MATERIAL SPECIFICATION CELL

TECHNICAL SPECIFICATION
OF

ON LINE

11 KV, 600 KVAR CAPACITOR BANK

ALONG WITH CAPACITOR SWITCH

INDEX

TECHNICAL SPECIFICATION OF

(A) 11KV CAPACITOR BANK

1. SCOPE:

This specification covers 11kV 50Hz pole-mounted automatically switched capacitor installations comprising of

(i)11kV automatic capacitor switches and
(ii)12.65kV capacitor banks of 795 kVAr rating

2. SERVICE CONDITIONS:

The equipment/material offered shall be entirely satisfactory for operation under the conditions indicated below:-

Sr. No.	Particulars	Specified value
1	Maximum Ambient Temperature (Deg. C)	50
2	Minimum Ambient Temperature in shade (Deg. C)	35
3	Relative Humidity (%)	10 to 100
4	Maximum annual rain fall (mm)	1450
5	Maximum wind pressure (Kg/sq.m)	150
6	Maximum Wind velocity	45
7	Isoceraunic level (days/year)	50
8	Maximum altitude above mean sea level meter	1000
9	Seismic level (Horizontal acceleration)	0.3g
10	Moderately hot and humid tropical climate conducive to rust and fungus growth	

3. SYSTEM PARTICULARS:

Sr.No.	Particulars	Specified value
1	Nominal system voltage	11kV
2	Highest system voltage	12kV
3	Frequency	50Hz ±3%
4	Min. Fault level	20 kA for 3 sec.

4. APPLICABLE STANDARDS:

Unless otherwise stipulated in the specification, the 11kV pole mounted switched capacitors shall comply with the latest version of IS:13925 (Part-I) 2012 & IS:13925 (Part-II) 2002 (Shunt Capacitors for Power Systems).

5. TEMPERATURE CATEGORY:

Unless otherwise specified, the capacitors shall be suitable for upper limit of temperature category 50° C as per IS:13925 (Part-I) 2012.

6. RATED OUTPUT:

The standard rated output of a switched capacitor bank shall be 795 kVAr at 12.65 kV rated voltage. The bank shall comprise of 3 single phase units of 265 kVAr each at 7.3kV phase to earth voltage connected in star with floating neutral.

7. PERMISSIBLE OVERLOADS:

The maximum permissible overloads with regard to voltage, current and reactive output shall conform to IS: 13925 (Part-I) 2012.

8. POWER LOSS:

The power loss in capacitors shall not exceed 0.2 Watt/kVAr. (Subject to a tolerance of plus 10%).

9. DISCHARGE DEVICE:

Suitable discharge device shall be connected across the capacitor units in accordance with the provision of IS: 13925 (Part-I) 2012. The discharge device shall reduce the residual voltage from the crest value of the rated voltage to 75V or less within10 minutes after the capacitor is disconnected from the source of supply.

10. EARTH CONNECTION:

The container of each capacitor unit shall be provided with suitable earthing terminal clearly marked as (1).

11. PROTECTIVE FUSES:

The capacitors shall be provided with external fuses. It shall be possible to identify the blown off fuse from outside. The tolerance and the degree of unbalances shall also be indicated as per relevant IS. The manufacturer shall supply a set of external fuses together with fixing accessories and a set of three spare fuse links alongwith the capacitor bank.

12. GENERAL REQUIREMENTS:

The raw material used for capacitor manufacturing i.e. polypropylene film, non PCB non toxic oil and aluminum foil shall be of best quality. Thickness of PP film (both sides hazy) shall be indicated in the technical particulars by weight method. No. of layers of dielectric shall not be less than three. Low loss

capacitors shall be preferred. Offers with less than three layers of dielectric will not be considered. List of sources of raw material shall be enclosed alongwith the offer.

