Saudi Electricity Company	الشركة السعودية للكهرباء

SEC DISTRIBUTION MATERIALS SPECIFICATION	33-SDMS-01
	DATE: 29-06-2004G

33-SDMS-01

SPECIFICATIONS

FOR

MV AUTO RECLOSERS UP TO 36 KV

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1.0 SCOPE

This SEC Distribution Materials Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, inspection, testing and performance of pole mounted electronic type medium voltage line Auto Reclosers, intended to be used in the overhead distribution system of Saudi Electricity Company (SEC) in Saudi Arabia

2.0 CROSS REFERENCES

This material standard specification shall be read in conjunction with SEC Specification No: 01-SDMS-01 (latest revision for "General Requirements for all Equipments/ Materials", which shall be considered as an integral part of this SDMS.
This SDMS shall also be read in conjunction with SEC Purchase Order or Contract Schedules and the Scope of Work and technical Specification for project as applicable.

3.0 APPLICABLE CODES & STANDARDS

The latest revision/amendment of the following codes and standards shall be applicable for the equipment/material covered in this SDMS.

3.1	IEC-60056	High voltage Alternating Current Circuit Breakers.
3.2	IEC-60137	Insulated Bushings for Alternating Voltages above 1000 Volts.
3.3	IEC-60296	Specification for un-used Mineral Insulating Oils for Transformers and Switchgears.
3.4	IEC-60376	Specification and Acceptance of New Sulphur Hexafluoride.
3.5	IEC-60437	Radio Interference Test on High Voltage Insulators.
3.6	ANSI-C37.60	Requirements for overhead, pad mounted, dry vault and submersible Automatic Circuit Re-closers and Fault Interrupters for AC system.
3.7	ISO-2063	Metallic coatings – Protection of iron and steel against corrosion, metal spraying of zinc and aluminum.
3.8	BS-729	Guidelines for Zinc Coating.
3.9	ASTM-123	Standard Specification for Zinc (Hot dip galvanized) coatings of iron and steel.

3.10 ASTM-153 Standard Specification for Zinc Coating (Hot dip) on iron and steel hardware.

4.0 DESIGN & CONSTRUCTION REQUIREMENTS

4.1 Ratings

Ref	Description	Unit	Specified Value	
1	Nominal Voltage	kV	13.8	33
2	Continuous Current Rating	Amps	560	560
3	Max. Symmetrical Interrupting Current	Amps	12000	12000
4	Minimum Phase Trip Rating	Amps	20-1120 (Adjustable)	20- 1120 (Adjustable)
5	Minimum Ground Trip Rating	Amps	10-560 (Adjustable)	10-560 (Adjustable)
6	Sensitive Earth Fault	Amps	2-40 (Adjustable)	2-40 (Adjustable.)
7	Maximum Symm. Interrupting Current	Amp.	12 kA	12kA
8	Minimum Creepage Distance: For Coastal and High Altitude Areas For Dry Areas	 mm mm	 552 345	 1320 825
9	Radio Influence Voltage (max.) for 1 MHZ	μV	500	650

4.2 Performance Characteristics

The mode of operation of the auto reclosers shall be as follows:

4.2.1 The Auto Re-closer shall be capable of performing a sequence of four trips prior to lockout even when the line fault is so close to the station that the station voltage is essentially zero at the instant of the trip.

4.2.2 Means shall be provided to enable the Re-closer to trip for the first or second time under fast operation and for the second or third and fourth time under delayed openings. The total operations to lock out on phase trip shall be determined by a suitable device. Thus, the Re-closer may lock out on all phase trip operations that reach the lock out setting. The selection of the number of fast trips shall be field adjustable.

4.2.3 If upon the first, second or third reclosing, normal conditions are restored on the line, the Re-closer shall automatically reset at adjustable times and be ready for a complete new sequence of operations. Means shall be provided to lock out the Re-closer after one, two, three of four reset trip operations. The selection of the reset time and the number of trip operations shall be through control unit.

4.3 Adjustments and Settings

4.3.1 One over-current device shall be provided for fault detection in each phase. The over-current device shall have adjustable minimum phase trip-current settings and adjustable time-current characteristics from very inverse to definite time.

