

Technical Brochure

12kV

Epoxy resin insulated and earth screened metal-enclosed switchgear

MSH-TB-001 Rev 0

RPS SWITCHGEAR

Reliability and safety you can trust

TABLE OF CONTENTS

1 INTRODUCTION 3
1.1 MSS DESCRIPTION AND FEATURES 3
2 APPLICABLE STANDARDS 5
3 SWITCHGEAR DESIGN 6
3.1 COMPARTMENTS AND KEY COMPONENTS 6
3.2 TECHNICAL SUMMARY 7
3.3 ACCESSIBILITY TO HIGH VOLTAGE COMPARTMENTS 8
3.4 SIRING POLE MODULE DESIGN AND FEATURES 9
3.5 OBSERVATION (VIEWING) WINDOW 10
ANNEX A – DOCUMENT REVISION HISTORY 10
A.1 Revision register 10

1 INTRODUCTION

1.1 GELPAG MSS DESCRIPTION AND FEATURES

- MV Switchgear has an exclusive Value Added Reseller (VAR) distribution agreement in place with Advanced Technology GmbH for the MSS range of solid insulated switchgear (SIS) and relevant components in South Africa and the SADC region.
- The MSS range of switchgear is fixed pattern medium-voltage, solid-insulated, fully screened, 3-phase AC, metal-enclosed switchgear compliant to IEC 62271-200. The switchgear is SF6 free and uses no air or other gas for the primary insulation. The switchgear performance is completely independent from environmental pollution, humidity and altitude.
- The MSS-H range of switchgear is primary switchgear rated up 3150 A and 40 kA.
  NOTE: Rating up to 4000 A is available with forced cooling.
- The MSS range of switchgear requires an extremely small footprint – offering panel widths of 500 mm for up to 1250 A and 700 mm for up to 2500 A and 1000 mm for up to 3150 A. The associated space saving reduces building and civil engineering costs.
- The core “Siring” module incorporated in the panel assembly comprises a circuit-breaker with a three-position disconnector and earthing switch as a single fully earth screened state-of-the-art epoxy resin insulated pole.
- Graphene nanomaterials are used to optimise the thermal conductivity and dielectric performance of the Siring pole module.
- Observation / viewing windows are provided on each panel assembly that allow for visible indication of the disconnector (isolation) and earthing position.
- Switchgear cable connection compartments are fitted with Type C bushing interfaces suitable for 3-core / 1-core front or rear-bottom entry power cable terminations using screened separable connector technology (i.e. Type 4 terminations in accordance with SANS 876). Top entry options are available on request – for which the panels are 200 mm deeper.
- The GELPAG switchgear incorporates ring type current transformers (CTs) that are located around the fully screened primary circuit behind the Type C bushing interface and not within the cable compartment. Power cables do not need to be terminated through the CTs.
- MSS switchgear is fitted with pressure relief devices which are designed to open in the event of an internal arc fault. MSS-H has been designed and tested in accordance to IEC 62271-200 for IAC AFLR 40 kA 1 second, thus maximising operator safety.
- The vacuum circuit-breakers (VCB’s), 3-position disconnectors and earthing devices are designed and tested to IEC 62271-100 and IEC 62771-102.
- IECEE-CB scheme type test certification has been achieved in accordance with IEC 62271-200 (and IEC 62271-1) for the complete assembly and in accordance with IEC 62271-100 and IEC 62271-102 for the Siring pole module. Type test reports of complete type tests have been issued by TUV Rheinland.
- The GELPAG switchgear has been dielectric type tested under C_H (frequent / heavy) condensation conditions in a climatic test chamber in accordance with IEC 62271-304, i.e. for switchgear used in severe service conditions. Dielectric testing included 100 % power frequency and lightning impulse withstand on the primary circuits and 2 kV 1 minute AC withstand tests on the auxiliary and control circuits.

