023-1 : 2007

CEB
STANDARD

12kV & 36kV SF6 GAS LOAD BREAK SWITCH

CEYLON ELECTRICITY BOARD
SRI LANKA

Specification

for

12kV & 36kV SF6 GAS LOAD BREAK SWITCHES

CEB Standard 023-1 : 2007

CEYLON ELECTRICITY BOARD

No. 50, Sir Chittampalam A. Gardener Mawatha, Colombo 2.
Sri Lanka

Telephone: 94-1-430471, 421720 Facsimile: 94-1-430473
E-mail : cebdp@mega.lk

CONTENTS

SPECIFICATION FOR 12kV AND 36kV SF6 GAS INSULATED LOAD BREAK SWITCH

1.0 SCOPE

This specification covers the general requirement of design, manufacture and testing of Three Phase SF6 Gas Insulated Load Break Switches (herein after called "LBS") for 12kV and 36kV overhead distribution system of the CEB.

2.0 SYSTEM PARAMETERS

(a)	Nominal Voltage	-	11kV	33kV
(b)	System highest voltage	-	12kV	36kV
(c)	System frequency	-	50 Hz.	50 Hz
(d)	Number of phases	-	03	03
(e)	Method of earthing	-	Effectively earthed	Non effectively earthed
(f)	System fault current	-	13.0kA	13.0 kA

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	-	30^0C
(b)	Maximum ambient temperature	-	40^0C
(c)	Temperature rise due to solar absorption of 1200 W/m²	-	10^0C
(d)	Maximum relative humidity	-	90%
(e)	Environmental conditions	-	Humid tropical climate with polluted atmosphere.
(f)	Operational altitude	-	From M.S.L. to 1900M above M.S.L.

4.0 APPLICABLE STANDARDS

The equipment and the components supplied shall generally be in accordance with the standards specified below or later editions and/or amendments thereof.

a)	IEC 60056	-	High Voltage AC Circuit Breakers
b)	IEC 60265-1	-	High Voltage switches
c)	IEC 60298	-	AC metal enclosed switchgear and control gear
d)	IEC 60694	-	Common specifications for HV Switchgear & Control gear
e)	IEC 60815	-	Guide for the selection of insulators in respect of polluted conditions
f)	BSEN ISO 1460:1999	-	Hot dip galvanized coatings on Iron and steel.
g)	IEC 60060-2	-	High-voltage test techniques
h)	IEC 60870-5-101	-	Telecontrol equipment and systems

The requirements stated in this CEB specification supersede the requirements in the above standards.

5.0 BASIC FEATURES

5.1 General

The LBS will be used in overhead distribution lines to isolate sections of the main distribution lines / branches (spurs) of the lines.

The SF6 Gas insulated Three Phase Load Break Switch (LBS) shall be of the three phase Gas Insulated type Load Break Switch suitable for outdoor applications. **Oil insulated type LBS shall not be acceptable**.

5.2 Design

I. The LBS shall be of compact, light weight, maintenance free type that can be easily mounted on single pole / double pole or gantry structures. It shall be tropicalized in accordance with Clause 3.0. Evidence of operational endurance in service, and design features to guarantee maintenance free performance shall be furnished with the offer.

II. LBS shall be complete with operating mechanism and all other components necessary for installation and operation. It shall be

a) able to control (ON/OFF) manually by means of a Hot-Stick
b) able to control (ON/OFF) by means of activating a switch button by an operator which is placed at the LBS mounting poles / structure in an level accessible to operator.
c) able to control remotely, via GSM communication link from CEB Control station. It shall contain Remote / Local / Manual control switch to select the required mode of operation. It shall be complete with a Remote Terminal Unit (RTU) that allows the unit to directly interface at the communication level via GSM link to the CEB Control Station. The communication protocol shall conform to IEC 60870-5-101 or DNP 3.0 or latest versions of them. The interface to the RTU shall be RS232/USB.

   The control software required at the CEB Control Station to operate the LBS, shall also be separately provided with the offer.

d) Upgradeable, when necessary, by adding necessary modules, to operate in conjunction with SCADA system which will be installed in future.

