

SPECIFICATIONS FOR 11 KV, 3000 KVAR HT CAPACITOR BANK WITH
SURGE ARRESTERS, ISOLATORS FOR OUTDOOR USE

PROJECT :

MATERIAL CODE :

DESCRIPTION : DESIGN, ENGINEERING, MANUFACTURE, TESTING,
PACKING AND SUPPLY TO SITE OF 11 KV, 3000 KVAR CAPACITOR
BANK WITH ASSOCIATED EQUIPMENTS VIZ. REACTORS, NEUTRAL
CURRENT TRANSFORMERS, ISOLATORS WITH EARTH SWITCH AND
LIGHTNING ARRESTERS, ASSOCIATED STRUCTURE ETC TO BE
INSTALLED AT BHEL, R.C. PURAM. DETAILED SPECIFICATIONS
ENCLOSED.

QUANTITY REQUIRED : 1 SET.

PROBABLE SUPPLIER :

TOTAL PAGES - SEVEN (1+6).

TECHNICAL SPECIFICATION FOR 11 KV CAPACITOR BANK

SCOPE:

This specification covers procurement of 3 (2+1) MVAR 11 KV Capacitor banks with associated equipment viz., reactors, Neutral current transformers, Isolators with earth switch & lightning arresters, associated structure etc., to be installed in 11 KV Sub-station at BHEL,R.C.Puram.

STANDARDS:

The equipment's shall comply with the latest applicable Indian Standards IEC specification.

Capacitors	:	IS 3725 / Latest IEC 871-2
b) Series Reactor	:	IS 5553
c) Bushings	:	IS 2099
d) Indicating Instruments	:	IS 1248
e) Internal fuse	:	IS 12672 / IEC 593
f) Current transformers	:	IS 2705 / 1964
g) Degree of protection for enclosures of control gear	:	IS 2147
h) Electrical wiring	:	IS 2274
i) Current limiting fuses	:	IS 9385 (Part-I)/1979
j) Lightning arresters	:	IS 3070(Part-I)1985/IEC 99-1/ IEC TC 37 WG-4
k) Isolators	:	IS 1818-1972, IS 9920 (Parts-I-IV) 1985
l) Post Insulators.	:	IS 2544-1973 and IS 5350 (Part -III) 1973

EM PARTICULARS:

a) Nominal System Voltage	:	11 KV
b) Highest System Voltage	:	12 KV
c) Number of Phases	:	3
d) Frequency	:	50 Hz
e) System Grounding	:	Solidly earthed
f) Voltage Variation	:	30% to + 10%
g) Frequency variation	:	4% to + 1%

CAPACITORS:

DESIGN AND STANDARDIZATION:

The capacitor banks shall be suitable for outdoor use, single/two tier steel rack assembly suitable to accommodate all the units of bank with all interconnections of the units fuses and bus bars.

The capacitor units shall be manufactured by adopting latest technology of using dielectric system ~~All~~ propertyline film & _____ the Polypropotyne having higher stability and low loss per KVAR. The impregnant used shall be most suitable for high temperature. The impregnation shall be carried out under high vacuum for increasing dielectric strength. Type of impregnant shall be non-PCB capacitor liquid. The capacitor units shall be hermitically sealed and suitable for operation on 3 phase 11 KV 50 c/s. AC supply. The capacitor elements shall be designed for low working stress per micron to ensure larger life and also a low loss per KVAR.

The 11 KV 3 phase capacitor banks shall have a net output of 3000 KVAR as specified after allowing for the reactors and the units may be conveniently arranged according to the standard practice of the manufacturer and type of protection offered. The switching in and out of the bank shall be by means of vacuum circuit breaker.

