

**KARNATAKA POWER TRANSMISSION CORPORATION LIMITED**

**SECTION-SURGE ARRESTOR FOR 400KV  
SUB-STATIONS**

## **CONTENTS**

1.0	GENERAL .....	3
2.0	DESIGN FEATURES .....	3
3.0	DUTY REQUIREMENTS.....	6
4.0	TESTS.....	7
5.0	SPARE PARTS AND MAINTENANCE EQUIPMENT:.....	10
6.0	TECHNICAL PARAMETERS .....	10
7.0	PRE-COMMISSIONING TESTS .....	14

## **1.0 GENERAL**

- 1.1 The Surge arresters shall conform to IEC: 60099-4 except to the extent modified in the specification and shall also be in accordance with requirements.
- 1.2 The Surge Arrestors shall be designed for use in the geographic and meteorological conditions at the site of installation.

## **2.0 DESIGN FEATURES**

- 2.1 Surge arresters shall be of the hermetically sealed type. They shall be provided with pressure relief devices and shall be capable of withstanding the internal pressures developed during various discharges or should safely vent the internal pressures associated with arrester failure without violent shattering. Details shall be furnished in the bids along with quality checks.
- 2.2 All metal parts shall be of non-rusting and non-corroding metal. Bolts, screws and pins shall be provided with lock washers, keys or equivalent locking facilities.
- 2.3 The non-linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.
- 2.4 The arresters shall not fail due to arrester insulation contamination.
- 2.5 Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.
- 2.6 Outer insulator shall be Porcelain / Polymer conforming to requirements stipulated in Technical parameters under 6.0. Terminal connectors shall be in accordance with the requirement.
- 2.7 Outer insulator housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrester.
- 2.8 The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.
- 2.9 The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer formed across each block are to be furnished. Metalizing coating thickness for reduced resistance between adjacent discs is to be furnished with additional information schedule of bid proposal sheets along with procedure for checking the same. Details of thermal

stability test for uniform distribution of current on individual disc is to be furnished.

- 2.10 The manufacturer will submit Data for rejection rate of ZnO blocks during manufacturing/operation for the past three years.
- 2.11 The sealing arrangement of the Surge Arrester stacks shall be done incorporating grooved flanges with the O-rings/elliptical cross-section gaskets of Neoprene or Butyl rubber.
- 2.12 The Surge arrester shall have cantilever strength of not less than 500 kg, 350kg for 390kV, 216kV surge arresters respectively or as per the value obtained vide Specifications, whichever is higher.

## **2.13**

### **a) Porcelain Housing:**

- i. All Porcelain housing shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths.
- ii. The Porcelain shall be well vitrified and non-porous.
- iii. The Creepage distance of the arrester housing shall be as per Technical Parameters under 6.0.
- iv. The Porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, Angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc., shall be indicated by the Bidder in his offer in the form, during detailed drawings
- v. The Arrester housing shall conform to the requirements of latest IEC 60099-4 specification. Amended up to date.

### **b) Polymer Housing:**

- i. Polymer housing material shall be silicon rubber. Polymer Rubber housing shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths. Properties of the polymeric materials shall be specified in the offer and test reports for the same from a NABL accredited laboratory shall be submitted for approval of the purchaser. The polymer material which is used for arrester housing must have resistant to tracking & erection, and stabilized against UV radiation.
- ii. The rain sheds/petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted and shall not be pre-molded push on type or slip on type. The adhesion between the polymeric housing and the metal oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous. Tests shall be

carried out on each batch during manufacturing and records maintained and provided as & when required during inspection.

- iii. The Creepage distance of the arrester housing shall be as per Technical Parameters under 6.0.
- iv. The Polymer weather shed design shall be preferably of self-cleaning type (Aerofoil design). The details of the Polymer housing shed profile such as distance, angle of inclination, gap between the shed, diameter (ID and OD) etc. shall be as per relevant standard and shall be indicated by the Bidder in his offer in the form, during detailed drawings.
- v. The Arrester housing shall conform to the requirements of latest IEC 60099-4 specification. Amended up to date.

## **2.14 Fittings & Accessories**

- a) 390kV/216kV Arresters shall be complete with insulating base having provision for bolting to flat surface of structure.
- b) Self contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit along with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of milliammeter and counters shall be visible through an inspection glass panel. The terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. Surge counter shall be provided with a potential free contact rated for 220V DC which shall close whenever a surge is recorded by the surge monitor. Necessary arrangement to be provided for extending the contact information to substation automation system
- c) The connection between lightning arrester earth terminal and discharge counter terminal shall be PVC/XLPE insulated for a minimum of 3.6 kV and this insulated conductor shall be supplied along with the arrester.

