केन्द्रीय विद्युत अनुसंधान संस्थान
CENTRAL POWER RESEARCH INSTITUTE
बेंगलूर
BANGALORE
स्थापित 1960 ESTD 1960
CPRI

केन्द्रीय विद्युत अनुसंधान संस्थान

Central Power Research Institute

Ministry of Power, Government of India

Reasearch | Evaluation | Consultancy | Training

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PROFILE

Central Power Research Institute (CPRI) is the knowledge house of the Indian power sector. It is an autonomous institute under the Ministry of Power (MoP). Set up in 1960 by the Government of India, it functions as a centre for applied research in electrical power engineering assisting the electrical industry in product development and quality assurance. CPRI also serves as an independent authority for testing and certification of power equipment. The head office of CPRI is located at Bengaluru and its units are at Bhopal, Hyderabad, Nagpur, Noida, Kolkata, Guwahati, Nasik and an upcoming unit at Raipur.

Activities of CPRI

1. Applied research in electrical power engineering
2. Testing & certification of power equipment
3. Contribution in developing national & international standards
4. Third party inspection and vendor analysis
5. Consultancy and field-engineering services for the power utilities & industry

Accreditations

- ISO/IEC 17025:2017 accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) – traceable to international bodies like International Laboratory Accreditation Co-operation (ILAC) and Asia Pacific Laboratory Accreditation Co-operation (APLAC).
- ISO/IEC 17065 accredited by National Accreditation Board for Certification Bodies (NABCB) for product certification of electrical equipment.
- ISO 9001:2015 certification for research and consultancy activities.
- Bureau of Indian Standards (BIS).

Credentials

- Member - Short Circuit Testing Liaison (STL)
- Corporate Member - DLMS UA (Device Language Message Specification User Association), USA
- Corporate Member - Utility Communication Architecture International User Group (UCA Iug), USA.
- Approved by INMETRO Brazil as a third-party testing laboratory for Brazil Energy Labeling Program on transformers
- Approved by Electricity Water Authority (EWA), Kingdom of Bahrain - Electricity Distribution Directorate (EDD) as an independent testing and certification body.

Research & Development

The institute carries out and promotes applied research leading to technology development in power sector. With the state-of-the-art infrastructure, CPRI has been carrying out applied R&D in the areas of electrical power generation, transmission and distribution in its endeavor to assist the power utilities to supply reliable, uninterrupted, safe and quality power to the consumers at affordable cost.

Testing & Certification

Over the years, CPRI has built vast expertise to cater to the wide range of services required for the power sector in the areas of generation, transmission and distribution under one roof. The state-of-the-art test facilities have been created for:

- EV chargers & batteries
- Cyber Security of IEDs & RTUs
- Advanced Metering Infrastructure (AMI)
- Transformers & switchgears
- Transmission tower & line accessories
- Power cables & capacitors
- Material characterization including CRGO
- Insulators & lightning arresters
- Conductor vibration studies
- Relays, energy meters and smart meters
- Refrigerators and air conditioners
- Domestic appliances including LED and SPV lighting systems
- Seismic qualification of equipment & structures
- Real Time Digital Simulation (RTDS) for power systems studies
- Communication Protocol for power system automation.
- Motors, inverters, solar pumps and other power system equipment

Consultancy

CPRI offers expert consultancy services in the areas of:

- Diagnostics & condition monitoring of substation and power plant equipment
- Failure analysis of substation and power plant equipment
- Evaluation of healthiness of transformers through transformer oil testing
- Power system studies through real time digital simulation (RTDS) and other tools
- Protection audit of generating stations and substations
- RLA and R&M studies of thermal & hydro power plants
- Non-destructive evaluation of thermal power station plant equipment
- Corrosion mapping of water wall tubes of boilers
- Energy efficiency studies through energy audit and fuel audit at thermal power stations
- Power system automation / distribution automation and smart grid etc.

The institute offers third party inspection, vendor analysis and assessment services for utilities. CPRI also undertakes programs of national interest initiated by the Government of India.

Capacity building

CPRI has been in the forefront for disseminating the knowledge assimilated by way of in-house research through organizing technical programmes. Specific training modules are designed to comprehensively address the needs of the power sector utilities for capacity building.

Services for Overseas Customers

CPRI has been catering to the testing requirement of electrical equipment for overseas countries like Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, Sri Lanka, South Korea, Japan, UK etc. CPRI technical services are also being utilized by the utilities and industries from USA, Europe, Australia, New Zealand, Africa, Asia etc.

R & D MANAGEMENT

CPRI plays a pivotal role in advancing research and development in the field of power generation, transmission, and distribution in India. With the State-of-the-art infrastructure, CPRI has been carrying out R&D projects that are crucial for addressing the pressing challenges faced by the Indian power sector. Focused on facilitating clean energy transition, CPRI's research contributions aim towards ensuring reliability, affordability, resilience, and access to energy for the masses. CPRI acts as a hub for fostering innovation by providing a platform for researchers in academia, utilities and industry to explore and nurture their innovative ideas through the “R&D schemes of MoP being implemented through CPRI”. A Center for Collaborative & Advanced Research (CCAR) has been established at CPRI, Bengaluru to foster collaborative research among R & D institutions, industry and academia.

CPRI is also the mission secretariat for the aspirational mission on ‘Advanced and High Impact Research (MAHIR)’ in power sector, a program that envisages end-to-end development of emerging and disruptive technologies for the power sector and implementing those in India and abroad. CPRI also coordinates and monitors the research required to support the Sustainable Agrarian Mission on use of Agri-Residue in Thermal Power Plants (SAMARTH) mission of MoP.