The capacitor elements shall be thoroughly dried & impregnated with an impregnant which had been completely refined & degasified so as not to have any gas or impurities which may cause detioration of the dielectric. The impregnant used shall have low viscosity & high chemical stability. The impregnant should be non-PCB (NPCB).

The containers shall be made from CRCA sheet of thickness not less than 2mm. (14 SWG).

The container shall be hermetically sealed by controlled arc welding process. The metal flanges of the bushing should be soldered/welded to the container and covered with epoxy compound providing a strong hermetical seal to the container.

Suitable mounting brackets, as required by the purchaser shall be welded to the container.

The outside of the container should have smooth and tidy look and should be coated with weather-proof and corrosion-resistant paint of white or light gray shade. The container/enclosure shall be painted with light gray colour, shade 631 as per IS: 5.

The fuses and capacitors cells shall be interchangeable.

The dielectric loss angle (tan delta) shall be less than as per IS: 13925(Part-I) 2012.

13. MARKING:

The capacitor shall be provided with a rating plate and terminal markings as stipulated in IS: 13925 (Part-I) 2012.

14. TESTS:

Routine Tests:

All the individual capacitor units shall be subjected to following routine tests at the manufacturer's works (at the cost of manufacturer) in accordance with IS: 13925 (Part-I) 2012 with latest amendments.

1) Visual inspection
2) Sealing Test
3) Measurement of output and capacitance
4) Insulation resistance between terminals and containers
5) Measurement of the tangent of the loss angle (tan delta) of the capacitor
6) Voltage test between terminals
7) AC Voltage test between terminals and containers
8) Test of internal discharge device

The routine tests at 3 & 4 shall be carried out on the 600 kVAR bank also.

Type Tests

The tests indicated in the IS:13925 (Part-I) 2012 & IS:13925 (Part-II) 2002 with latest amendments shall constitute the type tests. All the type tests as under shall be carried out at the laboratories accredited by National Accreditation Board of Testing and Calibration Laboratories (NABL) in accordance with IS: 13925 (Part-I) 2012 with latest amendments.

a) Thermal stability test
b) Measurement of the tangent of the loss angle (tan delta) of the capacitor at elevated temperature
c) Ac voltage test between terminals and containers
d) Lightning impulse voltage test between terminals and container
d) Short circuit discharge test
e) Endurance Test as per IS:13925 (Part-II) 2002

Acceptance Tests:

The inspecting officer will carry out the acceptance tests as per IS: 13925 (Part-I) 2012 with latest amendments.

15. TYPE TEST REPORTS:

The tenderer shall furnish detailed type test reports of the offered Capacitor Banks for the tests as per relevant IS mentioned in this specification. All these Type Tests shall be carried out at laboratories that are accredited by the National Accreditation Board of Testing and Calibration Laboratories (NABL)of Government of India. These tests should have been carried out within the years as per CEA guidelines prior to the date of opening of the tender i.e. validity of the Type Test reports will be considered as per CEA guidelines.

The detailed type test reports along with the relevant oscillograms/certified drawings, etc. are to be submitted along with the offer.

The purchaser reserve the right to demand repetition of some or all the Type Tests in presence of purchaser's representative at purchaser's cost. For this purpose, the tenderer shall quote unit rates for carrying out each Type Test. However, such unit rates will not be considered for evaluation of the offer. In case the unit fails in the type tests, the complete supply shall be rejected.

The successful tenderer shall take approval from C.E. (Tesing), M.S.E.D.C.L. Prakashgad, Bandra, Mumbai, as per Tender conditions.

Bill of Material enclosed alongwith the tender specification incorporating structure, Lightning Arresters are only indicative and the scope of the supply is already mentioned in this specification.

The equipment offered by the manufacturer shall comply with the general safety regulations.