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TYPE TEST REPORT OF COMPLETE TYPE TEST

TEST REPORT NO:	50283626 001	**ORDER NO:**	244155356
APPARATUS:	Intelligent fully insulated metal clad closed switchgear		
DESIGNATION:	GELPAG-MSS-12/1250-31.5	**SERIAL No.**	RD1007/1001/A1 RD1007/1001/A2
	Rated voltage: 12 kV Rated short-circuit breaking current: 31.5 kA Rated short-time withstand current: 31.5 kA/ 4 s	Rated normal current : 1250 A Rated frequency: 50 Hz	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
ESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	19th August until 30th August 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC/TS 62271-304:2008
IEC 62271-1:2007 sub-clauses:
6.9.1.2, 6.9.2.3, 6.9.2.4, 6.9.3.2, 6.9.3.3
IEC 62271-200:2011 sub-clauses:
6.2.6.1, 6.2.6.2, 6.2.9, 6.2.10, 6.4-6.6, 6.7.1, 6.101.2, 6.101.3, 6.102

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

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TYPE TEST REPORT OF COMPLETE TYPE TEST

TEST REPORT NO:	50283628 001	**ORDER NO:**	244155356
APPARATUS:	**High-Voltage Intelligent Fully Insulated Metal Clad Enclosed Switchgear**		
DESIGNATION:	GELPAG-MSS-12/2500-40	**SERIAL No.**	RD1007/1002/A1, RD1007/1002/A2, RD1007/1002/A3
	Rated voltage: 12 kV Rated short-time withstand current: 40 kA/4 s Rated peak withstand current: 100 kA	Rated normal current: 2500 A Rated frequency: 50 Hz Rated short-circuit breaking current: 40 kA	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
TESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	10th July 2019 until 19th September 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC 62271-200:2011 sub-clauses:
6.2.6.1, 6.2.6.2, 6.2.9, 6.2.10, 6.4, 6.5, 6.5.5, 6.6, 6.7.1, 6.101.2, 6.101.3, 6.102
IEC 62271-1:2007 sub-clauses: 6.9.1.2, 6.9.2.3, 6.9.2.4, 6.9.3.2, 6.9.3.3
IEC/TS 62271-304: 2008

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

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TYPE TEST REPORT OF COMPLETE TYPE TEST

TEST REPORT NO:	50283625 001	**ORDER NO:**	244155356
APPARATUS:	**Indoor high-voltage integrated alternating-current vacuum circuit-breaker**		
DESIGNATION:	GELPAG-SIRING-12/1250-31.5	**SERIAL No.**	RD1007/1501/A1 RD1007/1501/A2
	Rated voltage: 12 kV Rated short-circuit breaking current: 31.5 kA Rated short-time withstand current: 31.5 kA/ 4 s	Rated normal current : 1250 A Rated frequency: 50 Hz	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
ESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	24th June until 05th September 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC 62271-1:2007 sub-clauses:
6.9.1.2, 6.9.2.3, 6.9.2.4, 6.11
IEC 62271-102:2013 sub-clauses:
6.101, 6.102
IEC 62271-100:2017 sub-clauses:
6.2.6.1, 6.2.6.2, 6.2.9, 6.2.10, 6.4 to 6.6, 6.9.3.1, 6.9.3.2, 6.102 to 6.106, 6.108, 6.110, 6.111, 6.112

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

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TYPE TEST REPORT OF COMPLETE TYPE TEST

TEST REPORT NO:	50283629 001	**ORDER NO:**	244155356
APPARATUS:	**A Three-Phases High-Voltage Intelligent Vacuum Circuit Breaker**		
DESIGNATION:	GELPAG-SIRING-12/2500-40	**SERIAL No.**	RD1007/1502/A1, RD1007/1502/A2, RD1007/1502/A3
	Rated voltage: 12 kV Rated short-time withstand current: 40 kA/4 s Rated peak withstand current: 100 kA	Rated normal current: 2500 A Rated frequency: 50 Hz Rated short-circuit breaking current: 40 kA	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
TESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	10th July 2019 until 19th September 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC 62271-100:2017 sub-clauses:
6.2.6.1, 6.2.6.2, 6.2.9, 6.2.10, 6.4, 6.5, 6.5.5, 6.6, 6.102 to 6.106, 6.108, 6.110, 6.111
IEC 62271-1:2007 sub-clauses: 6.9.1.2, 6.9.2.3, 6.9.2.4, 6.9.3.2, 6.9.3.3, 6.11
IEC 62271-102:2013 sub-clauses: 6.101, 6.102