CPRI has established state-of-the-art laboratories and over the years, laboratories have developed expertise and offers research, testing and consultancy in specific focused areas. A brief overview of the facilities is detailed below:

CABLES AND DIAGNOSTICS DIVISION

The Division carries out diagnostic testing & condition assessment studies on high voltage substation & power plant electrical equipment in service, power cables testing and flame-retardant low smoke cables and materials.

A Cables Laboratory

Test Facilities

- Tests on power cables & accessories of voltage rating up to 400 kV
- Pre-qualification tests on EHV cable systems up to 400 kV rating
- Fire reaction tests on electric cables, insulating and composite materials

EHV Cable testing - 600 kV, 2400 kVA Series Resonant Test system

B Diagnostics Laboratory

Consultancy through Field Testing

Condition assessment of HV power equipment like

- Power Transformers
- Hydro and Turbo Generators
- Power Cables
- Large AC Motors
- Current Transformers (CTs)
- Capacitance Voltage Transformers (CVTs)
- Lightning Arresters etc. in service

C Insulation Laboratory

The laboratory has facilities to test solid insulating materials namely – paper, pressboard, insulating mats, epoxy, reinforced fiber, coatings, mica sheets, cable insulations, ceramic and polymeric insulations, clamps and connectors for AB cables, heat shrinkable materials, earth rods and cable clamps.

Test Facilities

- Climatic ageing chamber using Xenon arc and fluorescent lamps to simulate UV radiation
- Corrosion tests using salt spray, Sulphur-dioxide gas
- Environmental condition evaluation.

UV weather-o-meter chamber

Corrosion Chamber

CAPACITORS DIVISION

Test Facilities

- Routine, type and special tests on LV and HV power capacitors
- LV APFC panels up to 500 kVAR, 440V for all tests as per national & international standards.
- Environmental tests on various equipment - electrical, mechanical, automobile, medical, ATMs, etc.

Testing of LV APFC Panel

Testing of HV APFC Panel

Capacitor Testing Facility

DIELECTRIC MATERIALS DIVISION

A Testing Laboratory

The division has expertise with the state-of-the-art facilities to undertake testing of:

(a) Insulating oils
- Mineral Insulating oil
- Synthetic ester oils,
- Natural ester oils,

(b) Lubricating oil
- Hydraulic oils,
- Turbine oils,

(c) Polymeric composites,

(d) Lead content in paints,

(e) Condition assessment of power transformers using oil analysis:
- DGA analysis,
- Furan analysis

(f) Degree of polymerization

(g) Mobile transformer oil test facilities for onsite testing of in-service transformer oils

(h) De-chlorination plant for PCB-contaminated transformer oils.

(i) Referee Coal & Coal ash, biomass samples

GC-ECD

HPLC for Furan analysis

Automatic Bomb Calorimeter

B Test Facilities

- High-Performance Liquid Chromatography (HPLC) for Furan Analysis
- Head Space TOGA Gas Chromatograph with FID & TCD detector for DGA
- GC with ECD & MS for PCB analysis
- Auto-Titrator - Acidity Instrument
- Oxidation stability Instruments for transformer oil samples
- FTIR Spectrophotometer with ATR for oil and polymers
- ICP-OES for lead content in paint samples
- Thermal Conductivity (ISO22007-2) for polymers
- Differential Scanning Calorimetric (DSC) for polymers
- Simultaneous Differential Thermal Analyzer (SDT) for polymers
- Thermomechanical Analyzer (TMA) for polymers
- Proximate Analysis (IM, VM and Ash%) for coal samples

EARTHQUAKE ENGINEERING AND VIBRATION RESEARCH CENTRE

Seismic, shock and vibration qualification of instruments/electrical equipment for power plant and substations.

Test Facilities

- Tri-axial shaker system with six degrees of freedom,
- Table size: 3.0 x 3.0 m, maximum pay load: 10 tons, frequency range: 0.1 to 50 Hz
- Servo hydraulic shaker system: table size: 2 x 2 m,
- Maximum pay load: 2 ton, frequency range: 1 to 250 Hz
- Electro dynamic shaker systems with slip table force rating 25 KN and frequency range 5 to 3500 Hz.
- Climatic chambers: temperature and humidity environmental test facility.

Tri-axial Shaker System

Servo Hydraulic Shaker System

ELECTRICAL APPLIANCES TECHNOLOGY DIVISION

The division has test facilities for refrigerator, air conditioner, ingress protection, fan and battery. The division is playing an important role in check testing of air conditioner, refrigerator, electric fans under the star & labelling (S&L) programme of Govt. of India by supporting BEE towards improvement of energy efficient products.

A Ingress Protection Testing Laboratory

Test Facilities

- Dust Test chamber to accommodate large test sample of sizes up to 4m X 4m X 4m (width, depth, height) for 5X and 6X (category 1 & category 2) tests. The chamber size is 5m X4.5m X 4.5m (width, depth, height).
- Drip tank of size 2m X 2m to perform IP X1 and X2 tests.
- A turn table 2m X 2m with 1rpm, of capacity to withstand weight of test sample up to 15T. The test table also has hydraulic tilt facility for 15° to perform IP X2 test.
- Hassle free electrically operated auto movement test setups to perform IP X3 to IP X6 tests.
- Water tank of size 4m X 4m X 4m (width, depth, deep (height) to immerse the test samples for X7 and X8 water tests.
- IP X9 test facility as per IEC 60529 standard. The facility has test nozzles at 4 positions at different angles. The water with high temperature and pressure will be sprayed over the test object from each nozzle position to verify the water ingress.
- IP test facility to perform tests ranging from IP 11 to IP 69.