5.1 PRINCIPAL PARAMETERES:

- | | |
|--|--|
| a) Nominal system voltage | : 11 KV |
| b) Rated voltage of the capacitor bank KV | : 12.65 |
| c) Rated output of capacitor bank at rated voltage | : 3967.5 (2645+1322.5) KVAR |
| d) Rating of capacitor unit with internal fuses | : 200 KVAR or
Manufacturer's standard |
| e) Connection of capacitor bank | : Double Star with internal fuses/
Manufacturer's standard. |
| f) No. of units/bank | : 15 or manufacturer's standard |
| g) Power loss | : Not to exceed 0.2 watt/KVAR including
Losses in fuses subject to tolerance as
per IS 13925 |
| h) Permissible over loads | : Maximum permissible overloads with
reference to voltage, current and
reactive output shall conform to IS 13925 |
| i) Type of grounding | : Ungrounded |
| j) Capacitor impregnant | : Non toxic (i.e.) Non PCB |
| k) Type of Protection | : Internal fuse |
| l) Type of discharge | : Internally through resistor provided
within the capacitor unit |
| m) Capacity to receive in rush currents | : Not less than 100 time rated current. |

The tenderer shall give calculations for rise in voltage in other units in the event of failure of element(s) of a capacitor unit. The maximum rise in voltage shall not be more than 10% of rated voltage even if the entire capacitor unit failed/short circuited & relevant calculations in support of this shall also be furnished.

5.2 PHYSICAL ARRANGEMENT OF BANKS:

The tenderers shall state the total number of capacitor units per bank, number of series groups per phase, number of units in parallel groups per phase and enclose the detailed sketches. The tenderer shall furnish the detailed write-up about the construction features and manufacturing process of the capacitor unit detailing the internal arrangements of elements, protective features of element, functioning of discharge device. The physical arrangement of bank with associated equipment viz isolators, lightning arresters, *AS PER STANDARD.*

5.3 LOSSES:

The capacitor shall be of low loss type. The losses in capacitor including the losses in the fuses shall be guaranteed.

For operation in co-ordination with the protection provided, the tenderer should furnish characteristics of the fuses. The calculation for unbalance current on failures of fuse shall also be given. To ensure proper co-ordination of unbalance protection with fuse failure, unbalance characteristics starting from element failure, within an unit shall be furnished by the Bidder.

If the loss figures obtained during testing is more than the guaranteed values, then capacitors are liable to be rejected summarily.

5.4 DISCHARGE DEVICE:

Suitable discharge resistor shall be provided in the capacitor in accordance with provision of IS **13925**

The discharge device shall reduce the residual voltage from the crest value of the rated voltage to 50 volts or less within **10** minutes after the capacitor is disconnected from the source of supply.

5.5 EARTH CONNECTION.

The container of each capacitor unit shall be provided with suitable earthing terminal (marked with the earth symbol).

5.6 GENERAL REQUIREMENTS OF CAPACITOR:

- a) The capacitor shall be of non-PCB type.
- b) The container shall be made from sheet of thickness not less than 1.25 mm.
- c) Complete mounting brackets supporting insulators and all other components for elements for formation of capacitor bank racks shall be supplied along with the capacitor units.
- d) 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.

- e) The outside of the capacitor units and other structures should have smooth and tidy look and should be coated with weather-proof, corrosion resistant epoxy paint of light gray shade, shade No. 631 of IS 5. The structure shall be suitably GI coated.
- f) The capacitor units shall be provided with a rating plate and terminal marking as stipulated in IS 13925
- g) Necessary means shall be provided to discharge the capacitor bank to voltage not exceeding 50 volts in 10 minutes.

5.7 CAPACITOR BANKS WITH DOUBLE STAR FORMATION:

For capacitor banks connected in double star formation (capacitor banks with internal fuses), Neutral current transformer shall be supplied. The neutrals of the two portions of the capacitor bank (connected in double star formation) shall be connected through the neutral current transformer.

The ratio of neutral current transformer shall be selected such that the failure of one unit in any group is detected by an instantaneous current operated relay with setting of 20%. The main technical particulars of the neutral current transformer shall be:

- a) Rated voltage : 12 KV
- b) Reference standard : IS 2705
- c) Ratio : To be specified by tenderer
(secondary should be 1 amp or 5 Amps for full rated current)
- d) Rated burden
 - Core I : 15 VA
 - Core II : 15 VA
- e) Accuracy class
 - Core I : 5 P
 - Core II : 1
- f) Accuracy limit factor
 - Core I : 10
 - Core II : 5
- g) Short time rating : 100 times the primary rated current
- h) Minimum total creepage distance : 300 mm
- i) Basic insulation level : 75 KV peak
- impulse withstand voltage power frequency withstand voltage : 28 KV rms
- j) Test requirements : All routine tests shall be carried out
- k) Instrument security factor : Not more than 3

5.8 PROTECTION ARRANGEMENT:

The capacitors shall be provided with necessary protection devices as detailed below.