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

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TYPE TEST REPORT OF INTERNAL ARC PERFORMANCE

TEST REPORT NO:	50283627 001	**ORDER NO:**	244155356
APPARATUS:	**Intelligent fully insulated AC metal clad closed switchgear**		
DESIGNATION:	GELPAG-MSS-12/1250-31.5 Rated voltage: 12 kV Rated short-time withstand current: 31.5 kA/4 s Internal arc classification: IAC A FLR 31.5 kA, 1 s	**SERIAL No.** RD1007/1001/A2 Rated normal current : 1250 A Rated frequency: 50 Hz	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
TESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	3rd September 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC 62271-200:2011 sub-clause: 6.106

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

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TYPE TEST REPORT OF INTERNAL ARC PERFORMANCE

TEST REPORT NO:	50283630 001	**ORDER NO:**	244155356
APPARATUS:	**Intelligent fully insulated AC metal clad closed switchgear**		
DESIGNATION:	GELPAG-MSS-12/2500-40 Rated voltage: 12 kV Rated short-time withstand current: 40 kA/4 s Internal arc classification: IAC A FLR 40 kA, 1 s	**SERIAL No.** RD1007/1002/A1 Rated normal current : 2500 A Rated frequency: 50 Hz	
CLIENT:	**GELPAG Advanced Technology GmbH** *Bauhofstraße 20, 68623 Lampertheim, Germany*		
MANUFACTURER:	**ISEE Electric International Co., Ltd.** *No.2 The third Xinfeng Road, Torch High-tech Industrial Development Zone, Xiamen 361006,P.R.China*		
TESTING LOCATION:	**Xi'an High Voltage Apparatus Research Institute Changzhou Co., Ltd.** *No.159 Qing Yang North Street, Tianning District, Changzhou Jiangsu P.R.China*		
TESTING LABORATORY:	**TÜV RHEINLAND (SHANGHAI) CO., LTD.** *TÜV Rheinland Building, No. 177, Lane 777, West Guangzhong Road, Jing'an District, Shanghai 200072, P.R. China*		
DATE(S) OF TESTS:	10rd September to 22th October 2019		

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with

IEC 62271-200:2011 sub-clause: 6.106

This Type Test Report has been issued by TÜV Rheinland following exclusively the STL Guides. The tests performed in Laboratory were under supervision of TÜV Rheinland engineers.