B Refrigerator Testing Laboratory

The laboratory has facility to test four refrigerators at one go independently. The lab undertakes testing of domestic type frost free refrigerators, direct cool refrigerators and deep freezers of volume up to 1000 litre as per IS 15750:2006 RA (2017) and IS 1476 (PART-1): 2000 RA (2016) & 7872:2020 respectively and undertakes energy consumption test, pull down test and rated volume measurement test. CPRI is recognized by BEE as the only government check testing laboratory for star and labelling programme.

The facility extended to testing of domestic type frost free refrigerators and direct cool refrigerators as per national and international standards and as per customer requirements

Refrigerators testing in climatic chamber

C Air Conditioner Testing Laboratory

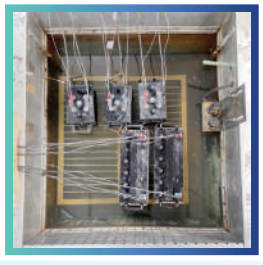
The laboratory has “Balanced Ambient Calorimeter” (BAC) test facility for testing the unitary and split air conditioners for cooling capacity up to 10500 watts. CPRI is recognized by BEE, as the only government check testing laboratory for star and labelling programme, for cooling capacity test, power consumption test and maximum operating condition test as per standard IS 1391 (Part-1): 2023 for unitary air conditioner and IS 1391 (Part-2): 2023 for split air conditioners.

Balanced Ambient Calorimeter (BAC) control panel test facility

D Battery Testing Laboratory

- The laboratory is involved in testing and certification of all types of batteries such as Lead-acid, Lithium-ion and Ni-Cd batteries and battery packs.
- Thirty-six cells and batteries can be tested at a time. Battery or cell up to 18V, 4000 Ah @ C10 & battery pack from 30V to 450V and up to 3000Ah @ C10 can be tested.
- Cells and batteries are tested as per various IS, IEC, JIS standards as well as customer requirements for R&D purpose.
- Besides testing, R&D activities in area of energy storage materials, electrode & device fabrication are also being carried out.

30-450V, 300ALife Cycle tester



Lead-acid batteries under test in temp Controlled water bath.

18V, 100A & 200A Life Cycle Tester

ENERGY EFFICENCY & RENEWABLE ENERGY DIVISION

A Renewable Energy Research and Testing Laboratories

- Solar Photovoltaic (SPV) module test laboratory- SPV modules up to 500 W_p capacity are tested for their 'Design qualification and type approval' and 'safety qualification'.
- Grid-tied inverter test laboratory - largest grid-tied inverter testing facility in the country having testing capacity up to 500 kW.
- LED test laboratory - quality, quantity and safety test facilities as per IES and IS standards for LED lighting to assure the parameters of the product.
- Solar pumping system test laboratory – testing of all types of surface/submersible, AC/DC, shallow/deep well type solar pumps up to 10 HP as per MNRE and IS standards.
- Induction motor test laboratory - Testing 3-phase induction motors up to 55 kW.
- EV Charger Test Station - Testing and research activities of Electric vehicle supply equipment (EVSE) up to a capacity of 50 kW DC / 22 kW AC.
- Photobiological Test Facility for optical sources - India's first and unique laboratory for Photobiological testing and research of lamps and luminaires (optical sources).
- Steady State Solar Radiation Test Facility up to 1000 W/m^2 - The solar radiation test facility can be utilized for exposure to products up to an irradiance level of 1000 W/m^2 and maximum temperature level of 55 °C with maximum test area being 2.5 m (L) X 1.5 m (W) X 2.0 m (H).

Grid Tied Inverter Test Facility

B Consultancy, Training & Third party services

- Energy audit and efficiency study of thermal power stations, hydro power stations, process industries, buildings, ports and commercials establishments.
- Special consultancy services are being rendered for fuel audit study; assessment & fixation of heat rate for regulatory bodies; Ex-bus capacity assessment of power plants; technical minimum study
- Performance evaluation of boilers and combustion systems; steam turbine generators; auxiliaries -pumps, fans, mills, blowers, etc. and associated motors; Heat exchangers - feed water heaters, steam surface condensers, cooling towers as per CTI ATC 105, Utilities - compressed air, water pumping, air conditioning, refrigeration.
- Conducting training programs on energy efficiency, various renewable energy products like solar PV modules, solar inverters, solar water pumping systems, etc.
- Third party testing services for power electronic products like UPS, EV Chargers, Solar inverters, etc. for high power capacities as per customer requirements, standard regulations and guidelines.
- Third party inspection services to renewable energy power plants like solar roof top systems, solar PV power plants, etc.

Gonio- Photometric Test Facility for LED Lighting System

EV charger test facility

Fire test facility for SPV module

Photo-biological test facility

Steady state solar simulator

HIGH POWER LABORATORY

High Power Laboratory (HPL) houses 2500MVA short circuit generator, short circuit testing transformers and auxiliaries. This provides a direct three phase testing facility of 2500MVA capacity and single-phase testing facility of 1400 MVA capacity.

