P.M ENTERPRISE

Manufacturers of Electrical testing equipment and Transformers

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COMPANY INTRODUCTION

Having rich experience in the field of design and manufacture of Current & Potential Transformers and also various Testing Equipments, the Company has developed in-house technology, Successfully designed/produced many products as per requirements of various industries, Electricity Boards as well as indoor and outdoor switchgear industries confirming to Indian and international Standards.

We have entered the Gujarat electrical market with the name P.M ENTERPRISE in 2017 and are looking forward to provide the same quality and efficiency of products in industrial sector and educational sector. The company's primary products are testing equipments like C.T. Testing and P.T. Testing kits, Transformer oil testing kits, Toroidal transformers, Hi-voltage Testers, Relay testing kits, Phantom load test sets, Load analyzers, Special Purpose transformers, Instrument transformers and Meter calibration test benches.

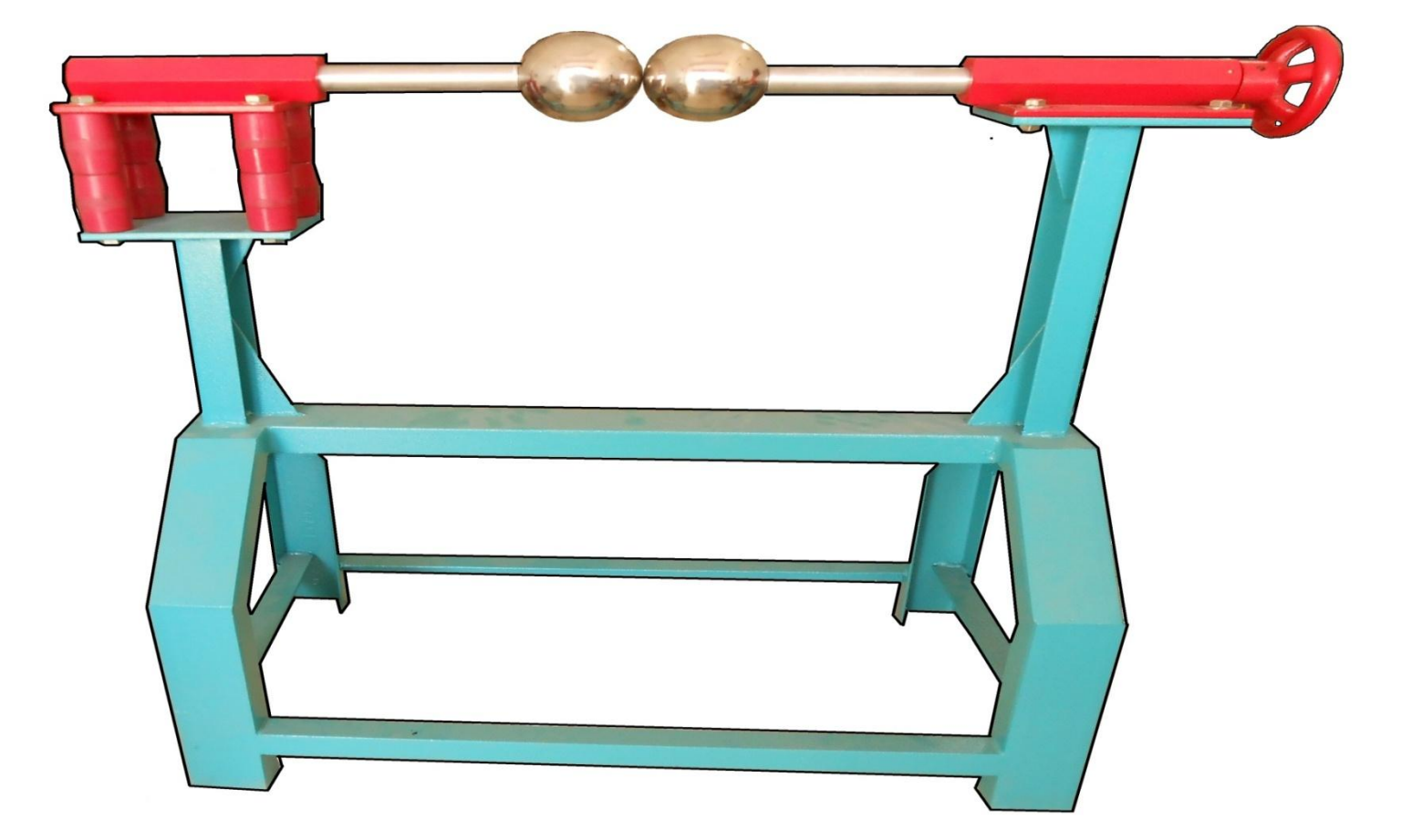
PRODUCT LIST

- Single phase and three phase transformers up-to 25Kva
- Oil Testing Kits
- High Voltage breakdown tester Up-to 100 kV oil Cooled
- Earth resistance meters
- Relay Testing Kits
- Phantom Load test Sets for calibration of Kwh Energy Meters
- DC Series Motors. Shunt Motors with Panels
- Resistive loads 1 Phase and 3 phase (Up to 50Amps)
- Capacitance Loads 1 Phase and 3 phase (Up to 50Amps)
- Inductive Loads 1 Phase and 3 phase (Up to 50Amps)
- Lamp Loads 1 Phase and 3 phase (Up to 50Amps)
- P.T Testing Kits with STD PT
- C.T Testing Kits with Std CT
- Burden Boxes. *(*Loading transformers up to 4000A/5V)