4.3.2 Each Auto Re-closer shall be equipped with a means of sensing, and operating on, an earth fault current, which may be lower than the minimum phase tripping current. Adjustable current and definite time settings shall be provided and shall be field selectable.

4.3.3 Provision shall be made to adjust the time interval, between opening and re-closing (dead time), and reset time (reclaim time).

4.4 Operating Mechanism

4.4.1 The operating mechanism should be capable of performing the sequence of opening and closing as specified in this specification. The breaker should also pass the operational tests, which ascertain the capability of the operating mechanisms. Further, the operating mechanism shall be capable:

a) To provide means whereby circuit breaker can be closed rapidly without hesitation at all currents from zero to rated making current capacity.

b) To hold the circuit breaker in closed position by toggles or latches till the tripping signal is received.

c) To allow the circuit breaker to open without delay immediately on receiving tripping signal. To give optimum contact level characteristics (time versus stroke).

d) To perform the auto reclosing cycle.

e) To perform the related functions such as, indication, control, alarm, lock out on low pressure.

f) The mechanism shall be capable to open and close the three phases of the equipment simultaneously.

4.4.2 Auto recloser shall be provided with manual tripping facility and lock out of the Re-closer locally / through operating rods. The automatic re-closing shall be locked out after the manual tripping.

4.4.3 An operation counter shall be provided. It shall be readable locally or at remote end with the re-closer in operation. The operating counter shall be well protected against moisture ingress. The number of operations shall also be readable through the control unit described in clause 4.13.

4.5 Tank

4.5.1 The tank shall be preferably made of stainless steel of minimum thickness 3 mm, strong enough to support the vibration of the Re-closer.

4.5.2 The tank and its accessories shall be adequately protected against corrosion and the supplier shall include a statement of the method of protection proposed.

4.5.3 Hot dip galvanizing is preferred (in case tank is not stainless steel fabricated), otherwise large size tanks shall be sand-blasted and then immediately zinc sprayed to an average weight deposit in accordance with BS-729. This shall be followed by zinc or zinc chromate based primary paint and two coats of durable oil and weather resisting paint shall be applied. The colors of each coat shall be easily distinguishable. The final coat shall be epoxy based. Finish color shall be cement gray RAL-7033, as per Deutsches Institute Normen e.v. Zinc spray shall be in accordance with ISO-2063.

4.5.4 The inside of tanks shall be oil resistant in case of oil as insulating medium to avoid oil contamination.

4.5.5 The tank shall be perfectly sealed and dielectric fluid tight, with all fittings in place. The tank shall be weather proof, sealed and suitable to operate under all operating conditions.

4.5.6 The tank shall be equipped with two brackets each to accommodate three nos. lightning arresters (conforming to 35-SDMS-01 for Surge Arresters) both on

incoming and outgoing side respectively.

4.6 Manual Operating Handle

It shall be possible to open and to lockout the Auto Re-closer manually with operating rod at ground level.

4.7 Indicators

4.4.4 A contact position indication (OFF in green and ON in red), as well as a "locked-out" indicator shall be provided these indicators shall be clearly visible from ground level.

4.4.5 In case SF6 gas is the insulation medium, an appropriate gas pressure indication gauge shall be provided to check the pressure conveniently.

4.4.6 Where the Re-closer uses oil, as the insulation medium the tank shall be fitted with a valve for oil draining and sampling. An oil level sight gauge shall also be provided to indicate oil condition and level.

4.8 Pole Mounting Frame

All units shall be supplied with a galvanized steel mounting frame with adjustable pole clearance suitable for SEC standard octagonal steel pole. Appropriate clamping ring shall be provided for recloser and control unit to secure the unit with a pole without using bolts through the octagonal steel pole.

4.9 Lifting Lugs

Lifting lugs shall be provided such that the auto recloser can be lifted with a single hook without damage.

4.10 Grounding Terminal

All units shall be provided with an appropriate ground terminal.

4.11 Bushings

The Auto Re-closers shall be fitted with Porcelain or Polymer bushings conforming to latest respective International Standards and compatible with SEC service conditions and system parameters. The bushings shall be provided with anti bird devices / caps. The bushings shall be terminated by flat pad terminals to accept vertical connection with ACSR Conductor size 70 mm² to 170 mm².