2500MVA Short circuit generator

Test Facilities

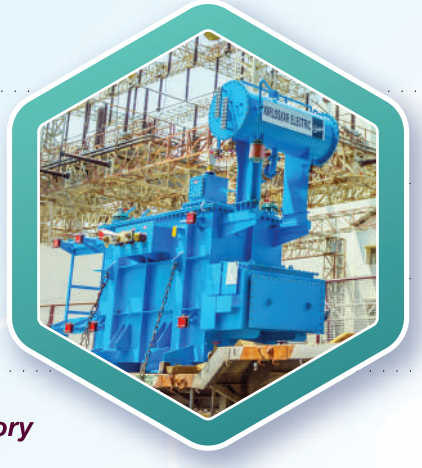
High Power Laboratory carries out short circuit testing of transformers, up to a voltage rating of 400kV. Internal arc tests are carried out for medium voltage AIS and GIS panels. Power arc tests are carried out for insulator strings of voltage rating up to 400kV. Arc tests are carried out for lightning arresters, instrument transformers etc.

High Power Laboratory regularly carries out making and breaking tests, including mainly terminal fault tests and switching tests, on medium voltage circuit breakers. Making tests are carried out on earthing switches. Induced current switching tests are carried out on 800kV earthing switches. Facility is available to conduct mechanical endurance tests on circuit breakers.

Short time withstand current tests are carried out up to 300kA RMS for 1s on bus-ducts, CTs, isolators, panels, power connectors etc., in a dedicated test cell.

Standards

IEC 60076 series, IEC 62271 series, IEC 61869 series, IEC 61439 series, IEC 60099-4, IEC 61467 IS 2026 series, IS 8084, IEEE C37.23, IS 5561



High Power Laboratory

HIGH VOLTAGE DIVISION

High Voltage Division comprises of the following laboratories for providing services on dielectric testing of all major high voltage electrical equipment.

1. Impulse Voltage Test Laboratory
2. Power Frequency Test Laboratory
3. Impulse Current Test Laboratory
4. Artificial Pollution Test Laboratory
5. Measurement and evaluation of earthing parameters

A Impulse Voltage Test Laboratory

Impulse Voltage Test Laboratory consists of an indoor laboratory and an outdoor laboratory test bay. Indoor laboratory is a high voltage test hall housing a 3000 kV, 150 kJ impulse generator with artificial rain equipment for wet test.

3MV, 150kJ
Impulse Voltage Generator

B Power Frequency Test Laboratory

The Power Frequency test facilities available with outdoor test bay consists of a 1800 kV, 2000 kVA cascade transformer comprising of three numbers of 600 kV, 2000 kVA transformer units and one additional 600 kV, 2000 kVA transformer located in the indoor test hall for the convenience of inter changeability and for parallel testing

1800 kV, 2000 kVA cascade transformer

600 kV, 2000 kVA Transformer

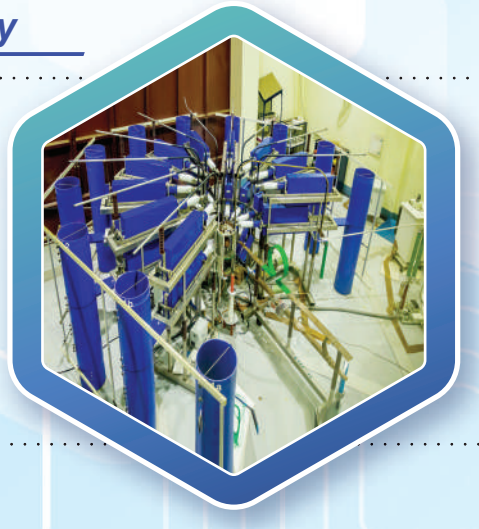
This setup is used for conducting power frequency voltage tests (Dry & Wet), RIV, corona tests and pollution test up to 500kV rating.

Artificial Rain Equipment

C Impulse Current Test Laboratory

The Impulse Current Laboratory has comprehensive test facility including accelerated ageing test for Zinc Oxide (ZnO) lightning arrester elements and pro-rated sections of voltage ratings from 3kV to 12 kV as per IEC 60099-4 Edition-3, 2014, IEC 60099-8, IS 3070 Part III and IEEE C62.11, 2012 Edition.

The laboratory has unique computer controlled impulse current generator of rated 100 kV, 300 kJ incorporating all conceivable features in a single consolidated design



Current Impulse Generator

D Artificial Pollution Test Laboratory

The artificial pollution test laboratory has dimensions of 12m x 12m x 12m. An array of nozzles confirming to IEC specifications is installed in the salt fog test chamber. The pollution laboratory can carry out tests on insulators and insulator assemblies for systems up to 400 kV class.

The chamber for carrying out thermo-mechanical load cycle tests is having the temperature control range from -60ºC to + 60ºC and the tensile strength ranging from 10 to 500kN (2 channels). This chamber is used to carry out the tests on composite long rod insulators and porcelain insulator strings

Artificial pollution test facility

E Measurement and Evaluation of Earthing Parameters

The division has the facilities and expertise to carry out grounding studies for various agencies including generating stations, substations and various industries.

Types of studies carried out viz.

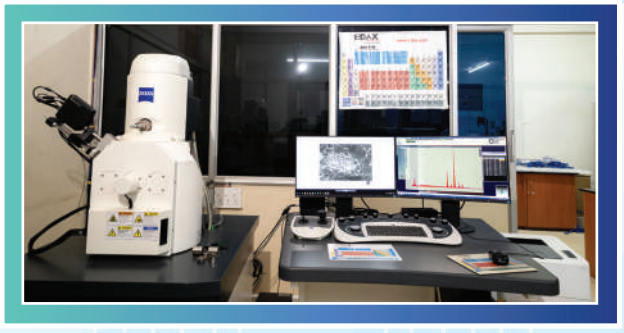
- Earth mat design for industries, switchyard / generating stations.
- Soil resistivity measurement at site
- Earth resistance measurement at site
- Adequacy check of grounding system
- Step and touch potential measurement at site

MATERIALS TECHNOLOGY DIVISION

Materials Technology Division has various facilities to test and characterize materials such as metals, ceramics, composites etc. The division is well equipped to carry out materials characterization and evaluation, mechanical and wear testing, fuel evaluation and testing, non-destructive testing, electrical steels evaluation test, field engineering services and consultancy.