- Multi Ratio CT Desk Top Types
- Potential Transformers Up to 22Kv Desk Top Type
- Choke Coils Variable Type 3 phase and 1 phase up to 50A
- DVDF Tester (Double voltage Double Frequency tester). Details as per requirement.
- Induction Generator.
- Impulse Generator
- Horn Gap
- Corona Cage (With or Without transformer)
- Rod Gap
- Insulation Tester
- AC/DC High voltage tester

5 Kv High voltage tester

SPHERE GAP



SINGLE PHASE ENERGY METER TESTING KIT

PRIMARY INJECTION TEST SET (WITH FUSE TESTING)

(200 A) PRIMARY INJECTION TEST SET

PHASE SHIFTING TRANSFORMER

HORN GAP APPARATUS

CAPACITANCE DIVIDER

TRANSFORMER OIL TESTING KIT

RELAY, ENERGY METER, C.T. TESTING BENCH.

IMPULSE GENERATOR 100 kV 225 J

ELECTRO MECHANICAL RELAY TESTING BENCH

MOTOR PROTECTION RELAY TESTING BENCH

CURRENT TRANSFORMERS

CUSTOMERS

- SWITCHGEAR MANUFACTURERS
- ELECTRICITY BOARDS
- RELAY MANUFACTURERS
- ENERGY METER, P.F. METER, etc MFG COMPANIES
- ENGINEERING COLLEGES
- ELECTRICAL CONTRACTORS
- ELECTRICAL INSTRUMENT DEALERS
- A/C MANUFACTURERS
- STABILIZER, UPS, ONLINE UPS MANUFACTURERS
- MOTOR MANUFACTURERS

CONTACT

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- Phone No: +91 9825568628.

- Website: http://pmenterprises.info/

- Please contact us for any inquiry or a detailed technical offer and quotation for any of the instruments listed above in the PPT and any special requirement.

Thanks.

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PMENTERPRISE

P.M ENTERPRISE

Manufacturers of Electrical Testing Equipments
and Transformers

in this brochure

About P.M

Having rich experience in the field of design and manufacture of Current & Potential Transformers and also various Testing Equipments, the Company has developed in-house technology, Successfully designed/produced many products as per requirements of various industries, Electricity Boards as well as indoor and outdoor switchgear industries confirming to Indian and International Standards.

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AC / DC HIGH VOLTAGE TESTER

Technical details of the instrument transformer are as follows:

Transformer input	**: 230 V A.C. 50 Hz**
Transformer output A.C.	**: 0 – 30 kV A.C.**
Transformer output D.C.	**: 0 – 40 kV D.C.**
Capacity	**: 30 mA**
Cooling:	**: Oil cooled**

Experiment:

The high voltage insulation tester is specially designed to check the insulation of electrical components and equipments as per I.S. Standards.
The insulation testers are available in 0-5kv, 0-10kv, 30Kv, 50Kv and up to 150kv models depending upon the customers requirements.

Basic Components:

1 No Main ON/OFF MCB
1 No AC/DC Voltage selector switch
1 No AC Voltage measuring voltmeter
1 No DC Voltage measuring voltmeter
1 No Leakage current measuring ma meter
1 No Push button switch for energizing the kit
1 No Variac for output voltage variation
1 No Main ON indicator
1 No Variac '0' position indicator
1 No H.T. ON indicator
1 No H.T. OFF indicator
1 No A.C. ON indicator
1 No D.C. ON indicator
1 No Quick action tripping circuit with indicator
1 No Buzzer and specimen failed indicator

CAPACITANCE DIVIDER

Specifications:
Applied Voltage: 100 kV
Ratio: 1: 1000
Output Voltage: 100V AC
Nominal Resistance Value: 150 mOhms

The divider has a large numbers of capacitors connected in series and parallel. The complete set is re-enforced and hermetically sealed in a epoxy fiber insulated glass tube and which is spray painted with anti-tracking paint which is corrosion free and the divider is fitted with castor wheel for easy mobility and the upper terminal of the divider is connected to top metal part and has provision for taking out the terminal for high voltage and grounding. The top portion of the resistance will have anti-corona tourous sheet with suitable HT connection.

Capacitance voltage dividers are ideal for measurement of fast rising voltages and pulses. The capacitance ratio is independent of the frequency, if their leakage resistance is high enough to be neglected. Usually the capacitance dividers are connected to the source voltage through long leads which introduce lead inductances and residual resistance. Also the capacitance used for very high voltage work is not small in dimension and hence cannot be considered as a lumped element.
Therefore the output of the divider for high frequencies and impulses is distorted as in the case of resistance dividers.