16. BILL OF MATERIAL:

1) 12.65KV Capacitor Bank (3 x 265 kVAr) - 1 set

2) Expulsion type fuse assembly (3 nos.) consisting of required mounting arrangement & post insulators of approved make - 1 set

3) Structure for capacitor Bank mounting

   1. M.S.Channel 75x40x6 - 600mm. - 2 nos.

   2. M.S.Channel 75x40x6 - 1400mm. - 2 nos.

17. DOCUMENTATION:

i) Type Test reports as per Clause No. 14 of Technical Specification shall be submitted for approval to Chief Engineer (Testing) as per Tender Conditions.

ii) Tender must accompany relevant catalogues and sectional drawing showing necessary details of the equipment offered. One copy of the dimensional drawing and internal construction drawing shall be submitted with the tender. The bidder shall take approval from C.E. (Tesing), M.S.E.D.C.L. Prakashgad, Bandra, Mumbai, as per Tender conditions.

18. INSPECTION:

The inspection may be carried out by the MSEDCL at any stage of manufacture. The successful Tenderer shall grant free access to the MSEDCL's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the MSEDCL, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the MSEDCL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

19. SCHEDULE:

The tenderer shall fill in the following schedules which form part of tender specification & offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

SCHEDULE 'A' – GUARANTEED TECHNICAL PARTICULARS

TECHNICAL SPECIFICATION OF 11KV 600KVAR LINE CAPACITOR BANK

GUARANTEED TECHNICAL PARTICULARS
FOR 11KV CAPACITOR BANK 0.6 MVAR UNIT

Sr. No.	Parameter Name	MSEDCL requirement	Offered by Manufacturer
1.	Name of the Manufacturer & Address	Mfg to give details	Text
2.	Type of capacitor cells	APP Type	Text
3.	Indian Standard according to which the capacitor cells are manufactured & tested	IS- 13925 (Part-I) 2012 & IS-13925 (Part-II) 2002 updated	Text
4.	Name of the insulating materials used in the capacitor cells with class/grade etc.	Mfg to give details	Text
5.	Nominal System Voltage in kV	11kV	Text
6.	Rated Voltage of capacitor cells in kV	7.3kV (P-N)	Text
7.	Rated capacity of single phase capacitor cells at rated Voltage	265 kVAr	Text
8.	Rated Frequency of capacitor cells	50 Hz	Text
9.	Power loss in capacitor	≤0.2 Watt/kVAr	Text
10.	Whether Suitable internal discharge device provided or not	Yes	Text
11.	Whether suitable external earthing terminal provided or not	Yes	Text
12.	Protective Fuses as per Technical specification provided	Yes	Text
13.	Thickness of the CRCA container sheet of capacitor cell	min.2mm	Text
14.	Size of the capacitor cell	Mfg to give details	Text
15.	Net weight of capacitor cell	Mfg to give details	Text
16.	Whether Type test reports as per Technical specification are submitted	Yes	Text

TECHNICAL SPECIFICATION OF

B) 11KV AUTIMATIC CAPACITOR SWITCH

1. SCOPE

This specification covers 11kV 50Hz pole-mounted automatically switched capacitor installations comprising of
(i)11kV automatic capacitor switches and
(ii)12.65kV capacitor banks of 795 kVAr rating

2. SERVICE CONDITIONS

The equipment/material offered shall be entirely satisfactory for operation under the conditions indicated below:-

Sr. No.	Particulars	Specified value
1	Maximum Ambient Temperature (Deg. C)	50
2	Minimum Ambient Temperature in shade (Deg. C)	35
3	Relative Humidity (%)	10 to 100
4	Maximum annual rain fall (mm)	1450
5	Maximum wind pressure (Kg/sq.m)	150
6	Maximum Wind velocity	45
7	Isoceraunic level (days/year)	50
8	Maximum altitude above mean sea level meter	1000
9	Seismic level (Horizontal acceleration)	0.3g
10	Moderately hot and humid tropical climate conducive to rust and fungus growth	

3. SYSTEM PARTICULARS:

Sr. No.	Particulars	Specified value
1	Nominal system voltage	11kV
2	Highest system voltage	12kV
3	Frequency	50Hz ±3%
4	Min. Fault level	12.5 kA for 3 sec.