4.12 Interrupting Medium & Insulation

The current interrupting medium shall be vacuum or SF6 and insulation medium shall be SF6 or oil.

4.13 Auto Recloser Control Unit

4.13.1 The auto recloser shall be electronic controlled. It shall have separate control cabinet, the control cabinet shall be suitable to be fixed on a SEC standard octagonal steel pole at a lower level than the recloser, by means of adjustable pole clamping ring. Suitable control cable with minimum 10-meter length shall be supplied for connection of control unit to auto recloser. The cabinet shall be tropicalized to withstand the severity of whether in coastal as well as hot inland areas of K.S.A as per specification 01-SDMS-01. All fittings required for mounting shall be supplied. All operating parameters of the Re-closer i.e; minimum trip current, time-current trip characteristics, reclosing reset times, and operating sequences, shall be controlled from the control cabinet locally as well as remote end. Communication interface facility shall be provided for local control and future automation.

4.13.2 The electronic control unit shall have below mentioned salient features:

- LCD with high degree of resolution and legibility, valid for life span of auto re-closer.
- Well-protected keypad, easy to operate with easy legibility.
- Non-volatile memory with enough capacity capable to record at least 150 events including distinction between local and supervisory functions and reporting of system events and display 30 different events with date and time.
- Chargeable battery with life span not less than 5 years.
- The charging unit for the battery capable to work at 110 Volts and 231 volts (phase to ground voltage)
- WSOS (windows switchgear operating system) programmability and downloading facility locally and at remote end.
- Capability to withstand lightning surges effecting through respective LT line.
- Protection class IP-54.
- Communication interface facility
- Open to all kinds of communication protocols.
- Sensing VTs or any suitable aid for loop automation

- All the programming and protection function selection shall be password protected.
- It shall be possible to enable or disable the individual protection function / elements.
- Ratings shall be clearly marked in relevant units of measure with no interpretation multipliers or conversion being required.
- Local control for Trip / Close through push buttons
- Fault status indication

4.14 Protection Characteristics

4.14.1 The ratio of drop off current to pick up current shall be at least 95 % for all protection functions.

4.14.2 The Earth Fault (E/F) and Sensitive Earth Fault (SEF) function shall be provided with harmonic filter /Inrush current restraint to prevent operation when harmonics are present in the primary residual earth currents.

4.14.3 All protection function i.e: over-current (O/C), E/F and SEF shall have elements with characteristics that comply with relevant ANSI standards or IEC 60255.

4.14.4 Delayed protection operation shall be possible by selecting by selecting an IDMTL protection element with normal inverse (NI), very inverse (VI) or extremely inverse (EI) curve.

4.14.5 The sequence of trip and auto reclose characteristics for O/C, E/F and SEF shall be programmable to enable the selection of any combination of the available elements for each trip in the trip-and-reclose sequence.

4.14.6 In case of Inverse Definite Minimum Time Lag (IDMTL) protection element, the auto recloser (A/R) shall be provided with adequate reset timer that stimulates the resetting function of an upstream relay. The length of time delay shall be settable so as to stimulate the upstream device.

4.14.7 A zone sequence coordination (ZSC) feature shall be provided to ensure trip close sequence co-ordination for combinations of rapid and delayed protection operations applied to series auto reclosers. (ZSC) function shall be such that:

i. An AR senses the presence of an over-current or earth fault as well as

clearance of the fault by an other device and proceeds to an other protection operation in its own sequence; and

ii. It proceeds in its sequence of rapid protection operation only allowing the full number of operations to be executed for in- zone conditions.

4.14.8 Loss Of Phase (LOP) protection shall be provided to ensure the protection functionality of AR as under:

i. AR should trip to lockout in case there is loss of voltage on one or two phases on the upstream part of line.

ii. Facility to turn LOP ON or OFF without effecting other protection function of the device.

iii. The information about LOP operation in case of the protection trip shall be recorded accordingly with indication of phase(s) causing the trip of AR. The information about LOP operation shall be easily accessible.