CORONA CAGE, 40 kV 100 mA

Basic Components:

1 No 40 kV 100 mA H.V. Transformer oil cooled
1 No H.V. Rectifier unit 50 kV D.C.
(It will be external for use of Polarity change)

Basic Components:

1 No Main ON / OFF MCB
1 No Variac for output voltage variation
1 No Main ON indicator
1 No H.T. OFF indicator
1 No H.T. ON indicator
1 No Output kV meter
1 No Cage & stand (Cage 200 mm diameter and 1000 mm length for clear visualization of the corona)

Experimental Procedure:

The AC source was a generator with maximum output voltage of 50 kV. In the tests an ideal cage made of steel which has a smooth surface is used. The corona cage is 25 cm long and has a diameter of 10 cm. Its thickness is measured as 1 mm. For current measurements a ring is placed on the centre of corona cage. The ring was fit to corona cage and the conductor taken from this ring is connected to a measuring device. Current measurements are done by using an oscilloscope which is connected to cage by the conductors fitted to the cage. To evaluate corona inception voltage, the applied voltage is gradually increased and the lowest voltage at which continuous corona occurs is noted. When measuring corona extinction voltage, applied voltage is raised % 10 up to the voltage level which corona inception voltage is recorded. Then the applied voltage started to decrease until the corona noise can not be heard and the harmonics were started to decline while monitoring from oscilloscope and control unit. One single conductor is used in each experiment for clearance.

ELECTROLYTIC TANK 0 – 30 V AC [5]

Basic Components:

1 No MS Fabricated tank
1 No Variac for output voltage variation
1 No Voltmeter
1 No ON / OFF Switch
1 No Fuse short circuit protection
1 No Double wound transformer
1 No Multimeter
3 Types of Electrodes

Use:

This equipment is used for field plotting by drawing equi-potential lines of different types of mod els supplied with it. The equipment is a pantograph type which makes an integral part of the tank and the base.

The parallel arms of the pantograph can be moved in X and Y directions. The lower arm holds the probe which can be moved between the electrodes, kept in the tank, to locate the equi-potential points. Upper arm has a spring loaded pencil holder and by pressing the top knob of the holder points can be located on the drawing sheet. The necessary power supply and high impedance digital meter is also supplied with the equipment.

HORN GAP [6]

Basic Components:

1 No Center earthed H.V. Transformer 20 kV 100 mA
1 No Main ON / OFF switch
1 No Main ON indicator
1 No Test push button
1 No Fuse for short circuit protection
1 No Electrode and safety panel
1 No Acrylic box for safety

Use:

The equipment continues to operate as long as we press the push button. We see that the spark starts from bottom of the horn, where the gap is minimum but sufficient to cause break down due to the application of 20kV. Now the gap goes on increasing and hence the spark also moves up and the length of the spark also increases as the gap increases and the spark vanishes at the end of the horns. This spark is nothing but corona formation.

How Corona Occurs:

As we apply the high voltage to the horn gap. The spark over or breakdown will occur at the point of minimum gap of the horns. The upper layer of the air will get ionized and its density and resistance will decease. So, the spark will move up progressively as the phenomenon goes on repeating until the corona reaches the peak of the horns.

60 kV TRANSFORMER OIL TESTING KIT

Basic Components:

1 Nos Main On Off switch and one main On indicator
1 Nos Increase Decrease switch
1 Nos H.T On Off push button switch
1 Nos H.T On indicator (1 Nos)
1 Nos H.T Off indicator (1 Nos)
1 Nos K.V. Voltmeter (1 Nos)
1 Nos Motorized Variac (Dimmer) (1 Nos)
1 Nos Center earthed High voltage molded transformer (1 Nos)

Use:

Oil test kits are used to find out the breakdown strength of transformer oil. The equipments are compete in them and supplied with oil cell. The equipments are available in 0-60kv, 0-80kv, and 0-100kv ratings. The equipments are made in manual, motorized or automatic versions.

IMPULSE GENERATOR 150 KV 225J

Introduction: This impulse generator works of the well proven Marx principle. The generator has 5 stages of 150 KV each. Each stage has one capacitor. The rating of each capacitor is 30KV, 0.1 micro fared.