Surge monitor consisting of discharge counters and milliammeters should be suitable to be mounted on support structure of the arrester and should be tested for IP66 degree of protection. The standard supporting structure for surge arrester should be provided with a mounting pad, for fixing the surge monitor. The surge monitor should be suitable for mounting on this standard mounting pad. Also all nuts, bolts, washers etc. required for fixing the surge monitor shall have to be supplied by the Contractor.

The arrangement for Surge Monitor enclosure fixing to the structure shall be at its rear/bottom. Connection between the Surge Arrester base and Surge Monitor shall be through stranded copper insulated cable of required length. The copper insulated cable shall be terminated at rear/bottom side

of the Surge Monitor. The gaskets of the surge monitors shall be of Neoprene, Butyl or equivalent material.

- d) Grading/corona rings shall be provided on each complete arrester unit as required. Suitable terminal connectors shall be supplied by the Contractor.

### **2.15 Name Plate**

The name plate shall conform to the requirements of IEC incorporating the year of manufacture.

### **3.0 DUTY REQUIREMENTS**

- 3.1 The surge arresters shall be of heavy duty station class and gapless type without any series or shunt gaps.
- 3.2 The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.
- 3.3 420 kV class Surge arresters shall be capable of discharging of severe re-energisation switching surges on a 400 kV, 450 km long line with Surge impedance of 300 ohms and capacitance of 11986 nF/km and over voltage factor of 2.3 p.u.
- 3.4 420 kV class arrester shall be capable of discharging energy equivalent to class 4 as per IEC, for a 420 kV system on two successive operation followed immediately by 50 Hz energisation with a sequential voltage profile as specified below:
- a) 650 kVp for 3 peaks
  - b) 575 kVp for 0.1 Sec
  - c) 550 kVp for 1 second
  - d) 475 kVp for 10 seconds
- 3.5 The surge arresters shall be suitable for withstanding forces as defined in Technical parameters under 6.0.
- 3.6 The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- 3.7 The surge arresters are being provided to protect the following equipment whose insulation levels are indicated in the table given below:-

<b>Equipment to impulse be protected</b>	<b>Lightning Switching</b>		<b>Lightning (kVp) for 245kV system</b>
	<b>impulse (kVp) for 420 kV System</b>	<b>Surge (kVp) for 420 kV system</b>	

Power Transformer	$\pm 1300$	$\pm 1050$	$\pm 950$	
Instrument Transformer	$\pm 1425$	$\pm 1050$	$\pm 1050$	
Reactor	$\pm 1300$	$\pm 1050$	---	
CB/Isolator Phase to ground	$\pm 1425$	$\pm 1050$	$\pm 1050$	
CB/Isolator Across open (-/+240)	$\pm 1425$ (-/+345)	$\pm 900$	$\pm 1200$	contacts

- 3.8 The duty cycle of CB installed in 420/245 kV System of the Purchaser shall be O-0.3 sec-CO-3 min-CO. The Surge Arrester shall be suitable for such circuit breaker duties in the system.

#### 4.0 TESTS

- 4.1 Type tests : Type tested Surge Arrestors shall be offered. The type test reports shall not be older than FIFTEEN (15) years as on the last date of submission of bid.

##### a) For Surge Arrestors manufactured in India:

- The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

##### b) For Surge Arrestors manufactured Abroad:

- Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.

- ii). The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

In case of in-house type tested imported equipment of foreign OEM, the term "Purchasing Utility" covers the foreign Utility who has purchased that equipment.

The surge arresters should have been type tested as per IEC/IS and shall be subjected to routine and acceptance tests in accordance with IEC document. In the switching surge operating duty test, the samples shall be pre-heated to 70 deg. C, (instead of 60 deg. C. as given in IEC) prior to application of long duration surges. For contamination test, procedures outlined in 60099-3 shall be followed.

4.2 Routine tests and acceptance tests as per the applicable standards shall be carried out on the arrester in the presence of Purchaser's representative.

4.3 Certificates of type tests carried out on arresters of similar type shall be furnished with the Bid.

4.4 The test equipment, meters, instruments etc. used for testing shall be calibrated at recognized test laboratories at regular intervals and valid certificates shall be made available to the Purchaser's representatives at the time of testing. The calibrating instruments used as standards shall be traceable to national/international standards.

4.5 The test reports of the type tests and the following additional type tests shall also be submitted for the Purchaser's review.

- i) Radio interference voltage test
- ii) Seismic withstand test.
- iii) Contamination test.
- iv) Accelerated ageing test
- v) Test to verify the power frequency V/s time characteristics
- vi) Temporary over voltage withstand test procedure to be mutually agreed.

**NOTE:**

All type tests on Polymer housing material shall be in accordance with IEC 61462, test reports for the same shall be furnished.

4.1 Each metal oxide block of surge arresters shall be tested for the guaranteed specific energy capability in addition to the routine/acceptance test as per IEC: 60099-4.