A Material Characterization and Evaluation

Materials evaluation using analytical facilities like SEM, EDAX, XRD, Optical microscopy, AE spectroscopy, XRD residual stress. Facility to test CRGO and CRNGO electrical steels.



Scanning Electron Microscope with EDAX

CRGO Test for Electrical Steel

XRD Residual stress test facility

X- Ray Residual Stress Test Facility

B Non-Destructive Testing

Visual Inspection (VI), Fibro Scope Test (FST), Dye Penetrant Test (DPT), Magnetic Particle Inspection (MPI), Ultrasonic Test (UT), Eddy Current Test (ECT), Thermography Test (TGT), Corrosion mapping of boiler tubes.

C Field Engineering Services

Condition assessment of power plant components, Remaining Life Assessment (RLA) for both thermal and hydro power plant components.

Fibro-scope

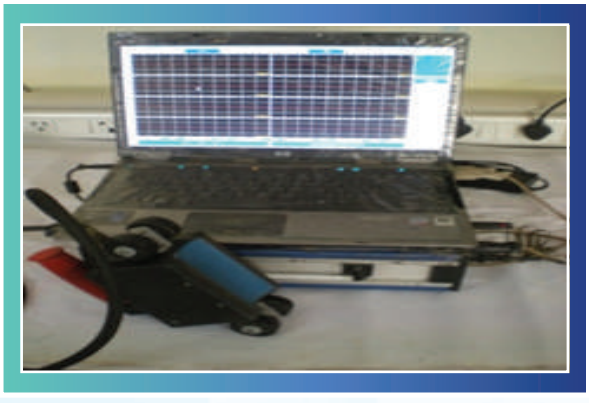
Ultrasonic Oxide scale measurement

EMAT system for scanning of boiler tube wall thickness

D Consultancy

Failure and root cause analysis of all the engineering components, product design & development, life extension studies of power plant critical components and Renovation & Modernization (R&M).

Robotic System for Boiler Water Wall Tube Inspection



Corrosion mapping of Boiler tubes – LFET & RFET

METERING AND UTILITY AUTOMATION DIVISION (MUAD)

Energy Meter Testing Lab: The laboratory undertakes type testing of static energy meters, tri-vector meters, thread through meters, prepayment meters and smart meters as per National/International standards and also carry out acceptance test, routine test and tamper simulation tests.

Energy Meter multi position test bench

Test facilities for Static Meters/ETV Meters/Prepaid & Smart meters:

- IS 13779:2020 - ac static Watthour Meters-Class 1 and 2
- IS 14697:2021 - ac Static Transformer operated WH and VARH meters Class 0.2S, 0.5S & 1.0S
- CBIP Research publication No. 325 – CBIP guide on Static Energy meter specifications & Testing
- IS15884:2010 - ac direct connected static prepayment meters for active energy (class 1 & 2)
- IS16444 (Part-1) 2015: a.c. Static direct connected watthour Smart Meter class 1 & 2 – specification
- IS16444 (Part-2) :2017 a.c. static transformer operated watthour and Var-hour smart meters, class 0-2s,0.5s and 1.0s
- IEC62052-11:2020-General requirements, tests and test conditions Part 11: Metering equipment

Test Set up for EMHF Immunity test by using GTEM

Protocol testing facility for Static/Smart Meter

- The laboratory's testing and developmental assistance services has been utilized by many Indian/overseas manufacturers, utilities, integrators etc.
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A Test facilities for conventional / static meters

- The laboratory's testing and developmental assistance services has been utilized by many Indian/overseas manufacturers, utilities, integrators etc.

DLMS Test Bench

B Test facilities for Smart meters

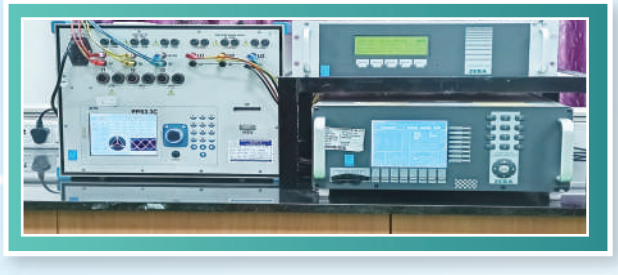
- The laboratory's testing and developmental assistance services has been utilized by many Indian/overseas manufacturers, utilities, integrators etc.
- CPRI is a member of DLMS UA (Device Language Message Specification User Association), Geneva. The CPRI Test Reports will carry the logo of DLMS UA.IS 15959 (Part 1): 2016 - Data Exchange for Electricity meter reading, tariff & Load control - Companion Specification (Part 2 Smart Meter)

Smart Meter Test Facility

- IS 15959 (Part 3): 2017 - Data Exchange for Electricity meter reading, tariff & Load control - Companion Specification (Part 3 Smart Meter - Transformer Operated kWh and kVARh, Class 0.2S, 0.5S and 1.0S)

Calibration Laboratory

The laboratory is equipped with a state-of-art technology to calibrate reference standard energy meter up to 0.02 class accuracy. The laboratory is accredited by NABL as per ISO/IEC 17025:2017 standard for both at-Lab and at-site calibration facility for AC voltage, AC current, power factor, frequency active & reactive power/energy, voltage & current harmonics parameters. Calibration services has been availed by many Indian / overseas customers.