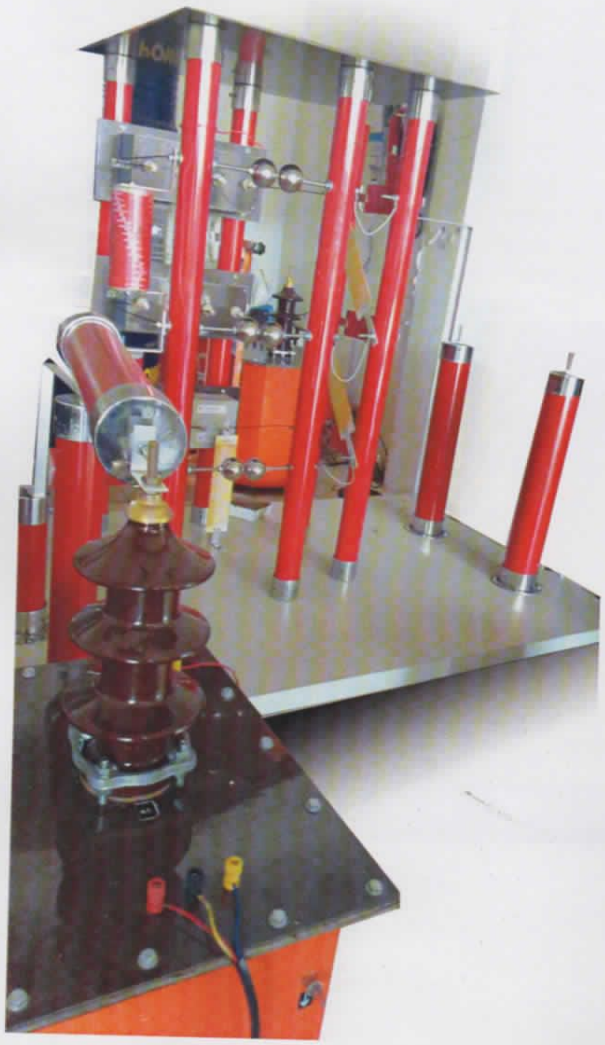
$E = (1/2)\ CV^2$

$= (1/2) \times (0.1/1)\ (30kv)^2$

$= 45$ J/ Stage

Thus total energy of the generator is **225 Joules**.

The control panel supply variable input of 0-230 V which is fed to the primary of the charging transformer rated 230V / 30KV, 100 mA. The output voltage of the transformer is rectified using a high voltage "D" (rated for 1.5A peak forward current and 75 KV PIV). This rectifier voltage charges both the capacitors of each stage through current limiting resistor, for the first stage charging resistance has been taken 500K to make the charging slow for other 4 stages the value of the charging resistors is 15 Kohm per stage. These resistors limit the charging current to a safe value.



Input voltage	0-230 V AC
Generator input voltage	22 to 25 KV (Max) per stage
Energy rating of the generator	225 J
Wave front resistor	30 ohms / stage x 4
Resistance of the L.V. unit of the resistance divider	10 ohms
Resistance divider	10 Kohm
Loading capacitor	21300 pf
Equipotential resistance per stage	100 – 110 Kohm/stage
Divider ratio considering the impedance of the cable	1000
Wave shape	1.2/50 Micro sec
Capacitor	1200 to 200 pf

Test object

The impulse generator is fabricated to deliver the impulse of the 1.2 micro sec rise time and 50 micro sec. fall time.

The generator consists of the following

1. Control panel
2. High voltage transformer
3. Rectifier
4. Bleeding resistor
5. Sphere and capacitor stages
6. Wave front resistors
7. Wave tail resistors
8. Loading capacitor
9. Manual earthing arrangement

Control Panel

The control panel has been made versatile for the ease of operation and taken into consideration the safety factors. The control panel has built in dimmer to feed voltage to the capacitors. Specially made isolation transformer has also been installed inside the control panel to avoid the entry of the unwanted surge to the generator or back to the transformer and hence the safety is ensured.
The panel contains necessary meters, switched and indicators.

A. Meters

Variable Input Voltage: It indicates the variable input voltage to the primary of the charging transformer.
D.C. Charging Voltage: It indicates the charging voltage of each stage.
Current: It indicates the current of the transformer.

B. High voltage transformers

It is an oil cooled step up transformer with one end grounded and the high voltage terminal brought out through the bushing. It is a mobile type transformer having the following specification.

Input voltage:	0-230 V AC
Output voltage:	0-30 KV AC
KVA Rating:	3 KVA

C. Rectifier

The variable output of the transformer is fed to the high voltage rectifier such designed that the PIV of this is 75 KV. The rectifier is mounted on a mobile base with insulating supports. Changing the position of the rectifier manually changes the polarity of the voltage.

D. Bleeding Resistors

A bleeding resistor is connected to the control panel meter to read the charging voltage of each stage. It is calibrated in such a way that 1Ma current flows in it when 30KV us applied. The bleeding resistor has been designed in such a way that it contains high voltage resistors in series.

E. Spheres and Capacitors

Each stage of impulse generator has a set of capacitor and spheres. The capacitor is impulse type, hermetically sealed and they have the minimum inductance to ensure better wave shape. Each capacitor is rated for 30KV, 0.1 Mfd. The sphere of the generator diameter is 62.5.

F. Wave front resistor

They are made of high quality resistance wire. The resistor are wound in such a way that they are non-inductive and can withstand the energy dissipated by the stage capacitor. The value of the resistor is 30 ohms per stage and the external resistor is also a part of the wave front resistor and its value is also ohms. The resistor controls the wave front time to 1.2 microseconds + or -20%.

G.Wave Tail Resistors

Similarly wave tail resistors are made and fixed at a proper as indicated in the figure. The resistors have the value of 1.1 Kohms per stage. The resistor divider has a shield L.V. Unit of 10 Ohms. Considering the impendence of the cable etc. the ratio of the divider is 1000. As per standards wave tail can be 50 micro seconds + or – 30% micro sec.

H. Loading capacitor

It is a high voltage loading capacitor and also forms a part of the impulse generator. It is made using high voltage capacitor in series and the value of capacitor is 3000 pf and it is rated for 200 Kv impulse applications. The entire assembly is mounted and housed in a fiber glass tube and these capacitors are immersed in oil for better cooling.

(Continued...)

IMPULSE GENERATOR 150 KV 225J[10]

Operation

1. Check all the connections and grounding properly.
2. Open the emergency switch on the control panel.
3. Bringing dimmer to "0" position and press the "MAINS ON" button.
4. Set the gap of sphere by the sphere gap.
5. Select the polarity with the help of polarity switch and press the "H.T. ON" as a result H.T. on indicator will glow.
6. Charge the capacitor little than the required level by increasing the input voltage with the help of DIMMER manually.
7. After testing press the EMERGENCY SWITCH and ground all capacitors with the help of earthing rods.