4. APPLICABLE STANDARD

Unless otherwise stipulated in this specification, the capacitor switch shall comply with the latest version of IEC 62271-103.

5. CONTROL SUPPLY:

The capacitor switch shall be self-powered from 11kV line i.e. no AC or DC control supply shall be required to be provided by the utility for

its operation. The source of control supply [Auxiliary transformer etc.] should work satisfactorily with voltage fluctuations on the 11kV line from +10% to -20%.

6. DESIGN & CONSTRUCTION REQUIREMENTS:

The capacitor switches may be of either single phase or three phase construction as per the standard design of the manufacturer. Preferred switching for single phase construction is as follows :-

In case of single phase construction the switching of capacitor shall be preferably near voltage zero i.e. when system voltage and capacitor voltage is zero.

The capacitor switch shall be suitable for outdoor installation and shall have sealed weather proof type construction.

The capacitor switch shall be provided with a mechanical indicator to show the contact position in the open/closed position. Provision shall also be made for manual closing and opening.

The metallic enclosure of the capacitor switch shall be provided with two earthing terminals (marked with the earth symbol).

The bushings provided on the switch shall be of higher quality porcelain and shall have clamp type of terminals to directly receive aluminum conductors up to 10mm.dia. in both horizontal and vertical directions. The terminal arrangement shall be such as to avoid bimetallic corrosion.

The switch should be provided with suitable structures for mounting the switch and control transformers on the double pole structures.

All nuts, bolts and mounting structures should be hot dip galvanized.

7. CONTROL PARAMETER:

The control parameter for switching operation shall be the line current at the point of installation of the switch. The maximum value of the line current shall be 200A and accordingly, a current transformer of 200/5A ratio shall be supplied along with the switch to monitor the line current in one of the phases for the purpose of control. The control box of the capacitor switch shall have adjustable current setting at which the capacitor bank shall be switched on or switched off.

This adjustment shall be available in continuous variation or in steps not exceeding 5A each over a minimum range of 10-40 Amps. [line current]. The capacitor bank shall be switched off whenever the 11kV line voltage exceed (+) 10%. The measurement of line voltage should be done by the auxiliary transformer as per clause No. 5.

8. MECHANICAL AND ELECTRICAL ENDURANCE:

a) Mechanical Endurance Test:

The switch shall be capable of performing not less than 10,000 mechanical operations.

b) Electrical Endurance Test:

The switch shall be capable of performing successful 10,000 electrical operations at 50A capacitive current.

9. MARKING:

The capacitor switch shall be provided with a name plate legibly and distinctly marked with the following:

a) Name of the manufacturer
b) Type, design and serial number
c) Rated voltage and current
d) Rated frequency
e) Number of poles
f) Rated short time current (symmetrical)
g) Rated making current
h) Rated capacitive switching current

10. TESTS:

The switch shall be subjected to the following tests in accordance with the IEC 62271-103 with latest amendments.

Type Tests:

a) Tests to verify the insulation level, including withstand tests at power frequency voltages on auxiliary equipment.
b) Tests to prove that the temperature rise of any part does not exceed the specified values.
c) Making and breaking tests
d) Tests to prove the capability of the switch to carry the rated short-time current.
e) Tests to prove satisfactory operation and mechanical/ electrical endurance.

Routine Tests:

1)Power Frequency voltage dry test
2)Voltage tests for auxiliary circuits
3)Measurement of the resistance of the main circuits
4)Tests to prove satisfactory operation

11. TYPE TEST REPORTS:

The tenderer shall furnish detailed type test reports of the offered Automatic Capacitor Switches for the tests as per relevant IS mentioned in this specification. All these Type Tests shall be carried out at laboratories that are accredited by the National Accreditation Board of Testing and Calibration Laboratories (NABL) of Government of India. These tests should have been carried out within the years as per CEA guidelines prior to the date of opening of the tender i.e. validity of the Type Test reports will be considered as per CEA guidelines.