Set up for Calibration of Reference Standard Meters (At-Lab)

Set up for Calibration of Reference Standard Meters (At- Site)

MECHANICAL ENGINEERING DIVISION

The Division has state-of-the-art tower testing station and offers consultancy services on design of transmission line towers.

A Tower Testing Station

- Square, rectangular and triangular based towers and poles
- Maximum base width of 26m x 26m square base with 22 x 11m rectangular base – height 75m , Pole Testing up to 8000 TM Over Turning moment
- UTM of 600 KN capacity for pre / post testing calibration of load measuring equipment

Testing of Tower & Monopole

B Design & Consultancy Cell

Design and Design Vetting of transmission line monopoles, transmission line towers, pile foundations, isolated foundations, caisson foundations, raft foundations, strapped foundations, communication towers, communication monopoles, and pier foundations for different voltage levels for various utilities across India and abroad.

C Vibration Laboratory

- The Vibration Laboratory is equipped with advanced Electrodynamic Shaker Systems, Servo-Hydraulic Vibration Systems, and Mechanical Shaker Systems, enabling high-quality simulations and world-class testing for mechanical fatigue and vibration testing of overhead transmission line conductors, vibration dampers, spacer dampers, and related accessories. Additionally, the laboratory supports the evaluation of assembly insulator strings and hardware for transmission lines up to 1200 kV, in compliance with both national and international standards.

Wake Simulation Laboratory

- Universal Testing Machine UTM of 100 kN capacity with built in world class features has been incorporated which caters to the testing of all types of hardware materials including the testing of individual wires/strands of all types of transmission line conductors.

POWER SYSTEMS DIVISION

Accurate and reliable simulations of three-phase electromagnetic and electromechanical transient phenomenon in electric networks both for closed loop equipment testing and off-line simulation studies is possible with Real Time Digital simulation facility available at CPRI. The Dynamic performance studies of various types of controllers such as HVDC, FACTS, SVC, PPC and protection relays with hardware-in-the-loop testing have been executed.

Power System studies for transmission planning and power evacuation, Load flow studies, short circuit studies, stability studies – transient, dynamic and voltage stability, fixed and dynamic reactive power compensation studies, Islanding studies, Harmonic analysis and Filter Design, SSR Studies, Insulation co-ordination studies, Grid Integration studies of Renewables – Wind, Solar, Battery energy storage systems, third party protection audit of generating stations and substations, power system equipment protection setting calculations and relay coordination studies can be carried out for electrical Utilities and Industries.

Real Time Digital Simulator

A Relay Testing Laboratory

Type testing of protection relays: equipped with the computerized relay test systems for conducting type tests on protection relays used for protection of generators, transformers, bus bar, transmission line, reactors, motors, capacitors etc., in accordance with IEC: 60255 Standard series and IS: 3231 Standard series.

B Testing of Phasor Measurement Unit (PMU)

Phasor measurement unit calibration facility is available for carrying out validation/evaluation of M-class and P-Class Phasor Measurement Unit (PMU's) for both Steady state and dynamic conditions as per IEEE C37.118.1, IEEE C37.118.1a, IEEE C37.242, IEC/IEEE 60255-118-1 Measuring relays and protection equipment - Part 118-1: Synchrophasor for power systems - Measurements.

SHORT CIRCUIT LABORATORY

Test facilities available for

- Low Voltage Switchgear & Control gear (MCB / MCCB / RCCB / ACB / fuses / starter modules)
- Distribution transformers
- Instrument transformers
- Low voltage switchgear and control gear assemblies [LT Panels (PCC/MCC) / distribution boards /feeder pillars/ LV bus ways]
- Test facilities for current transformers up to 765kV, 6000A and potential transformers up to 66kV class

50MVA, 12kV Short Circuit Generator

30V, 10000A Current Source for Accuracy Test on CT

Laboratory test facilities

- Two 50 MVA short circuit generators for conducting short-time withstand current tests of 50 kA RMS for 1.0s and 30 kA RMS for 3s on various electrical equipment.
- Short circuit breaking capacity tests at 50kA, 460V can be performed.
- DC short circuit test facility of 600V, 30kA for 3.0s
- Temperature rise test facilities for Distribution Transformers upto 2.5MVA, 33/22/11kV class and dedicated sound proof room for conducting sound level measurement tests on distribution transformers.
- All environment test facilities like dry heat/damp heat/glow wire/ball pressure
- Impulse Test facility for LV equipment, short time over current, electrical endurance, fault current making capacity, short circuit current carrying capacity test facility on smart meter / prepayment meter

Heat Run Test Facilities Temperature rise test up to 10,000A on distribution boards, LT and HT bus-ducts, isolators, circuit breakers, control panels, CTs & PTs etc.

Heat Run Test Facility

SMART GRID RESEARCH LABORATORY

Testing Services

Smart Grid Research Laboratory is having one of the unique test facilities in the country. This facility caters to offering services including:

- IEC 61850 conformance testing for Intelligent Electronic Devices (IEDs). The laboratory was established during 2007-08 and was the first laboratory in the country for IEC 61850 testing. Also, this is the first laboratory in the country to get accredited to latest version of IEC 6A1850 standards including Edition 2 with amendment 1 (Edition 2.1) by UCA International Users Group (UCA Iug), USA.
- Conformance testing for Remote Terminal Units (RTUs)/ Field RTUs (FRTUs)/ those devices conform to IEC 60870-5-101 / 104 communication protocol standards as per IEC60870-5-601 / 604 respectively. This is the first laboratory in the country to have this test facility.
- Conformance testing for security implementation as per IEC 60870-5-7 applying IEC 62351-3 and IEC 62351-5 standards. Security testing is carried out as per IEC62351-100-3 and IEC 62351-100-1 respectively. This is the first laboratory in the country to have this test facility.
- Advanced Metering Infrastructure (AMI) system testing and evaluation for end-to-end system consisting of Smart Meters, Data Concentrator Units (DCUs) in case of RF and PLC communication, Head End System (HES), Meter Data Management System (MDMS), Billing engine, consumer app and other associated modules.