The value of external is 10 ohms and it works as resistor divider to control the wave tail. It is a part of the wave tail resistor distributed inside the generator.

Precaution

1. Charging voltage should never exceed more than 25 Kv
2. After testing various parts of the generator specially capacitor and load capacitor, they must be grounded manually also.
3. Make sure the micro-switch of the door is properly closed otherwise the H.T. will not work.

HIGH VOLTAGE INSULATIONITESTING OF ELECTRICAL APPARATUS

Technical specsal ·
Input: 230v AC
Output: 30kv
Capacity: 30mA

Instrument transformer spees:
Voltage rating: 30kv
Ampere rating: 30mA
Cooling: Oil cooled

Testing of Insulators, Bushings, Gables and Transformers:
The over voltage tests are classified into two categories: 1> Power frequency voltage tests and 2> Impulse voltage tests. These tests ensure the overvoltage withstand capability of the electrical apparatus.

Testing of insulators:

The tests that are normally conducted are subdivided into two categories as follows:

1. Type tests 2. Routine tests

Type tests are intended to check and prove the design features and the quality. The routine tests are conducted to ensure the quality of an individual test piece. Type tests are done when new designs or design changes are introduced, whereas the routine tests are done to ensure the reliability of the individual test object, and the quality and consistency of the materials used to manufacture them.

Here we will understand how the power frequency tests are undertaken.

1. Dry and wet flashover tests:

In these tests, the AC voltage of power frequency is applied across the insulators and it is increased at a uniform rate of about 2 percent per second of 75% of the estimated test voltage, to such a value that a breakdown occurs along the surface of the insulator. If the test is conducted under normal condition without any rain or precipitation, it is called 'Dry flashover test'. If the test is conducted in rainy conditions it is called 'Wet flashover test'. In general, wet tests are not intended to reproduce the actual operating conditions, but only to provide a criterion based on experience that a satisfactory service operation will be obtained. The test object is subjected to a spray of water of given conductivity by means of nozzles. The spray is arranged such that the water drops fall approximately at the inclination of 45° to the vertical. The test object is sprayed for at least one minute before the voltage application, and the spray is continued during the voltage application. The characteristics of the spray are as below.

> Precipitation rate: **3 ± 10% (mm/min)**
> Direction: **45° to the vertical**
> Conductivity of water: **100 micro Siemens ± 10%**
> Water temperature: **Ambient ± 15°C**

(Continued...)

HIGH VOLTAGE INSULATION TESTING OF ELECTRICAL APPARATUS

2. Wet and dry withstand tests:

In these tests the voltage specified in the relevant specification is applied under dry or wet conditions for a period of one minute with a insulator mounted as in service conditions. The test-piece should withstand the specified voltage.

Testing of bushings:

1. Power frequency tests:

> **Power factor-Voltage test** – In this test, the bushing is set up as in the service or immersed in oil. This connected such that the line conductor goes to the high voltage side and the tank or earthi portion goes to the detector side of the high voltage Schering-bridge. Voltage is applied up-to the line value in increasing steps and then reduced. The capacitance and power factor are recorded at each step. The characteristic of power factor or tan delta versus applied voltage is drawn. This is normal routine test but sometimes may be conducted on percentage basis.

> **Internal or Partial Discharge Test** - This test is intended to find the deterioration or failure due to internal discharges caused in the composite insulation of the bushing. This is done by using internal or partial discharge arrangement. The voltage versus discharge magnitude as well as the quadratic rate, gives an excellent record of the performance of the bushing in service. This is now a routine test for high-voltage bushings.

> **Momentary Withstand Test at Power Frequency** – This is done as per the Indian Standard Specifications, IS: 2099, applied to bushings. The test voltage is specified in the specifications. The bushing has to withstand without flashover or puncture for a minimum time (~ 30 s) to measure the voltage. At present this test is replaced by the impulse withstand test.

> **One Minute Wet Withstand Test at Power Frequency** – The most common and routine tests used for all electrical apparatuses are the one minute wet, and dry voltage withstand tests. In wet test, voltage specified is applied to the bushing mounted as in service with the rain arrangement as described earlier. A properly designed bushing has to withstand the voltage without flashover for one minute. This test really does not give any information for its satisfactory performance in service, while impulse and partial discharge tests give more information.

> **Visible Discharge Test at Power Frequency** – This test is intended for determining whether the bushing is likely to give radio interference in service, when the voltage specified in IS: 2099 is applied. No discharge other than that from the arching horns or grading rings should be visible to the observers in a dark room. The test arrangement is the same as that of the withstand test, but the test is conducted in a dark room.

Testing of cables

Cables are very important electrical apparatus for transmission of electrical energy by underground means. They are also very important means for transmitting voltage signals at high voltages. For power engineers, large power transmission cables are of importance, and hence testing of power cables only is considered here. Of the different electrical and other tests prescribed, the following are important to ensure that cables withstand the most severe conditions that are likely to arise in service.

