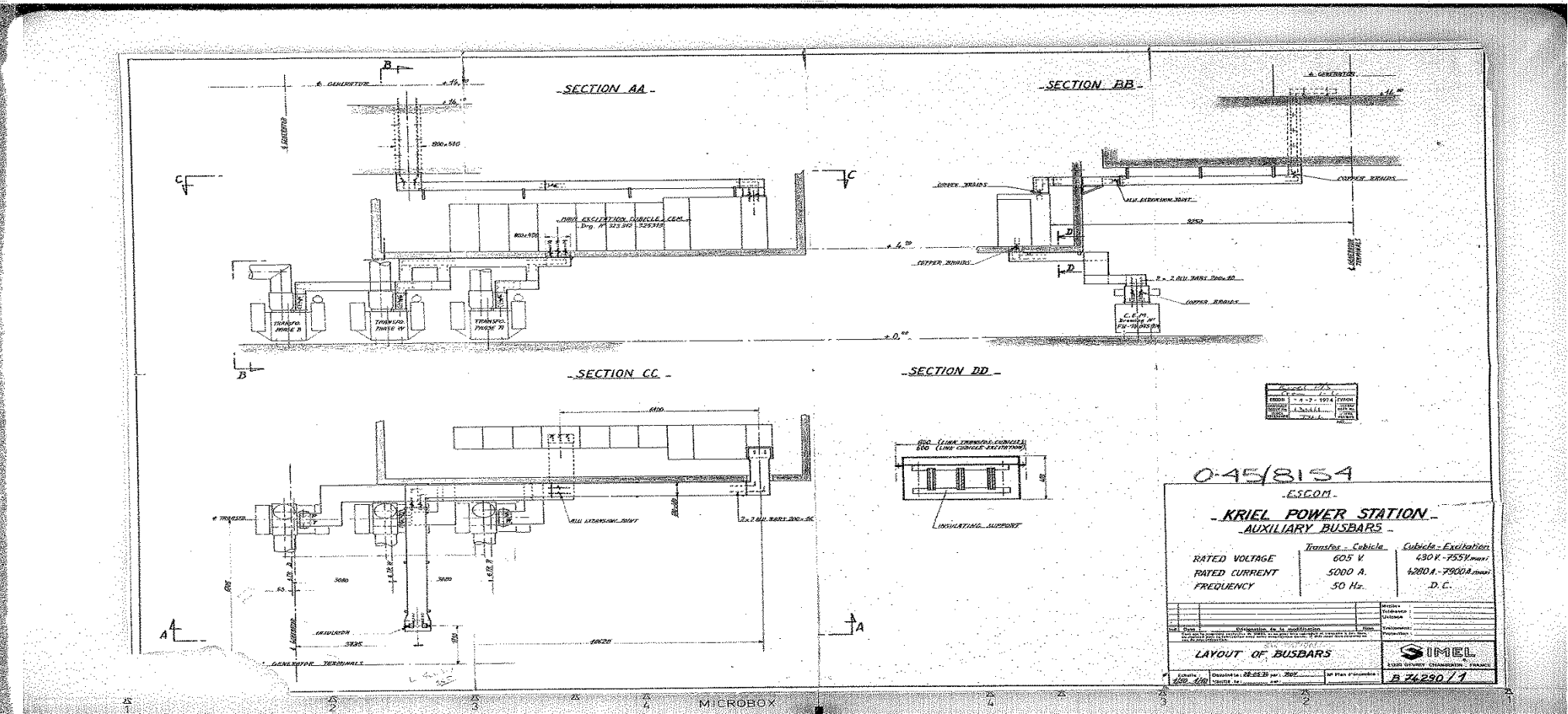


Figure 1: Kriel Auxiliary Busbars

10. APPENDIX B

Table 1: Torque Settings

System part	Component	Torque settings
Generator connection line side	Adaptor to busbar	90 NM
	Flexible to busbar	95 NM
	Flexible to generator	90 NM
Generator connection neutral side	Adaptor to busbar	90 NM
	Flexible to adaptor	95 NM
	Flexible to generator	90 NM
Breaker connection to generator side	Flexible to busbar	95 NM
	Flexible to adaptor plate	90 NM
	Adaptor plate to breaker	90 NM
	Earth busbar to breaker	95 NM
Breaker connection to transformer side	Flexible to busbar	90 NM
	Flexible to adaptor plate	90 NM
	Adaptor plate to breaker	96 NM
	Earth flexible to busbar	95 NM
Unit transformer A connection HV side	Flexible to adaptor plate	90 NM
	Flexible to busbar	95 NM
Unit transformer B connection HV side	Unit transformer A connection HV side	90 NM