- The division also supports the manufacturers in carrying out development testing work for the above-mentioned activities for developing and improving their products.

Consultancy Services

Project Management Consultancy Services in the area of Smart Grid, AMI Systems, Cyber Security and SCADA & Automation related areas.

SCADA and Automation, AMI System and Smart Grids, RTUs & FRTUs for IEC 60870-5-101 /104 with security.

CPRI SWITCHGEAR TESTING & DEVELOPMENT STATION, BHOPAL

Test facilities: short circuit testing of power transformers, LV and HV switchgear, energy meter testing, calibration laboratory, transformer oil testing and IP test.

A Station 1

Short Circuit Test station utilizing two specially designed 1500MVA short circuit generators for conducting short circuit tests on high and medium voltage switchgears, transformers and other allied equipment.

Two Nos., 1500MVA, 12.5 kV, 69 kA, 3 Phase SHORT CIRCUIT GENERATOR

B Station 2

On-line testing station with 100 MVA short circuit capacity catering to short circuit tests for low voltage switchgears, transformers and other allied equipment.

C Supplementary Test Facility

- Impulse voltage generator of 2400kV, 240kJ for impulse test on equipment upto 400kV/800kV class, 20kJ impulse voltage generator for impulse test on equipment upto 132kV class.
- 350kV Power frequency test on equipment upto 132kV class
- Ingress protection (IP) test with automatized facility to conduct IP 11 to IP 66
- Instrument Transformer test facility

2400kV, 240kJ Impulse Voltage Generator

- All tests on LV switchgears and control gears including environmental test.

D Energy Meter Test Laboratory

The laboratory has type test facility for static energy meter and smart meters up to 100A as per national and international standards.

E Calibration Laboratory

Calibration Laboratory has facility for calibrating electro-technical and thermal parameters.

Energy Meter Test Facility

Computer Aided Feeder Loading Unit

F Oil Test Laboratory

The lab is equipped to test new as well as serviced mineral oil as per IS 335:2018 and IS 1866:2017/IEC 60422:2024 respectively, the testing includes:

1. Physical Parameters – Color and Appearance, Density, Inter Facial Tension, Viscosity and Flash Point.
2. Chemical Parameters – Water Content, Acidity, Sludge Content.
3. Electrical Parameters – Dielectric Strength, Specific Resistance, Dielectric Dissipation Factor.

In addition to these tests lab also facilitates testing for dissolved gas analysis, particle size/counter analysis and Furan analysis (HPLC) of mineral oil.

Testing Capabilities

- Short Circuit dynamic and thermal withstand test facility for distribution and power transformers of rating up to 63MVA, 220kV class
- Transformer loss measurement facility up to 40MVA, 132/33kV class power transformers
- Short circuit making and breaking capacity test facility for MV and LV circuit breakers.
- Capacitor bank switching test, cable charging and line charging test facility for medium voltage circuit breakers & Switches.

Internal Arc Fault Test on 33kV, 400A, Outdoor Kiosk Panel

- Internal arc fault test facility for metal enclosed switchgear (MV/LV) and motor terminal boxes.

CPRI ULTRA HIGH VOLTAGE RESEARCH LABORATORY, HYDERABAD

A Test Facilities

- UHV Indoor Double Shielded test facility with 1200 kV, 2 A, 2400 kVA HVAC test system
- 5 MV, 500 kJ, 25 stage outdoor impulse voltage generator laboratory
- +/- 1200 kV, 200 mA (continuous) outdoor HVDC Generator laboratory
- 1600 kV, 6 A, 9600 kVA outdoor Power Frequency Transformer laboratory
- Artificial Pollution testing laboratory
- Oil testing laboratory
- Smart meter and cyber security testing laboratory
- LED Lamps and Luminaires Testing laboratory

Aerial view of 5 MV, 5 kJ impulse voltage generator laboratory

C and tan δ test on 800 kV Bushing at UHV indoor double shielded laboratory

B Testing Capabilities

- Partial discharge measurement test on current transformer, capacitor voltage transformer, bushings, GIS, etc.,
- Type, routine and special tests on instrument transformer
- Dielectric test on high voltage electrical equipment
- Radio interference voltage measurement and corona test on high voltage electrical equipment and accessories
- Temperature rise test on switchgear equipment
- Artificial pollution test on insulators strings by salt fog method
- HVDC pollution test on insulator strings by solid layer method
- HVDC puncture voltage withstand test on DC porcelain disc insulator
- Routines test on Smart meter including cyber security test
- Testing on LED Lamps and Luminaires
- Routine testing facilities on transformer oil.

C Energy Meter & Smart Meter Test Laboratory

Energy meter test laboratory of CPRI, Hyderabad has state-of-the-art test facilities for carrying out Routine tests, Acceptance tests and DLMS compliance tests as per National and International standards.