Different tests on stators may use different test

- Insulation tests like dielectric test, shaking and shrinkage tests. Pre-resistance and corrosion tests.
- Electrical duty tests
- Mechanical tests
- Power frequency withstand voltage tests
- Impulse voltage withstands
- Partial discharge test
- Thermographic tests

test. On the application of high voltage tests are applied. **Appropriate winding samples** for overvoltage and withstand tests, samples have to be carefully selected and temperature withstand resistance test and dielectric test. The temperature of the winding is measured by the thermometer by providing the semiconductor thermometer or temperature resistance test. Insulation withstand test is carried out by applying the test voltage between the winding and the frame.

High voltage tests on stators Dielectric test for withstand voltage between the coil and the frame. In the dielectric test, the stator is tested for withstanding the voltage between the coil and the frame. As a routine test, the stator is tested for withstanding the voltage of 1.5 times the rated value for 1 minute. Insulation resistance test is carried out by applying 1 kV between the coil and the frame for 1 minute and the stator is said to pass the test.

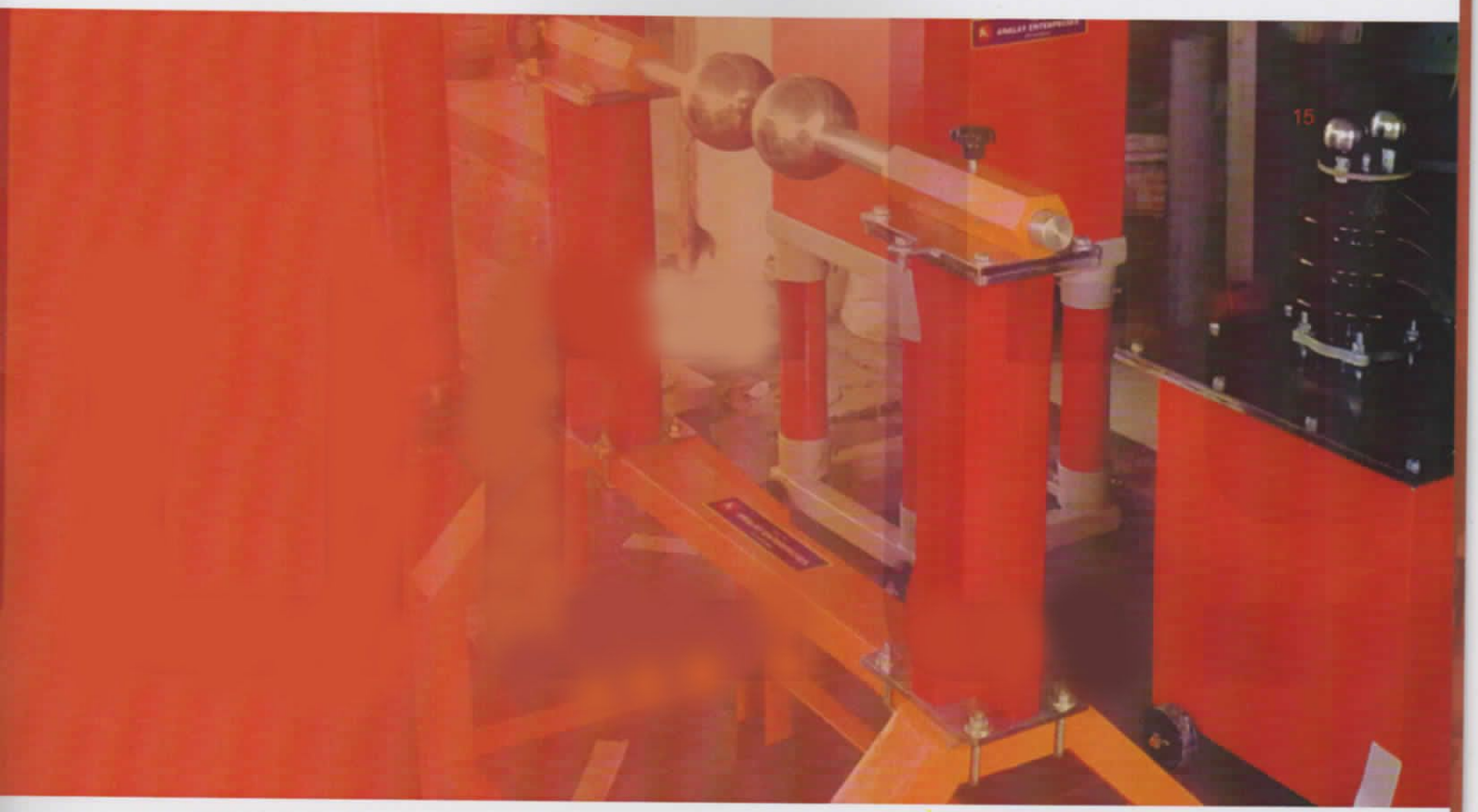
SPHERE GAP (With 60 mm sphere)

Basic Components:

2 No. Sphere 60 mm (Adjustable)
1 No. Nylon rod
1 No MS Fabricated box
1 No Rotation wheel (Hand operated)

Use.