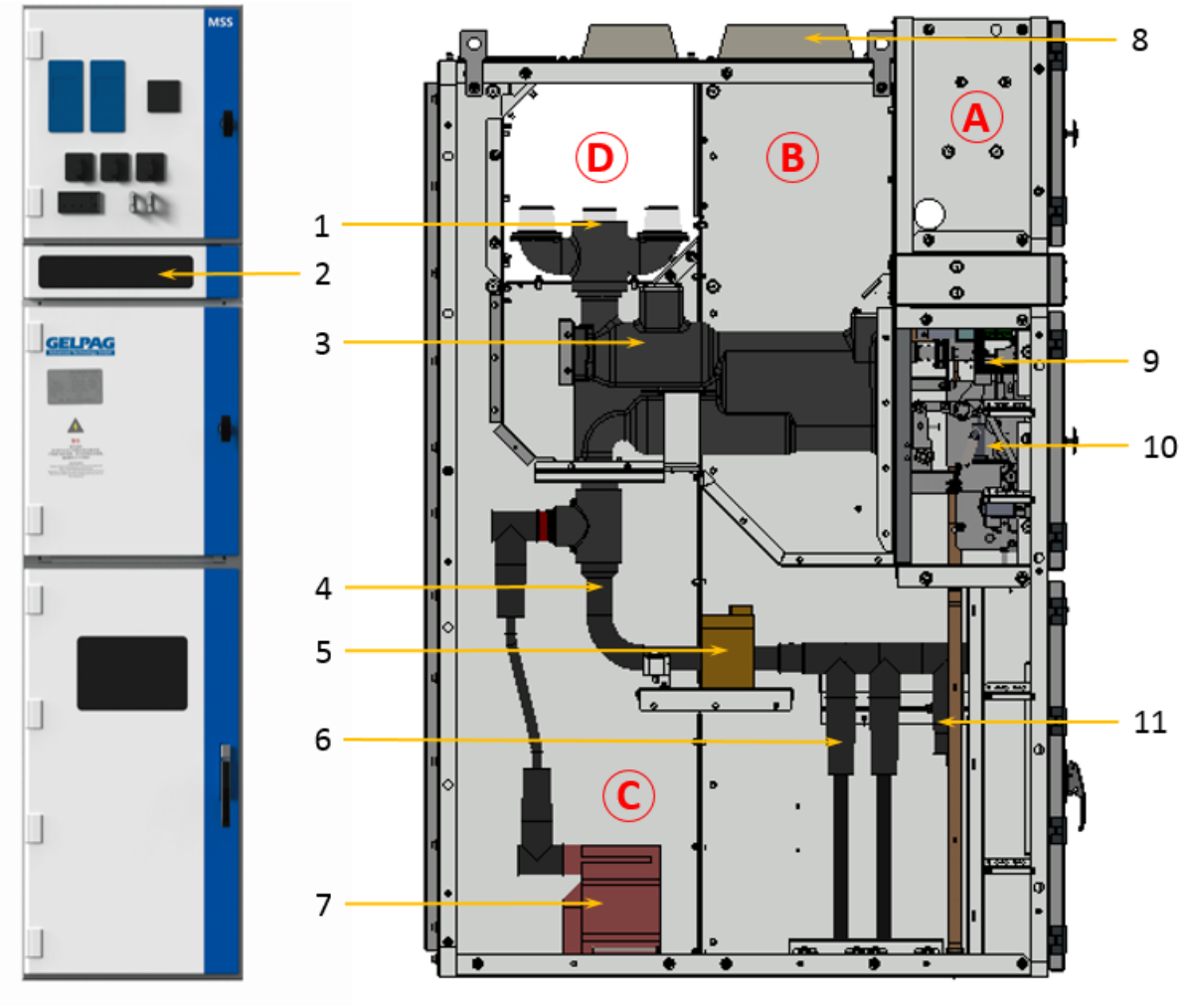
- The switchgear uses tried and tested vacuum interrupter technology requiring no maintenance on the interrupting device and entire primary circuit.
- The circuit-breaker incorporates a trip-free, stored energy operating mechanism having a closing spring that is charged by an electric motor with manual charging available as a back-up.
- The spring type operating mechanism has the facility of storing a spring charge whilst the breaker is closed, thus enabling a further open, close, open (O-C-O) operation to be carried out without recharging the closing spring. The circuit-breaker has been type tested for both extended electrical (E2) and mechanical endurance (M2).
- The three-position disconnector and earthing switch is operated by an electric motor with manual operation as a back-up. The disconnector and earthing switch has been type tested for M1+ mechanical endurance (i.e. 5000 mechanical operations). The earthing switch has been type tested for extended electrical endurance (E2).
- A great deal of attention has been given to both the design and testing to ensure maximum practicable operator safety and ease of operation under normal and abnormal operating conditions.

2 APPLICABLE STANDARDS

Standard	Title
SANS/IEC 62271-1	High-voltage switchgear and controlgear Part 1: Common specifications
SANS/IEC 62271-200	High-voltage switchgear and controlgear Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
SANS/IEC 62271-100	High-voltage switchgear and controlgear Part 100: Alternating-current circuit-breakers
SANS/IEC 62271-102	High-voltage switchgear and controlgear Part 102: Alternating-current disconnectors and earthing switches
SANS/IEC 62271-304	High-voltage switchgear and controlgear Part 304: Classification of indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV related to the use in severe service conditions with respect to condensation and pollution
SANS 876	Cable terminations and live conductors within air-filled enclosures (insulation co-ordination) for rated A.C voltages from 7,2 kV up to and including 36 kV

3 SWITCHGEAR DESIGN

3.1 COMPARTMENTS AND KEY COMPONENTS



A	B	C	D
Low-voltage compartment	**Circuit-breaker & disconnector compartment**	**Cable and instrument transformer compartment**	**Busbar compartment**
1 – Busbar bushing (adapter)		2 – Observation window (see clause 3.2 below)	
3 – Siring pole module		4 – Circuit branch	
5 – Current transformer		6 – Power cable	
7 – Voltage transformer (optional)		8 – Internal arc pressure relief cover / cooler	
9 – Disconnector operating mechanism		10 – Circuit-breaker operating mechanism	
11 – Surge arrester (optional)			

3.2 TECHNICAL SUMMARY

MSS-H indoor metal-enclosed switchgear is currently available in a single-busbar configuration. Single-busbar switchgear has proven to provide the most economical solution for the majority of users. It is currently type tested up to 31.5 kA and 2500 A.