(a) Acceptance Tests:



- i) Measurement of power frequency reference voltage of the arrester units.
- ii) Lightning Impulse Residual voltage on arrester units.
- iii) Internal Ionisation or partial Discharge test.

(b) Special Acceptance Test:

- i) Thermal stability test on three sections.
- ii) Ageing & Energy Capability test on blocks (procedure to be mutually agreed).  
Ageing test for Zinc Oxide blocks as acceptance test Is to be carried out on 3 samples for 72 hours at maximum continuous overvoltage (MCOV) and at a temperature of 115°C. Acceptance norms being  $I_r$  (Resistive current) / Watt loss shall remain or decrease at the end of 72 hours from the value taken after one hour of start of test.
- iii) Wattloss test.

(c) Routine Tests:

i) Sealing test:

Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed during assembly of Surge Arrester stacks (followed by other routine tests, i.e. P.D. Measurement, Reference Voltage, Residual Voltage & IR measurement).

- ii) Measurement of reference voltage.
- iii) Residual voltage test of arrester unit.
- iv) Internal Ionisation test or partial discharge test.
- v) Verticality check on completely assembled Surge arresters as a sample test on each lot.

(d) Test on Surge Monitors:

The Surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse withstand tests to verify efficacy of the same. Additional routine/ functional tests with one 100A and 10kA current impulse, (8/20 micro sec.) shall also be performed on the Surge monitor.

Surge monitors shall be routinely tested for water dip test at 1.5m for 30 minutes. No water vapors shall be visible on the monitor glass.

(e) Test on insulators:

All routine tests shall be conducted on the hollow column insulators as per IEC - 62155. The following additional tests shall be carried out on 420 kV and 245kV Insulators:

- i) Ultrasonic test as a routine test.
- ii) Pressure test as a routine test.
- iii) Bending load test in 4 directions at 50% specified bending load as a routine test.
- iv) Bending load test in 4 directions at 100% specified bending load as a sample test on each lot.
- v) Burst pressure test as a sample test on each lot.

## 5.0 SPARE PARTS AND MAINTENANCE EQUIPMENT:

Bidder shall include spare parts and maintenance equipment in the proposal if required.

## 6.0 TECHNICAL PARAMETERS

### **A. 420kV class surge arrester**

A6.0(a)	Rated arrester voltage	390 kV
A6.0(b)	i) Nominal discharge current	10kA of 8/20 microsecond wave.
	ii) Discharge current at which insulation co-ordination will	20kA of 8/20 microsecond wave
A6.0(c)	Minimum discharge capability	8kJ/kV or corresponding to clause-2.0(d) referred to rated arrester voltage and at minimum discharge characteristics whichever is
A6.0(d)	Continuous operating voltage at 50 deg.C	303 kV (rms)

A6.0(e)	(i) Min. switching surge voltage (1kA)	730 kVp residual
	(ii) Max. switching surge voltage (1kA)	780 kVp residual
A6.0(f)	Max. residual voltage at	
	i) 10kA nominal discharge current	900 kVp
	ii) 20kA nominal discharge current	975 kVp
	iii) Steep fronted wave residual voltage at 10 kA	1050 kVp
A6.0(g)	Long duration discharge class	Class IV
A6.0(h)	High current short duration test value (4/10 micro second wave)	100 kAp
A6.0(i)	Current for pressure relief test (kA rms)	40/50/63(as applicable)
A6.0(j)	Low current long duration test value (2400 micro sec)	As per IEC.
A6.0(k)	Prospective symmetrical fault current	40/50/63kA (rms) for 0.2 Sec(as applicable)
A6.0(l)	Insulation Level	
	i) Full wave impulse withstand voltage (1.2/50 micro sec.)	
	1. Arrester Housing (kV peak)	±1425
	ii) Switching impulse withstand voltage (250/2500 micro sec) dry and wet	
	Arrester housing (kV peak)	±1050

	iii) One minute power frequency dry withstand voltage	
	Arrester housing (kV rms)	630
A6.0(m)	Minimum creepage distance (mm)	10500
A6.0 (n)	Cantilever strength (for 1 minute withstand test) (kg)	350
A6.0(o)	Maximum deflection at above cantilever load (mm)	200

**B. 245 kV CLASS SURGE ARRESTER**

B6.0(a)	Rated arrester voltage	216 kV
B6.0(b)	Nominal discharge current	10 kA of 8/20 microsecond wave
B6.0(c)	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.)
B6.0(d)	Continuous operating at 50 deg.C	168 kV rms voltage
B6.0(e)	Max. switching surge voltage (1kA)	500 kVp residual
B6.0(f)	Max. residual voltage at	
	i) 5 kA	560 kVp
	ii) 10 kA nominal discharge current	600 kVp
B6.0(g)	Max. steep current impulse voltage at 10 kA.	650 kVp residual
B6.0(h)	Long duration discharge	3 class
B6.0(i)	High current short test value (4/10 micro second wave)	100 kAp duration
B6.0(j)	Current for pressure test	40 kA rms / 50 kA rms relief (as applicable)
B6.0(k)	Low current long duration value (2400 micro sec)	As per IEC. test