4.14.9 Directional blocking shall be provided to ensure the protection functionality of AR as specified below:

i. AR and control element shall be capable to detect the direction of the fault current. Minimum time to determine fault current for O/C and E/F shall be not greater than 50 m sec. For SEF the time to determinate the fault direction shall not be greater than 1 sec.

ii. Configuration for directional blocking shall include the separate settings for characteristic angles for O/C and E/F elements.

iii. The directional blocking shall have the facilities to configure AR automatically to trip or block for upstream and down stream faults. This shall be configured separately for O/C .E/F and SEF.

iv. The information about directional blocking operation in case of protection trip shall be recorded accordingly in memory.

4.15 Auto Recloser Operation Parameters

4.15.1 The number of sequential trips to reach lockout shall be selectable to be either 1, 2, 3 or 4.

4.15.2 Reset times shall ideally be separately selectable for SEF and the combination of over-current and earth fault functions. The reset time shall be selectable from 0.5 sec to 180 sec.

4.15.3 Dead times shall ideally be separately selectable for SEF and the combination of over-current and earth fault functions. The dead time shall be selectable from 0.1 to 180 s for the first and second sequence and from 0.5 to 180 seconds for subsequent re-closer sequences.

4.15.4 A close instruction initiated locally or remotely during a dead time shall result in lockout if the fault is still persistent up to closure.

4.16 Measurement Functions

4.15.1. Below mentioned quantities shall be calculated/ measured.

a) r.m.s phase to phase and phase to neutral voltage of all three phase.
b) r.m.s current per phase
c) Three phase active power in kW
d) Three phase reactive power in kVAR
e) Total three phase active energy in kWh
f) Power factor
g) Maximum demand

4.15.2. AR and control element shall have the facility to record the number and time of outages. The information shall be accessible locally or remotely. The following parameters shall be recorded:

a) Cumulative total number of outages
b) Cumulative total outage duration
c) Time and duration of each outage

4.17 Voltage Transformer

A Power Voltage Transformer (VT, conforming to International Standards and to be installed outside the recloser), with respective MV rating and preferably dual LV rating of 127V, 231V (phase--neutral) or 220V—380V (phase – phase), as auxiliary source of supply shall be supplied with Auto Re-closers and its cost shall be included in the respective bid price.

4.18 Current Transformer

Measuring and Protection Current Transformers shall conform to SEC Specification 50-SDMS-01

4.19 Name Plate

Each auto recloser shall be fitted with an easily readable nameplate of weather proof material giving the following details marked in English and Arabic:

- Manufacturer Name
- Serial Number
- Rated maximum voltage
- Rated symmetrical interrupting capacity
- Interruption medium
- Insulation Medium
- Rated continuous current
- Rated frequency
- Rated impulse withstand voltage
- Gross weight
- P.O. Number

5.0 TESTING AND INSPECTION

5.1 General

All equipment shall be tested in accordance with the latest relevant standards and as specified in this specification.

5.2 Type Tests

The following tests shall be carried out in accordance with ANSI-C37.60 except for item 5.2.8, which shall be as per IEC-60437.

- Impulse and power frequency voltage withstands tests.
- Interruption tests.
- Operation tests.
- Making current test.
- Minimum tripping current test
- Temperature rise test
- Time current test.
- Radio influence voltage test (IEC-60437).

5.3 Routine Tests

The following routine tests shall be carried out in accordance with ANSI-C37.60.

- Re-closing and over-current trip calibration.
- Control, secondary wiring and accessory device check tests.
- Dielectric withstand test, one minute dry low frequency.
- Mechanical operation test.

5.4 Testing Procedure

The method of test, including test circuit arrangements, shall be in accordance with:

- ANSI-C37.60 and
- IEC-60437.

6.0 PACKING AND SHIPMENT

6.1 The auto reclosers shall be delivered ready for service.

6.2 They shall be packed in sea-worthy non-returnable crates.

6.3 Packing notes shall be included in each crate giving a description of goods packed.

6.4 Packing shall be designed to protect against mechanical damage and ingress of moisture and dust.

6.5 Auto Re-closers shall not be packed in any organic material.

6.6 Electrically conducting components shall be marked conducting, clearly and permanently.

6.7 Components or materials, if subject to a shelf life limitation, shall have the final date of use prominently and permanently shown on all cases.