	Phase flexibles	50 NM
Generator transformer connection	Flexible to busbar	95 NM
	Flexible to adaptor	90 NM
	Adaptor to bushing	60 NM

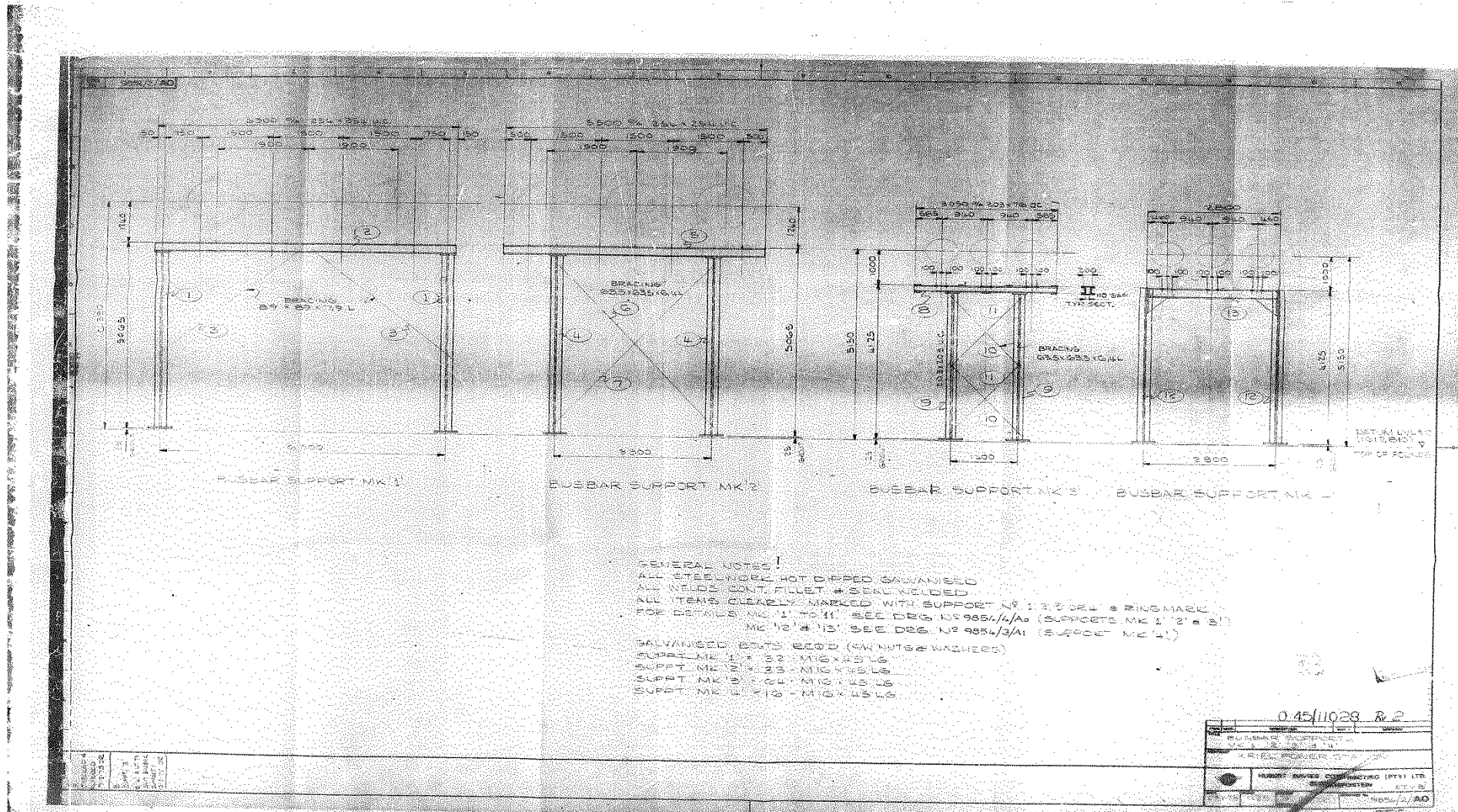
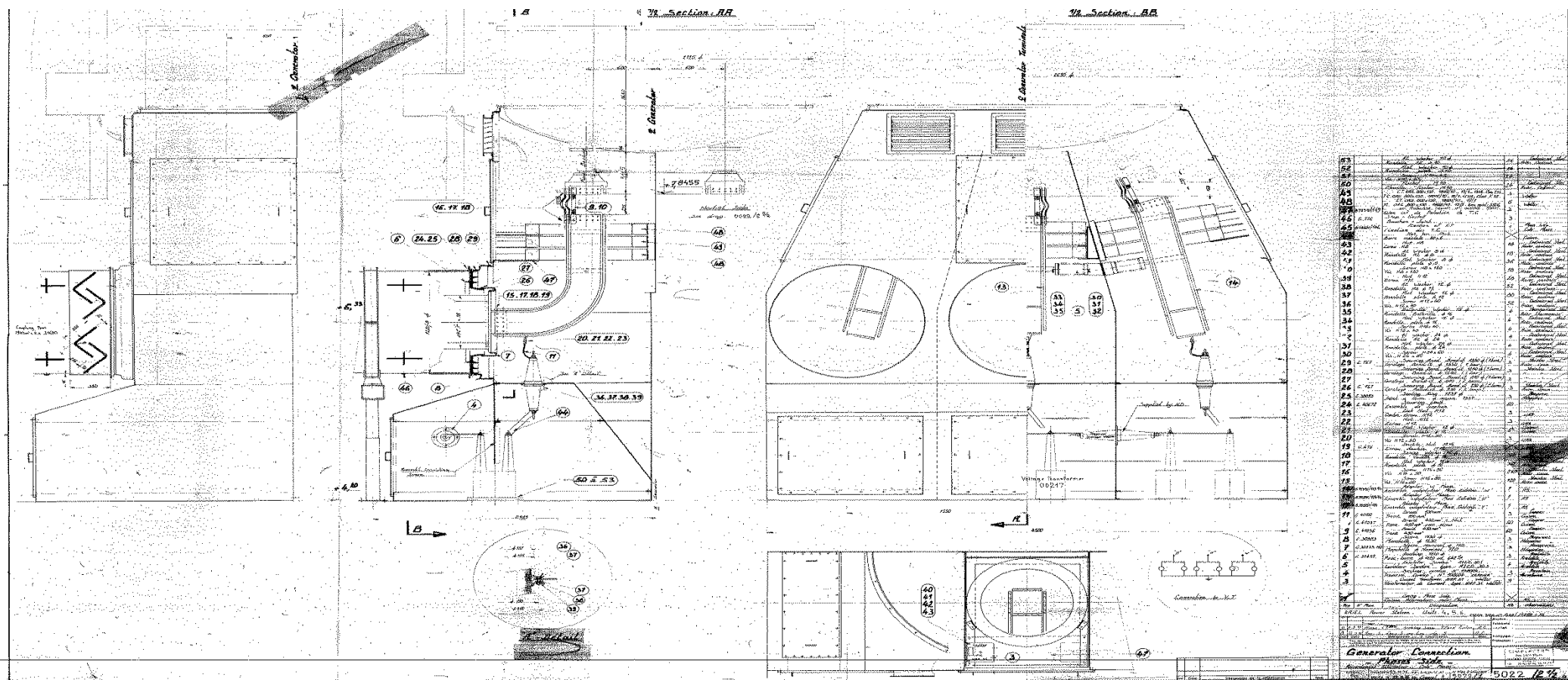


Figure 2: Busbar supports

Figure 3: Generator Connection Phases side



11. APPENDIX B: RISK ASSESSMENT

Risk description	Risk cause	Consequences	Existing controls	Risk Treatment Plans	Implementation Date
IPB pressure is low	Leaks on GCB covers and where IPB meets transformers	Dirt entrapped in busbar and electrical faults	Cleaning of the IPBS in every MGO and GO	Get drawings for sealing of the excitation transformer, and sealing of the breaker enclosure	March 2021