Rated Voltage	12 kV
Rated power frequency withstand voltage	42 kV, 60 s
Rated lightning impulse withstand voltage	95 kV
Rated normal current	1250 A / 2500 A / 3150 A (standard design) 4000 A (with forced cooling)
Rated short-circuit current	31.5 kA (I_k), 4 sec (t_k) / 2 sec (t_{ke}) 40 kA available on request
Loss of Service Continuity Class	LSC2 (Fixed pattern switchgear with only one accessible high-voltage compartment for the cable connections)
Partition Class	PM (Metallic Partitions)
International Protection (IP)	IP4X (Enclosure) IP2X (between compartments) IP67 (primary circuit: +24hr underwater)
Internal Arc Classification (IAC)	AFLR 31.5 kA 1 sec AFLR 40 kA 1sec available on request
Primary Insulation	Fully screened epoxy-resin (state-of-the-art using graphene nanomaterials to optimise the thermal conductivity and dielectric performance)
Altitude for Rated Operation	≤4000 m AMSL
Temperature Range for Rated Operation	-40 to +60 °C
Safety Interlocks	Mechanical interlocks (IEC 62271-200) Optional electromechanical interlocks to prevent cable or busbar earthing if cable or busbar is alive.
Circuit-breaker Type	Fixed pattern circuit-breaker incorporated in the Siring pole module (motorised/manual)
Circuit-breaker Class	S1, E2, M2 (10 000 operations), C2 (cable and line-charging)
Circuit-breaker Rated Operating Sequence	O – 0,3s – CO – 3m – CO (auto-reclose duty) O – 3m – CO – 3m – CO (non auto-reclose duty)
Circuit-breaker Out-Of-Phase Switching	OP1 & OP2 (7.9kA for 1250 A, 10kA ≥ 2500 A)
Circuit-breaker Interrupting Technology	Vacuum interrupter (AMF contacts)
Circuit-breaker Mechanism	Stored energy operation
Circuit-breaker Energy Storage Device	Spring (manual and electric motor charged)
Disconnector and Earthing Switch Type	Three-position disconnector incorporated in the Siring pole module (motorised/manual)
Cable Earthing Device	Integral earthing via the three-position disconnector and circuit-breaker (incomer & feeder panels)
Busbar Earthing Device	Integral earthing via the three-position disconnector

	and circuit-breaker (bus-section panels)
Earthing Switch Class	E2, M1+ (5000 operations)
Busbar Design and Insulation	Single busbar fully screened epoxy resin insulated
Busbar Configuration	Delta
Busbar Ratings	1250 A / 2500 A / 3150 A (standard design) 4000 A (with forced cooling)
Current Transformer Design	Ring type located around the fully screened primary circuit behind the Type C bushing
Cable Connection Compartment Design	Interlocked hinged compartment door Suitable for "Type 4" terminations (SANS 876)
Cable Connection Interface(s)	Type C (EN 50181 outside cone profile) 1 x 1250 A per phase for 1250 A panels. 2 x 1250 A per phase for 2500 A panels. 3 x 1250 A per phase for 3150 A panels.
Cable Live Indication	Voltage Detection System – VDIS (IEC 62271-213)
Partial Discharge Routine Test Acceptance Level	< 10 pC @ 1,1 x Ur (complete panel)
Specific Creepage	Not applicable (fully screened technology)
Overall Dimensions (W×D×H) (mm) (bottom entry)	500 × 1400 × 2200 (630/1250 A panel) 700 × 1400× 2200 (2000/2500 A panel) 1000 × 1400× 2200 (3150 A panel)
Overall Dimensions (W×D×H) (mm) (top entry)	500 × 1600 × 2200 (630/1250 A panel) 700 × 1600 × 2200 (2000/2500 A panel) 1000 × 1600 × 2200 (3150 A panel)
Performance in severe service conditions with respect to condensation and pollution	Full dielectric type testing under C_H (frequent / heavy) condensation conditions (IEC 62271-304)
Auxiliary and Control Voltages	110/220 V AC/DC
Auxiliary and Control Circuit Insulation Withstand	2 kV (1 minute)
Corrosion Protection (enclosure)	Enclosure: AZ150 to SANS ISO 9364 ("Aluzinc®") Covers: Powder coated mild steel Mechanism: Zinc plated and passivated mild steel