Meter test facility

Test facilities for energy meters

- Tests of Insulation Properties, Accuracy Requirements, Electrical requirement, Climatic requirement as per National and International Standards.
- Verification / tamper simulation

Test facilities for conventional / static meters

Data exchange for electricity meter reading, tariff & load control – companion specification as per IS 15959 (Part 1): 2011

Test facilities for Smart meters

- DLMS/ COSEM open protocol testing and certification of Static and Smart energymeters for conformance to IEC 62056.
- Data Exchange for Electricity meter reading, tariff & Load control – Companion Specification (Part 2 Smart Meter) as per IS 15959 (Part 2): 2016
- Data Exchange for Electricity meter reading, tariff & Load control – Companion Specification (Part 3 Smart Meter – Transformer Operated kWh and kVARh, Class 0.2S, 0.5S and 1.0S) as per IS 15959 (Part 3): 2017

Oil Test Laboratory

Oil test laboratory of CPRI, Hyderabad has state-of-the-art test facilities for carrying out In service mineral insulating oils as per IS 1866 / IEC 60422 and IEC 60567.

Tests facility for oil test as per IS 1866 / IEC 60422

- Interfacial Tension
- Neutralization Value (Total Acidity)
- Water Content
- Flash Point
- Breakdown Voltage (BDV)
- Sediment & Sludge
- Dielectric Dissipation Factor (Tan Delta)
- Specific Resistance (Resistivity)
- Dissolved Gas Analysis to assess the internal condition of the transformer as per IEC60567

D Consultancy

- AC electric and magnetic field strength measurement near transmission lines and substation
- DC electric field strength and ionic current measurement near UHV DC transmission lines
- Measurement of radio interference voltage, audible noise on UHV DC / AC transmission lines, substations, valve stations etc.

CPRI REGIONAL TESTING LABORATORY, NOIDA

A High Voltage Lab

- Lightning impulse voltage withstand test on power/distribution transformers up to 25MVA
- Transformer routine tests up to 1MVA
- Instrument transformers up to 132kV, HV switchgears, bus ducts, fuse units up to 132kV, insulators up to 66kV
- Temperature rise test set up of 6kA

1000kV, 100kJ Impulse Voltage Generator

B Cables Laboratory

- DC Test facility up to 5kV, 50mA and AC power frequency test facility up to 60kV, 150mA
- Tests on cables and accessories - all type tests on XLPE cables up to 33kV
- PVC insulated, PVC sheathed cables up to 11kV
- FRLS tests on cables and insulating materials

Cable test facility

C Energy Meter Lab

- Energy Meter tests for single phase and three phase AC static watt hour meter & smart meter class 1 and class 2
- Facility for energy meter testing at consumer premises.

Energy Meter Test Facility

D Liquid Dielectric Lab

Facilities for testing Transformer Oils as per IS: 1866.

CPRI THERMAL RESEARCH CENTRE, NAGPUR

Facilities

- Life assessment, renovation & modernization and life extension studies, Non-Destructive Evaluation (NDE) of thermal power station plant equipment like boilers, turbines & condensers etc., and condition assessment of RCC and steel structures in thermal power plants and process steam industries.
- Investigation study for root cause analysis on boiler tube/ turbine component failure for power utilities and industries.
- Performance evaluation of high temperature materials used for stress corrosion,fatigue and creep and material characterization.
- Phased Array Ultrasonic Testing (PAUT) an advanced non-destructive examination technique to find flaws in manufactured materials such as welds.
- Finite element analysis of plant components
- Mechanical tests for ascertaining material properties.
- Condition assessment of RCC and steel structures of power utilities and industries using NDE techniques.
- Hot spot measurement in boilers, switch yards, transformers etc.

CPRI REGIONAL TESTING LABORATORY, KOLKATA

Test Facilities

- Testing of insulating oils in power transformers as per IS 1866-2000 and dissolved gas analysis for assessing the internal condition of the transformers.
- Test facilities like Ultra High Performance Liquid Chromatography (UHPLC) to evaluate furfural content for assessing the condition of solid insulation in power transformers.
- The unit caters to the testing requirements of electrical power equipment manufacturing industries, utilities and consumers in the eastern region.

PCB Instrument

HPLC Instrument

REGIONAL TESTING LABORATORY, GUWAHATI

Test Facilities :

- Testing of Insulating Oils in Power Transformers as per IS 1866-2017 and Dissolved Gas Analysis for assessing the internal condition of the Transformers.
- The Unit caters to the testing requirements of Electrical Power Equipment Manufacturing Industries, Utilities and Consumers in the North Eastern region.

Oil Breakdown Voltage Tester

Gas Chromatograph with Head Space Auto Sampler

CPRI REGIONAL TESTING LABORATORY, NASHIK

A Energy Meter test Laboratory

The Energy Meter Test Laboratory at RTL, Nashik, will accommodate the testing of both conventional and smart energy meters. This includes metrological testing and load switch capability testing as per national and international standards.

B Transformer Routine Test facility

The Transformer Routine Test Laboratory will be used for conducting all routine tests on transformers up to 10 MVA, in accordance with national and international standards.

C Temperature Rise Test facility

The Temperature Rise Test Laboratory will be used for conducting Temperature Rise tests on transformers up to 10 MVA, in accordance with national and international standards.

D 800kV, 80 KJ Impulse Voltage test facility

The impulse voltage laboratory will be used for conducting lightning impulse tests on up to 132 kV class transformers up to 10 MVA, as well as high voltage switchgears, in accordance with national and international standards.

E 1500 MVA On Line Short circuit Station (Under Commissioning as on January 2025)

The 1500 MVA On Line Short Circuit Station will be used for conducting Short Circuit tests on transformers up to 10 MVA along with Low voltage and High Voltage equipment, in accordance with national and international standards.

On Line Short Circuit Station

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