The detailed type test reports along with the relevant oscillograms/certified drawings, etc. are to be submitted along with the offer.

The purchaser reserve the right to demand repetition of some or all the Type Tests in presence of purchaser's representative at purchaser's cost. For this purpose, the tenderer shall quote unit rates for carrying out each Type Test. However, such unit rates will not be considered for evaluation of the offer. In case the unit fails in the type tests, the complete supply shall be rejected.

The successful tenderer shall take approval from C.E. (Tesing), M.S.E.D.C.L. Prakashgad, Bandra, Mumbai, as per Tender conditions.

Bill of Material enclosed alongwith the tender specification incorporating structure, Lightning Arresters are only indicative and the scope of the supply is already mentioned in this specification.

The equipment offered by the manufacturer shall comply with the general safety regulations.

12. BILL OF MATERIAL

i.	Capacitor Switch	- 1 no.
ii.	11KV CT for Switch if not built in	- 1 no.
iii.	Control Transformer	- 1 no.
iv.	Control Box for Capacitor Switch	- 1 no.
v.	Control Cables -	As required
vi.	Structure for control transformer mounting on double pole structure	- 1 no.
vii.	Structure for mounting of capacitor switch on double pole structure	- 1 no.

13. DOCUMENTATION:

i) Type Test reports as per Clause No. 10 of Technical Specification shall be submitted for approval to Chief Engineer (Testing) as per Tender Conditions.

ii) Tender must accompany relevant catalogues and sectional drawing

showing necessary details of the equipment offered. One copy of the dimensional drawing and internal construction drawing shall be submitted with the tender. The bidder shall take approval from C.E. (Tesing & QC), M.S.E.D.C.L. Prakashgad, Bandra, Mumbai, as per Tender conditions.

iii) INSPECTION:

The inspection may be carried out by the MSEDCL at any stage of manufacture. The successful Tenderer shall grant free access to the MSEDCL's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the MSEDCL, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the MSEDCL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

iv) SCHEDULE:

The tenderer shall fill in the following schedules which form part of tender specification & offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

SCHEDULE 'A' – GUARANTEED TECHNICAL PARTICULARS

GUARANTEED TECHNICAL PARTICULARS OF 11KV CAPACITOR SWITCH SUITABLE FOR 0.6 MVAR CAPACITOR BANK

Sr. No.	Parameter Name	MSEDCL requirement	Offered by Manufacturer
1.	Name of the Manufacturer & Address	Mfg to give details	Text
2.	Type of capacitor switch	Mfg to give details	Text
3.	Indian Standard according to which the capacitor switch are manufactured & tested	IEC 62271-103 updated	Text
4.	Nominal System Voltage in kV	11kV	Text
5.	Highest System Voltage in kV	12kV	Text
6.	Rated Voltage of capacitor switch	12kV	Text
7.	Rated Current of capacitor switch	200 A	Text
8.	Rated Frequency	50 Hz	Text
9.	Rated short time current Capacity (symmetrical)	10 kA	Text
10.	Rated making current of capacitor switch	25 kA peak	Text
11.	Rated capacitive switching current	200 A	Text
12.	Is capacitor switch self powered from 11kV line	Yes	Text
13.	Name plate details of Auxiliary Control Transformer provided	Mfg to give details	Text
14.	Details of C.T. & P.T. provided	Mfg to give details	Text
15.	Whether On/Off Indicator along with manual On/Off switching arrangement is provided on capacitor switch	Yes	Text
16.	Name plate details & size of Control box	Mfg to give details	Text

17.	Net weight of capacitor switch	Mfg to give details	Text
18.	Structure for mounting Arrangement for capacitor switch,control transformer & control box provided along with drawings etc.	Yes	Text
19.	Whether Type test reports as per Technical specification are submitted	Yes	Text