3.3 ACCESSIBILITY TO HIGH VOLTAGE COMPARTMENTS

Compartment	Accessibility
Circuit-breaker and disconnector compartment	Tool-based
Busbar compartment	Tool-based
Cable connection compartment	Interlock-controlled

3.4 SIRING POLE MODULE DESIGN AND FEATURES

- circuit-breaker with three-position disconnector and earthing switch module
- fully earth screened single (individual) pole design – eliminates high current phase-to-phase faults and associated internal arc safety hazards.
- state-of-the-art epoxy resin insulated using graphene nanomaterials to optimise the thermal conductivity and dielectric performance
- three-position disconnector design incorporates a longitudinal operating drive spindle that ensures a reliable and precise connection between the fixed and moving contacts while preventing malfunction or incorrect operation
- circuit-breaker design incorporates a stored energy spring operating modularised mechanism with vacuum interrupters
- IP 67 primary circuit is completely encapsulated, maintenance free and can operate in severe environments with respect to humidity and pollution and even under water
- full motorised operation provided as a standard with manual operation as a back-up (ideal for remote operation and SCADA)
- incorporates the observation windows that allow for visible indication of the disconnector (isolation) and earthing positions (see clause 3.5 below).

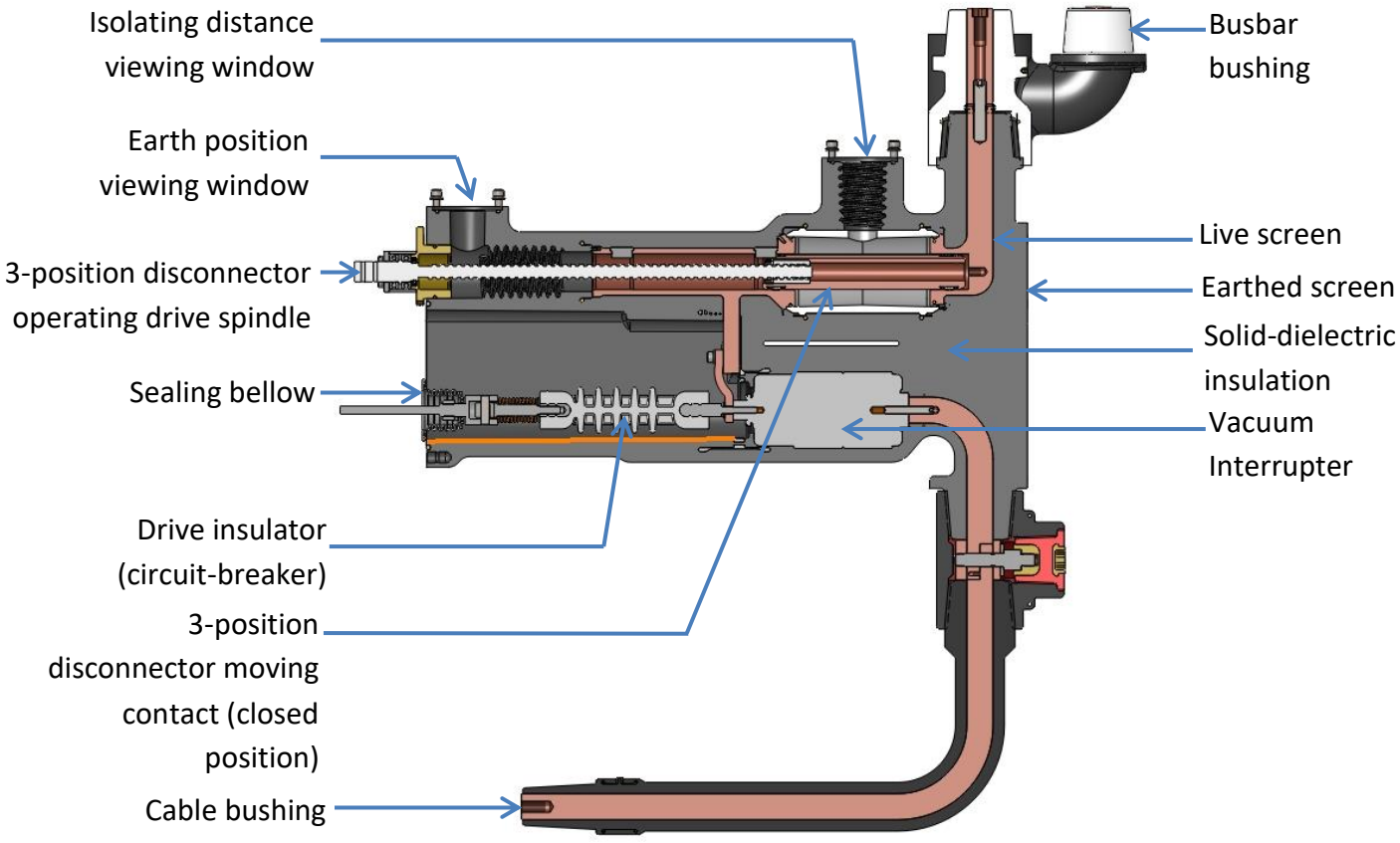


Figure 1 – Siring pole module