Sphere Gap Assembly is used for measurement of A.C. / D.C. / impulse voltages. It can be of vertical or horizontal type depending on requirements. Micrometer scale is provided to read the gap up to the accuracy of 0.1mm.
Each sphere gap assembly comes with a series water resistor for the protection of spheres against pitting. All the metal parts are hard chrome plated and insulating base support is painted with anti-tracking paints.
Sphere gap assemblies are available in 50mm, 62.5mm, 100mm, 150mm, 250mm and 500mm diameter ratings.



Procedure (Usage):

1. Connect the test gap to the transformer.
2. Adjust the gap distance to an initial value of 10mm.
3. Close the circuit breaker.
4. Slowly raise the till faint hissing audible sound is heard. Note the reading on the Analog Multimeter and actual value from the calibration chart provided. This is the beginning of corona. Hence, the Corona Inception Voltage.
5. Raise the Voltage further till such time there is a faint visible glow at the high voltage electrode. This is the Visible Corona Inception level. Note the value.
6. Then slowly reduce voltage further till such time the hissing sound subside i.e., dies down or becomes extinct. Note this value as Corona Extinction Voltage.
7. Once again raises the voltage till such time there is a Break Down. Note this value as break down Voltage.
8. Reduce the voltage completely and open the circuit breaker.
9. Increase the gap distance by 5mm and repeat steps 3 to 8.
10. Repeat step 9 for 6 (six) different gap distances.
11. Repeat the experiment for test Gap.
12. Correct the observed values for standard atmospheric conditions and plot the gap distance Vs Breakdown voltage for each gap.

Other Products

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- Induction Generator.
- Impulse Generator
- Horn Gap
- Corona Cage (With or Without transformer)
- Rod Gap
- Insulation Tester
- AC/DC High voltage tester