III. LBS shall be able to operate (ON/OFF)

i. by operating with a hot-stick as per clause 5.2 II a)
ii. by activating a switch/button as per clause 5.2 II b)
iii. via remote GSM link as per clause 5.2 II c)
iv. even when HV (33kV or 11kV) line is de-energized from both load side as well as source side and when no external supply is available. In such a situation, LBS shall be able to carry out at least 8 nos. operations (ON or OFF) by activating the control push button as per ii above or by remote operation as per iii

above, within 48 hour period.

The battery, charging and other control circuitry shall be an integral part of the LBS. Battery shall be sealed maintenance free rechargeable type having a minimum service life time of 5 years or 2000 On/OFF operations.

IV. Auxiliary power supply for battery charging for above III shall be 230V, 50 Hz Single phase. This power supply shall be derived from the Medium Voltage supply (11kV or 33 kV as applicable) lines and the required supply transformer shall be provided.

V. Each LBS shall have its own self contained operating mechanism and self supporting control unit with software as applicable. All components that might be adversely affected by water and / or dust shall be housed in lockable cabinets having a degree of protection to IP54. Anti condensation heaters or equivalent means to eliminate the formation of condensation shall be included as required.

VI. The source side and the load side of the LBS shall be interchangeable. Provision of Surge arrester mounting brackets on either side is preferable.

VII. All three poles of the LBS shall be operated simultaneously by the operating mechanism.

VIII. A mechanical position indicator shall be provided to indicate the ON/OFF position of the LBS. This indicator shall be light reflecting mechanical ON/OFF position indicator, with which the position of the switch can be clearly seen from the ground even under bad weather conditions.

IX. All non metal parts including insulating materials of cables shall be able to withstand effects due to ultra violet radiation.

X. An earthing terminal shall be provided for bonding the LBS metal work and mounting frame to the local earthing electrodes / galvanized steel mounting structure. The mounting frame shall have a earthing terminal suitable to accommodate two Nos. 5mm dia. to 15mm dia. earthing conductors. The mounting frame shall be suitable for single pole mounting/double pole structure mounting and steel gantry structure mounting.

XI. A reliable locking device and locking mechanism to lock the switch / operating mechanism in OFF/ON position shall be provided.

5.3 Bushing Insulator

Bushing/housing insulator shall be of the Porcelain or Polymeric type and terminals shall be of the Universal Clamp type to accommodate copper/aluminium conductors of diameter ranging from 12mm to 20 mm.

5.4 SF6 LBS Tank

Tank used to enclose SF6 gas for insulating purposes shall be made of stainless steel and of robust construction based on the design requirements of pressurized enclosures. Tank shall have a degree of protection to IP54.

Tanks exposed to the decomposition products of SF6 gas shall be fitted with appropriate filters sufficient for the life of the equipment. Gas fill valve shall be provided for topping up of the SF6 gas. Provision to prevent explosion during internal arc fault shall be provided. Alternatively, hermetically sealed type tanks are acceptable.

5.5 Insulation and Interrupting Media

i) The insulation media of the LBS shall be SF6 and the interrupter shall be SF6 or Vacuum type. Gas seals shall be designed to prevent the leakage of gas or ingress of moisture throughout the service life.

ii) Following safety requirements shall be incorporated to LBS:

a) Features to ensure the safe release of internal over pressure exceeding the safe design pressure shall be provided.

b) A SF6 gas pressure indicator shall be provided to indicate the gas pressure. The indication shall be visible from the ground. Devices to protect against mal-operations due to insufficient gas pressure shall also be included.

c) An operation counter shall be provided to positively indicate the number of operations of the LBS.

d) It shall be fitted with appropriate filters sufficient for the life of the equipment to minimize the presence of moisture and SF6 decomposition products.