5.8.1 FUSES:

Each element of the capacitor unit shall be protected by internal element fuses conforming to IS 12672/IEC 593 which shall be properly designed to cut off the element that may fail due to electrical or mechanical failure.

5.8.2 REACTORS:

The reactor should be air cooled dry type and non magnetically shielded. The reactor shall be with enclosure suitable for outdoor duty having bushings as terminal arrangements.

The series reactor of 0.2% rating shall be connected on neutral end of star section. The reactors shall be suitable to carry 130% or more of the rated current of the capacitor bank.

6. NEUTRAL CURRENT TRANSFORMER:

Unbalance current through Neutral current transformer is required. The current transformers shall have adequate rating and burden for both banks (if required summation CTs also can be used). It shall be of outdoor type as indicated in clause 5.7. ✓

7. LIGHTNING ARRESTORS:

The lightning arrestors shall be of metal oxide, heavy duty type and should have impulse flash over characteristic and other technical parameters as per IS 3070 or any other equivalent international standards.

8. ISOLATORS:

STANDARDS:

12.1 The isolators with supporting structure for two banks of 2645 KVAR & 1322.5 KVAR shall conform to the latest version of IS 1818 IS 9920 (Para-I to IV) and IS 9921 (Part-I to IV or any other International standards.

12.2 The Isolators shall have the following ratings:

a) Rated voltage	: 12 KV
b) Rated impulse withstand voltage	: 75 KV
c) Rated current	: 800A
d) Rated frequency	: 50 Hz
e) Rated short time current	: 20 KA
f) Rated peak short circuit current	: 50 KA
g) Rated max. duration of short circuit	: 1 Sec.

12.3 GENERAL REQUIREMENTS:

- a) Isolator shall be of double break off-load type.
- b) The short circuit withstand capacity of the isolator shall be the same as that of circuit breakers.
- c) The isolator and total structure shall be suitable for outdoor operation with GI coating and will have provision for manual operation.
- d) The isolator shall be provided with earth blade with suitable interlocking arrangement.
- e) Isolator shall have suitable mechanical/electrical inter locking arrangement.

13. TESTS:

Type test certificates of capacitors, capacitor fuses, Neutral current transformers, lightning arresters, isolators etc., shall be submitted by the successful tenderer for approval. The type test for capacitor shall include endurance test as per IEC. Type test for breaker shall include capacity of breaker for capacitor switching.

13.1. ROUTINE TESTS:

- a) Capacitor : Routine tests as per IS 13925.
- b) Measurement of losses of capacitor on 5% of each consignment.

14.0 GUARANTEED TECHNICAL PARTICULARS:

The tenderer shall furnish guaranteed technical particulars as per the annexures enclosed.

15.0 MOUNTING AND INTER CONNECTIONS:

A diagram showing the mounting arrangement for housing the capacitor bank shall be furnished along with the tender. Necessary arrangement shall be provided for connecting the capacitor banks with their associated protection equipment to the bus bars and respective vacuum circuit breaker (Indoor VCB will be ordered separately) . A schematic diagram for the complete capacitor bank with protective and control equipments of the capacitor banks shall also accompany the tender.

The interconnections between the capacitor banks and the all the associated equipment viz., Neutral Current Transformer, Reactors, Lightning Arresters, Isolators etc., shall be provided by the successful bidder. The elevating structures for mounting of the equipment are also to be provided by the bidder. The suitable connectors also shall be supplied along with the equipment.

16.0 DESCRIPTIVE LITERATURE AND DRAWINGS:

All descriptive literatures and drawings connected with the capacitors, controlling breaker, relays, Isolator, Lightning Arresters etc., shall accompany the tender.

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