6.8 Each crate shall be printed with the following information:

(a) Re-closer catalogue number.
(b) Purchaser's order number.
(c) Manufacturer's name.
(d) Year of manufacture.

(e) Gross weight in kilogram.
(f) Position of slinging points and other relevant handling instructions.

7.0 SPARE PARTS

7.1 A comprehensive list of manufacturer's recommended spare parts shall be included in

7.2 The quantities offered should be adequate for the initial five (5) years of operation.

7.3 A firm price and delivery period shall be quoted for each item.

7.4 Spares supplied shall be packed to provide long storage without deterioration. Each package shall be clearly marked and labeled in Arabic and English with the description of its contents.

7.5 If any spare part requires special storage conditions, these conditions shall be detailed.

8.0 GUARANTEE

The supplier shall guarantee the reclosers against all defects arising out of faulty design, faulty workmanship or of defective material for a period of two (2) years from the date of delivery.

9.0 TRAINING

The supplier shall provide at site training, regarding programming and commissioning for an adequate period, to be agreed by the SEC and the supplier after supply of the auto reclosers.

10.0 SUBMITTALS

10.1 Submittals Required With Tender

The Bidder shall submit the following along with the Tender.

a) The Bidder shall complete and return one copy of Technical Data Schedule.

b) Type test reports complete as per clause 5.2.

c) The Bidder shall also provide original catalogs giving details of the equipment being offered along with accessories available and the maintenance requirements.

d) The manufacturer / vender shall clearly state and give a list of clause by clause acceptance /deviations or exceptions in respect of this specification.

e) SEC reserves the right to reject any or all of the exceptions / deviations without assigning the reasons.

10.2 Submittals Required Following Award of Contract

The following submittals shall be provided by the supplier including the Award of Contract:

a) Details of manufacturing and test schedule.

b) Factory test reports.

c) Detailed installation and commissioning and maintenance instructions.

d) Literature, drawings and photographs adequate to explain in detail the functioning of the Auto Recloser.

10.3 Details of Drawings Required:

The following drawings shall be provided with the tender:

a) Detailed dimension drawings.

b) Time-current characteristics of Auto Reclosers for ratings being offered.

c) Mounting details for pole mounted units (Auto Recloser and Control).

11.0 DATA SCHEDULE

MV AUTORECLOSERS UPTO 36 kV

SEC Inquiry No: _____ Item No: _____

(Sheet 1 of 5)

REF. SEC.	DESCRIPTION	SEC SPECIFIED VALUE / REQUIREMENTS		VENDOR OFFER VALUE
4.0	**DESIGN AND CONSTRUCTION REQUIREMENTS**			
4.1	Ratings:			
	Nominal System Voltage	13.8 kV	33 kV	
	Maximum Operating Voltage (Nominal)	15.2 kV	36 kV	
	Continuous Current Rating	560 Amp.	560 Amp.	
	B.I.L. (kV)	95, 110	170, 200	
	Minimum Trip Rating	20- 1120 Amps (Adjustable)	20- 1120 Amps (Adjustable)	
	Minimum Ground Fault Setting	10-560 Amps (Adjustable)	10-560 Amps (Adjustable)	
	Minimum SEF Setting	2-40 Amp	2Amp-40 Amp	
	Minimum Sym. Interrupting Current	12 kA	12 kA	
	Short time Current for 3 seconds	12 kA	12 kA	
	Minimum Fault Making Current	12 kA	12 kA	
	One Minute Withstand Voltage Dry	50 kV	80 kV	
	One Minute Withstand Voltage Wet	50 kV	80 kV	
	Creepage length of Bushings: - For Coastal and High Altitude Areas - For Dry Areas	 552 mm 345 mm	 1320mm 825 mm	
	Radio Influence Voltage (μV)	500	650	
4.5	Tank Material	Stainless		
4.6	Manual Operating Handle	Required		
4.7	Contact Position Indicator SF6 Gas Pressure Indicator	Required Required		
4.8	Pole Mounting Frame	Required for steel octagonal poles		
4.9	Lifting Lugs	Required		
4.10	Grounding Terminal	Required		
4.11	Bushings	Porcelain / Polymer		