5.6 Technical Requirements

a)	Rated voltage	kV	12	36
b)	Frequency	Hz	50	50
c)	Continuous current rating	A	400	400
d)	Rated Short Circuit Making Current peak	kA	31.5	31.5
e)	Rated Short time current (1 second) RMS	kA	12	16
f)	No. of operations at rated Full Load		300	300
g)	Mechanical endurance (operations)		5000	5000
h)	Fault making Operations	minimum of 5 making operations at the fault making current in Section 5.6 d).		

i)	Rated transformer off load	Equivalent to no load current of a 1250 kVA Transformer		
j)	Rated line charging breaking current	10A		10A
k)	Rated insulation levels			
	1) Lightning Impulse withstand voltage (1.2/50 μs) kV peak dry.			
	Between earth and terminals of switches (of same phase).	kV	75	170
	Across the terminals of open switches.	kV	85	195
	2) 1 min. power frequency withstand voltage wet.			
	Between earth and terminals of switches (of same phase)	kV	28	70
	Across the terminals of open switch.	kV	32	80
l)	Operating mechanism	i. Manual operation by Hot stick ii By activating a local switch by the operator iii Remote operation from CEB master Control Station via communication with GSM link		
m)	Gas pressure monitoring	shall be provided		
n)	Trip Counter	shall be provided		

5.7 Galvanizing

i) All iron and steel parts (except stainless steel parts) such as mounting and support brackets, bolts and nuts ,washers etc. shall be galvanized after the process such as sawing, shearing, drilling, punching, filling, bending and machining are completed.

ii) Galvanizing shall be of the hot-dip process to comply with the relevant standard specified.

5.8 Routine Test

The following routine test shall be carried out on all equipment as per IEC 60265-1.

i) Power frequency voltage withstand tests on the main circuit
ii) Measurements of resistance of the main circuit

Gas leakage check shall be carried out as per relevant standard.

5.9 Type Test

The following Certificates of type tests shall be carried out by an independent testing laboratory, in accordance with the IEC 60265-1; The copies of the type-test reports, certified as true copies by the Bidder, shall be forwarded with the offer.

i) Lighting impulse withstand voltage test
ii) Power frequency (wet) withstand voltage test
iii) Temperature rise test.
iv) Making and breaking test for specified currents.
v) Short time withstand current test.
vi) Peak withstand current test.
vii) Measurements of resistance of the main circuit

6.0 QUALITY ASSURANCE

The manufacturer shall process ISO 9001 quality assurance certification for the manufacture of Gas Insulated SF6 Circuit Breakers for the plant where the manufacture of the Load Break Switches is done.

The Bidder shall furnish a copy of the ISO certificate along with the offer. This document shall be certified as a true copy of the original by the bidder.

7.0 ADDITIONAL REQUIREMENTS

7.1 Manufacturer's Experience

The manufacturer of LBS shall have minimum of 15 years experience in manufacturing SF6 gas insulated switch gear. Documentary evidence to this effect shall be forwarded.

The product offered shall be in service utilities over 5 years. List of purchasers with year and quantity of the product offered shall be furnished.

7.2 Rating Plate Markings

A Stainless steel rating plate shall be provided on the lower part of the tank and shall contain the information according to Table III of IEC 60265-1

7.3 Spares

List of spares necessary for Ten years of trouble free operation shall be furnished with the offer.

8.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be furnished with the offer.

(a) Catalogues describing the equipment and indicating the model No.

(b) Literature describing the operational features of the equipment.

(c) Constructional features, materials used for components and relevant technical literature.

(d) Overall dimensional drawings of the equipment and mounting arrangement.

(e) Drawing of name plate to scale, incorporating the particulars called for.

(f) Quality Assurance Certification Conforming to ISO 9001.

(g) Completed schedule of particulars (Annexure A)
`

(h) Documentary evidence shall be furnished to prove that the

a. Equipment offered shall have a minimum of 5 years service record **and**
b. The manufacturer shall have 15 years experience in manufacturing SF6 products.

Name of the purchaser, year of purchase and the make / quantity sold shall be indicated.

Test Certificates, based on the type tests conforming to relevant standard shall be supplied along with the offer. The test certificates should clearly identify the equipment concerned, showing the manufacturer's identity, type number and basic technical parameters. The test certificates referred to, shall be issued from an internationally recognized independent testing authority acceptable to the Purchaser. Failure to furnish the particulars requested in Clause 8 shall result in the offer being rejected.

9.0 INSPECTION AND TESTING

9.1 Inspection

The selected Bidder shall make necessary arrangements for inspection by an Engineer appointed by the Purchaser and to carry out in his presence Acceptance/Sample tests on equipment offered. Routine test report shall be furnished to the Inspector.