3.5 OBSERVATION (VIEWING) WINDOW

The observation window allows for visible indication of the three-position disconnector switch (closed, isolated (open) and earthing positions).

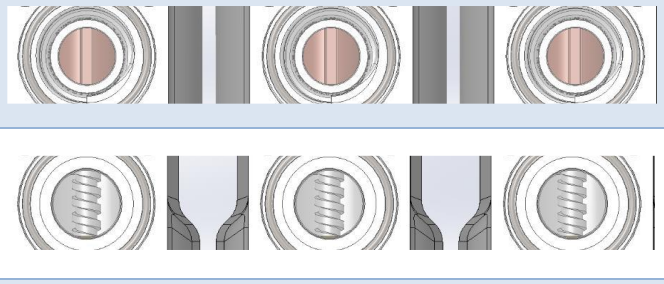
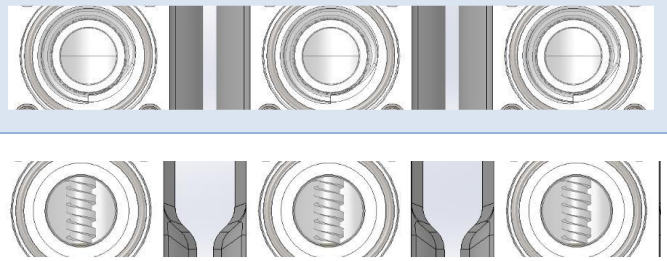
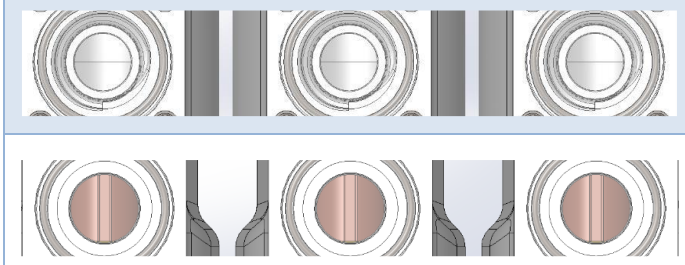
	The three position disconnector switch is in the CLOSED position: The moving contact (red copper) can be seen through the upper viewing window. The threaded operating drive spindle (screw) can be seen through the lower window.
	The three position disconnector switch is in the ISOLATED (OPEN) position: The moving contact can NOT be seen through the upper viewing window (isolating distance). The threaded operating drive spindle (screw) can be seen through the lower window.
	The three position disconnector switch is in the EARTHING position: The moving contact can NOT be seen through the upper viewing window (isolating distance). The moving contact (red copper) can be seen through the lower viewing window.

Figure 2 – Observation window positions

ANNEX A – DOCUMENT REVISION HISTORY

A.1 Revision register

Revision number	Date	Changes made by	Document changes
01/2021	2021-03	RK	Original Issue
Rev 2	2021-03	RK	Updated images and terminology. Improved Figure 2 wording.
Rev 3	2023-02	JJJ	Updated images. Added 3150 A and 4000 A rated options which became available
MSH-TB-001 Rev 0	2024-09	RK	Changed document reference number to MSH-TB-001. Updated ACTOM header format and information.