11.0 DATA SCHEDULE

MV AUTORECLOSERS UPTO 36 kV

SEC Inquiry No: _____ Item No: _____

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4.12	Current Interrupting Medium Insulating Medium	SF6/ Vacuum Oil / SF6	
4.13	Recloser control Unit Battery (Type and Life) LCD Legibility /Expected Life Degree of Protection Type of Communication port Connection Interface Loop Automation	Conforming to specs. To be mentioned by bidder -do- -do- -do- -do- Required	
4.14	Protection Characteristics	Conforming to specs	
4.15	**OPERATION PARAMETERS PROTECTION SETTINGS RANGE**		
	Variable Trip Time Settings (Over current Fault Current)		
	Trip seq. no	**SEC specified Trip time range**	**Offered Trip Time range**
	1	.05--180 sec.	...sec…sec.
	2	.05--180 sec.	...sec…sec.
	3	.05--180 sec.	...sec…sec.
	4	.05--180 sec.	...sec…sec.
	Variable Re-Closing Time Settings (Over Current fault)		
	Trip seq. no	**SEC specified time range**	**Offered Time range**
	1	0.1--180 sec.	...sec…sec.
	2	0.1--180 sec.	...sec…sec.
	3	0.5--180 sec.	...sec…sec.
	4	0.5--180 sec.	...sec…sec.

11.0 DATA SCHEDULE

MV AUTORECLOSERS UPTO 36 kV

SEC Inquiry No: _____ Item No: _____

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4.15	**Variable Trip Time Settings (Earth Fault)**		
	Trip sequence no.	SEC specified time range	Offered Time range
	1	0.1--180 sec.	...sec…sec.
	2	0.1--180 sec.	...sec…sec.
	3	0.5--180 sec.	...sec…sec.
	4	0.5--180 sec.	...sec…sec.

	Variable Reclose Time Settings (Earth Fault)		
	Trip sequence no.	SEC specified time range	Offered Time range
	1	0.1--180 sec.	...sec…sec.
	2	0.1--180 sec.	...sec…sec.
	3	0.5--180 sec.	...sec…sec.
	4	0.5--180 sec.	...sec…sec.

	Variable Trip Time Settings (Sensitive Earth Fault)		
	Trip sequence no.	SEC specified time range	Offered Time range
	1	0.1--180 sec.	...sec…sec.
	2	0.1--180 sec.	...sec…sec.
	3	0.5--180 sec.	...sec…sec.
	4	0.5--180 sec.	...sec…sec.

11.0 DATA SCHEDULE

MV AUTORECLOSERS UPTO 36 kV

SEC Inquiry No: _____ Item No: _____

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	Variable Reclose Time Settings (Sensitive Earth Fault)		
	Trip seq. no	SEC specified time range	Offered Time range
	1	0.1--180 sec.	...sec…sec.
	2	0.1--180 sec.	...sec…sec.
	3	0.5--180 sec.	...sec…sec.
	4	0.5--180 sec.	...sec…sec.

	Re-Setting Time Settings		
SEC specified time range		**Offered Time range**	
0.05--180 sec		Sec - Sec	

4.16	Measurement Functions	As per Specifications		
4.17	i. Current Transformers a-Ratio b-Accuracy class -- (Protection) (Measuring) c- VA burden (to be mentioned by -bidder) ii. Voltage Transformers a-Ratio	 2000/5 5P10 0.5 11,13.8 / 127,230	 2000/5 5P10 0.5 33 /127,220	

5.0	Testing and Inspection	Type test certificates attached	

11.0 DATA SCHEDULE

MV AUTORECLOSERS UPTO 36 kV

SEC Inquiry No: _____ Item No: _____

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A. Additional Technical Information or Features Specified by SEC.

B. Additional Supplementary Data or Features Proposed by Bidder / Vendor / Supplier.

C. Other Particulars to be filled-up by the Bidder / Vendor / Supplier.

D. List of Deviations and Clauses to which exception is taken by the Bidder / Vendor / Supplier. (Use separate sheet, if necessary).

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Name of Company		
Office Address		
Name and Signature of Authorized Representative Date		
Official Seal / Stamp		