9.2 Acceptance/Sample Test

The following Acceptance/Sample tests as per IEC 60265-1 shall be witnessed by the Purchaser.

i) Dielectric withstand tests. (Lighting impulse withstand voltage test and Power frequency (wet) withstand voltage test)

ii) Mechanical operating tests

iii) Measurements of resistance of the main circuit

10.0 TECHNICAL LITERATURE AND DRAWINGS

i) All relevant drawings, hand-books etc. required for installation, operation (programming), and maintenance of the equipment, shall be supplied with the equipment.

ii) A set of Spare Parts manual and technical details of the equipment and components shall be supplied with the equipment.

iii) These documents constitute apart from the equipment supplied and shall be listed with the equipment supplied to make sure that the documents are shipped along with the equipment.

iv) The information provided should include essential circuit diagrams, general arrangement and detailed drawings of the installation, make mention of special material where used and include schedules of lubricants and all ball and roller races employed on the Plant. The drawings and diagrams, may be reduced to a convenient size, should be bound into the volume and not inserted into cover pockets.

11.0 ANNEXURE

A - Schedule of Particulars - To be filled by the Bidder

ANNEXURE A

GURANTEED SCHEDULE OF PARTICULARS
(To be filled by the Bidder for each type and voltage rating)

			11kV	33kV
1)	Manufacturer's Name and country of origin		-	
2)	Class Designation (Catalogue ref. No.)/Applicable standard		-	
3)	Type			
	a)	Indoor/out door	-	
	b)	Insulation media	-	
	c)	Interrupting media	-	
4)	mounting		-	
5)	Rated Voltage	kV	-	
6)	Continuous current rating	A	-	
7)	Rated frequency	Hz	-	
8)	Type, Size and Material of Terminal Clamps		-	
9)	Temperature rise for			
	a) Contact	°C.	-	
	b) Terminals	°C	-	
10)	Making current	A	-	
11)	Short time current rating (1 Sec.)	kA	-	
12)	Fault making current rating (peak)	kA	-	
13)	Mechanical Endurance (no. of operations)		-	
14)	Service life, No. of opening operations at			
	a)	full rated load	-	
	b)	Half the rated load	-	
15)	No. of fault-making operations		-	

16) Rated insulation level

a) Lightning Impulse withstand voltage (1.2/50 μs) kV peak dry

1. Between earth and terminals of switches (of same phase) kV -
2. Across the terminals of open switches. kV -

b) 1 min. power frequency withstand voltage wet.

1. Between earth and terminals of switches (of same phase) kV -
2. Across the terminals of open switch. kV -

17) Total creepage distance . mm -

18) Galvanizing thickness mm -

19) Whether the Type Test Certificates conforming to Clause 8.0 furnished Yes/no

20) Whether the electronic components used are of tropicalised type Yes/No

21) Whether a mechanical ON/Off position indicator provided Yes/No

22) Whether the LBS operating mechanism be securely locked in On/OFF positions Yes/No

23) Whether operation counter is provided Yes/No

24) Protection category of control cabinet / LBS tank -

25) Whether the LBS can be

a) operated by a Hot-Stick Yes/No
b) operated by activating switched placed at the LBS fixing structure as per clause 5.2 II. b) Yes/No
c) Remotely operated via GSM link as per clause 5.2 II. c) Yes/No
d) upgradable to SCADA compatibility as per clause 5.2 II. d) Yes/No

26) Is control software as per clause 5.2 II. c) provided Yes/No

27) No. of operations LBS can perform without external power supply and when HV line is de-energised -

28) Type of back-up supply of LBS for operations stated in above 27) -

29) Is battery maintenance-free type Yes/No

30) Type of battery and service life-time -

31) Whether the quality assurance certification furnished Yes/No

32) Whether the Specified Type test certificates furnished Yes/No

33) Whether the specified routine tests will be carried out as per IEC 60265-1. Yes/No

34) Whether the specified acceptance tests will be carried out as per IEC 60265-1. Yes/No

35) Does the LBS provide protection against mal-operation when SF6 gas pressure is insufficient Yes/No

36) Whether SF6 gas pressure monitoring / indicator provided Yes/No

.....

Seal and Signature of the Manufacturer and date