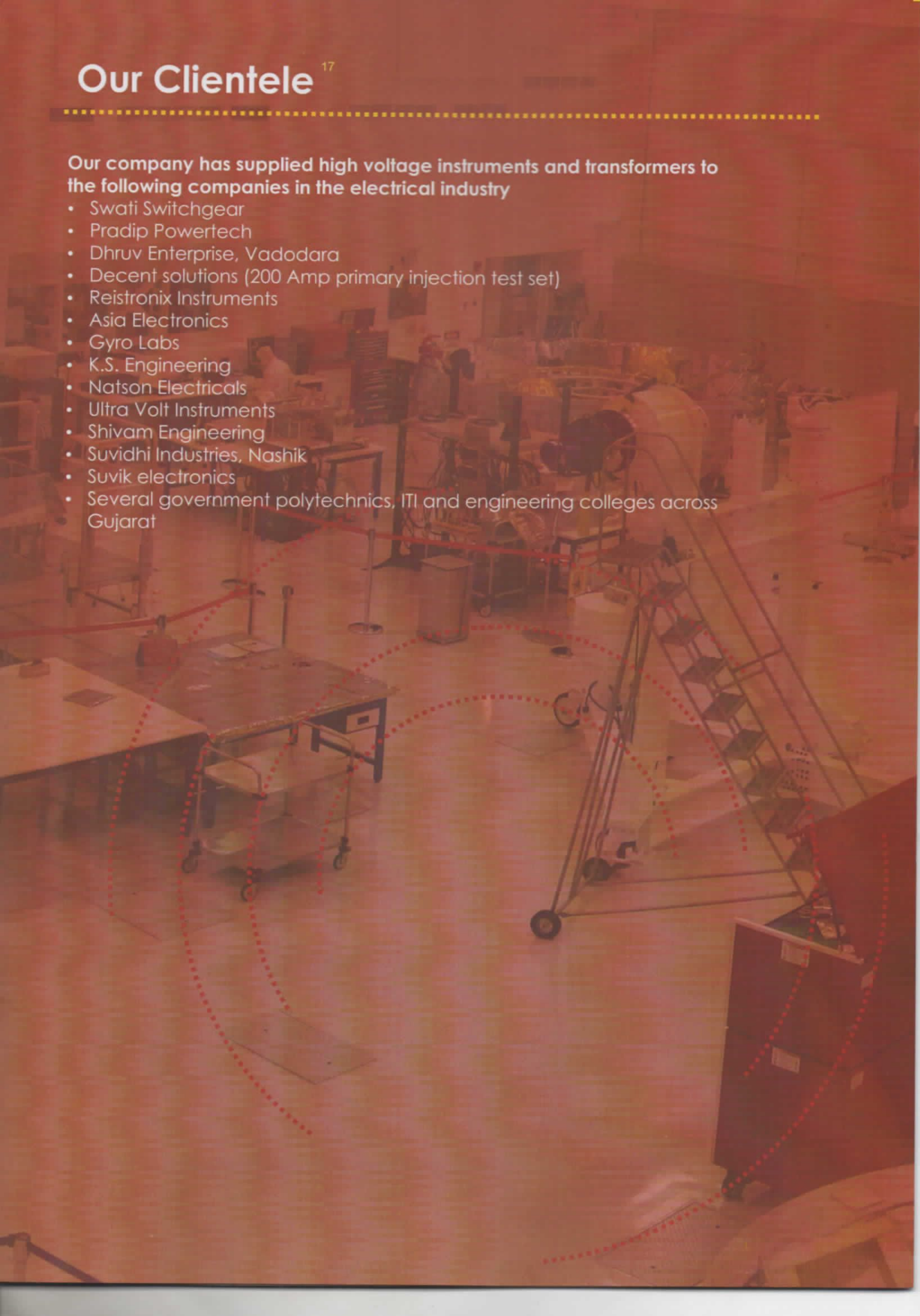
Training Kits

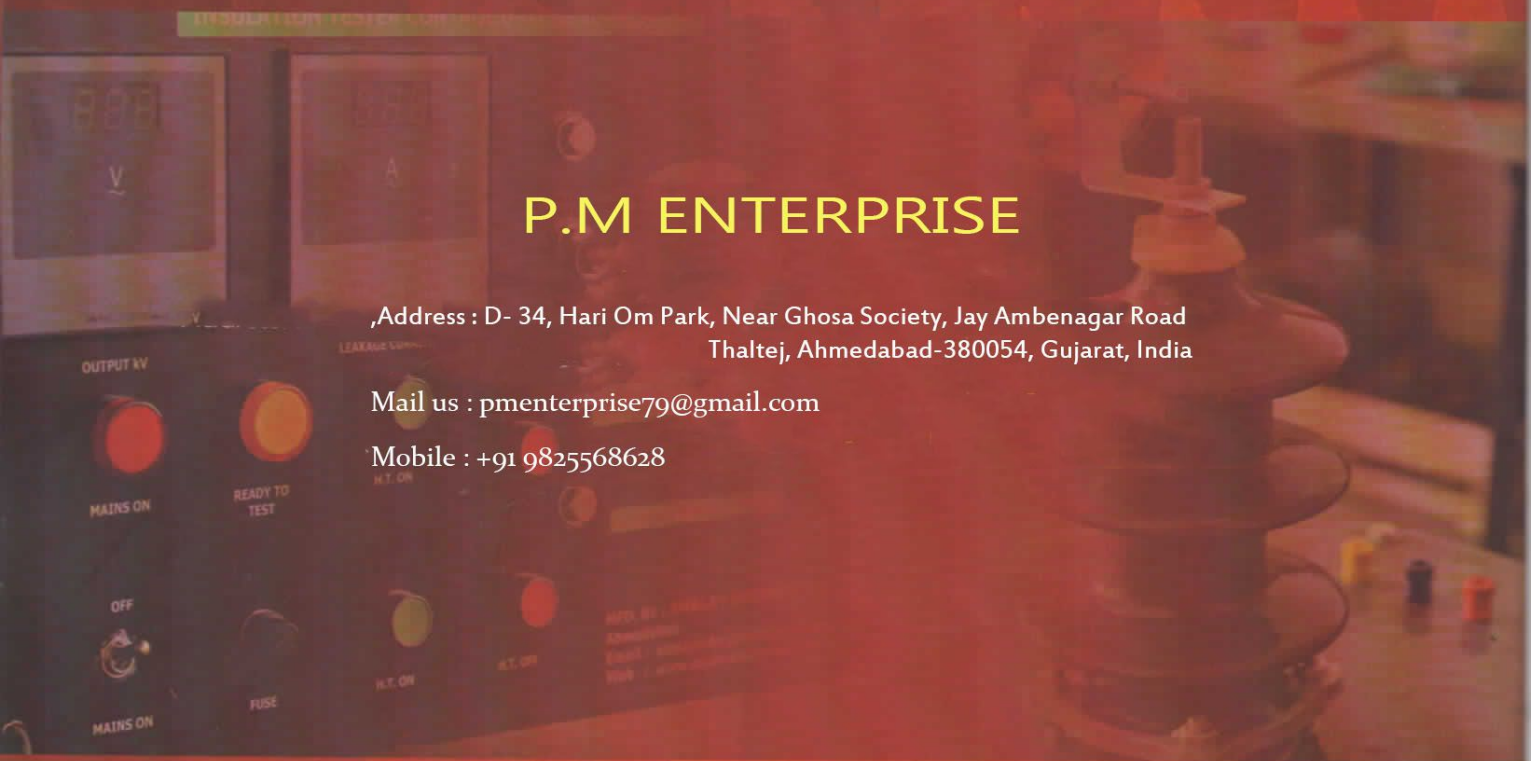
- Trainers as per Different Labs
- Computer & Communication Networks Labs
- Computer Hardware Lab
- Analog Communication Lab
- Digital Communication Lab
- Advanced Digital & Data Communication Lab
- Antenna & Microwaves Lab / High Frequency RF Lab
- Fiber Optic & Laser Communication Lab
- Audio / Sound Engineering Lab
- Video & TV Engineering Lab
- Consumer Electronics Lab
- Power and Industrial Electronics Lab
- Instrumentation & Measurements Lab

Our Clientele

Our company has supplied high voltage instruments and transformers to the following companies in the electrical industry

- Swati Switchgear
- Pradip Powertech
- Dhruv Enterprise, Vadodara
- Decent solutions (200 Amp primary injection test set)
- Reistronix Instruments
- Asia Electronics
- Gyro Labs
- K.S. Engineering
- Natson Electricals
- Ultra Volt Instruments
- Shivam Engineering
- Suvidhi Industries, Nashik
- Suvik electronics
- Several government polytechnics, ITI and engineering colleges across Gujarat





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