B6.0(l)	Pressure relief class	40 kA / 50 kA (as applicable)
B6.0(m)	Insulation Level	
	i) Full wave impulse withstand voltage (1.2/50 micro sec.)	
	1. Arrester Housing (kV peak)	±1050
	ii) Switching impulse withstand voltage (250/2500 micro sec) dry and wet	
	Arrester housing (kV peak)	-----NA-----
	iii) One minute power frequency dry withstand voltage	
	Arrester housing (kV rms)	460
B6.0(n)	Minimum creepage distance (mm)	6125
B6.0 (o)	Cantilever strength (for 1 minute withstand test) (kg)	150
B6.0(p)	Maximum deflection at above cantilever load (mm)	200

### **C 36 kV and 11 kV CLASS SURGE ARRESTER**

	<b>36 KV</b>	<b>11 kV</b>
C6.0(a)	Rated arrester voltage	30 kV 9 kV
C6.0(b)	Nominal discharge current	---10 kA of 8/20 microsecondwave --
C6.0(c)	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.)
C6.0(d)	Continuous operating voltage at 50 deg.C	25 kV rms 7.2 kV rms

C6.0(e)	Max. switching surge residual voltage (1kA)	72 kVp	22.4 kVp
C6.0(f)	Max. residual voltage at		
	i) 5 kA	85 kVp	26 kVp
	ii) 10 kA nominal discharge current	90 kVp	28 kVp
C6.0(g)	Long duration discharge class	3/2(as applicable)	3/2
C6.0(h)	Pressure relief class	25kA	25 kA
C6.0(l)	Insulation Level		
	i) Full wave impulse withstand voltage (1.2/50 micro sec.)		
	1. Arrester Housing (kV peak)	±170	±75
	ii) Switching impulse withstand voltage (250/2500 micro sec) dry and wet		
	Arrester housing (kV peak)	-----NA-----	
	iii) One minute power frequency dry withstand voltage		
	Arrester housing (kV rms)	70	28
C6.0(m)	Minimum creepage distance (mm)	900	305
C6.0 (n)	Cantilever strength (for 1 minute withstand test) (kg)	150	150
C6.0(o)	Maximum deflection at above cantilever load (mm)	200	200

## **7.0 PRE-COMMISSIONING TESTS**

6.1 An indicative list of tests is given below.

a) Operation check of LA counter.

- b) Insulation resistance measurement
- c) Capacitance and Tan delta measurement of individual stacks.
- d) Third harmonic resistive current measurement (to be conducted energisation) after Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

**INFORMATION/DRAWINGS TO BE SUBMITTED BY VENDOR**  
**FOR APPROVAL AFTER PLACEMENT OF ORDER**

- 1.0 Drawing to be submitted for approval **before 8 weeks after placement of order**
- 1.1 Dimensional drawing of the completely assembled arrester showing plan and elevation views, overall and mounting dimensions.
- 1.2 Clearance diagram for installation.
- 1.3 Dimensional drawing for the line and earth side terminals of the arrester.
- 1.4 Dimensional drawing of the connectors and clamps for line and earth side terminals, if included in the scope.
- 2.0 Power frequency voltage versus time characteristics.
- 3.0 Test Reports for the tests carried out as called for in the specification.



## **ANNEXURE-A CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST**

### **1. General**

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

### **2. Test Levels:**

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

### **3. Test Methods for RIV:**

- 3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.
- 3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.
- 3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.
- 3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 765kV, 400 kV, 220 KV is listed

in the detailed specification together with maximum permissible RIV level in microvolts.

- 3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.
- 3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.
- 4. Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 110% of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

For recording purpose, modern devices utilizing UV recording methods such as image intensifier may also be used.

- 4.1 The test shall be recorded on each photograph. Additional photograph

shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

- 4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.
- 4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.
- 4.4 However, both tests shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.
5. Test Records:  
In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:
  - a) Background noise before and after test.
  - a) Detailed procedure of application of test voltage.
  - c) Measurements of RIV levels expressed in micro volts at each level.
  - d) Results and observations with regard to location and type of interference sources detected at each step.
  - e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.
  - f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

## **ANNEXURE – B: SEISMIC WITHSTAND TEST PROCEDURE**

The seismic withstanding test on the complete equipment shall be carried out alongwith supporting structure.

The Bidder shall arrange to transport the structure from his Contractor's premises/KPTCL sites for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Purchaser. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser.