Vol 56 No 6 June 2016 ₹ 100

Since 1961

Electrical India

India's oldest magazine on power and electrical products industry

Fifty-sixth Year of Service to the Power Industry 56

Insights into the World of Transformers...

- Current Transformers In Electrical Diagnostics
- Significance Of Transformer Oil Monitoring
- Thermal Performance Of Distribution Transformers
- Looking At The Transformer Kraft Paper

A Chary Publication®

Scan the QR Code to know more about EI Website

Follow us on

SUBSCRIBE/RENEW Online • Log on to www.electricalindia.in

At L&T, we have re-defined smart. And made our **Smart Electrical & Automation Systems** more relevant to your requirements.

Smart Training - we share industry best practices with your personnel at our training centres
Smart Access - instant digital communication of information on products and applications
Smart Interface - dedicated customer interaction centre to respond to your needs

Experience '**smart**' in the complete package we offer you, and maximize value for your enterprise.

Customer Interaction Center (CIC)
BSNL / MTNL (toll free): 1800 233 5858 Reliance (toll free): 1800 200 5858
Tel: 022 6774 5858 Fax: 022 6774 5859 Email: cic@Lntebg.com
Web: www.Lntebg.com

LARSEN & TOUBRO

Regd. Office: Larsen & Toubro Limited, L&T House, N. M. Marg, Ballard Estate, Mumbai - 400 001, INDIA CIN: L99999MH1946PLC004768

50 years of excellence

GUPTA POWER
Making life better on Earth

TOUGH INSIDE
TOUGH OUTSIDE

Carnival/ GPIL

German Technology copper max | American Technology Tangle free | Fire Retardant | CE | UL

Gupta Power Infrastructure Limited

Cuttack Road, Bhubaneswar-751006, Odisha, India
Ph: +91-674-2313898/2312945, Fax: +91-674-2312083 | rhino@guptapower.com

EN 62, 7th Floor, Sector - V, Salt Lake City,
Kolkata-700 091, Telefax: +91-33-40657348 | kolkata@guptapower.com

/rhinowiresandcables /rhinowires

CONSUMER CARE CELL : Toll Free No : 1800-200-1176

Conductors | Cables | Wires | EPC | LED

RHINO
WIRES • CABLES
www.guptapower.com

Publisher's Letter

A Few Cautionary Findings

Of late we have been witnessing ubiquitous use of LED lighting primarily putting attention only on their positive aspects like energy saving potential, near zero maintenance, longer life and so on. As economy influences choice of FMCGs in most of the cases, total savings potential of the LED lamps has undoubtedly stood as a strong determining factor supporting their selection and deployment. However, findings of a recent survey that assert that human factor is important in LED use, highlight a few areas where the LED lighting designers need to pay stringent attention.

The survey; commissioned by the Society of Light and Lighting (SLL), part of the Chartered Institution of Building Services Engineers (CIBSE), and produced by Public Health England, which was intended to provide data on the positive and negative effects of exposure to light from LED light sources; concluded that designers should consider the LED as part of the whole light fixture and the environment in which it is used to determine if it is suitable – a factor that is as important as the price of the LED or its efficiency.

As per the survey, "Cost was shown to have no significant impact on the flicker or colour rendering of the lamp, but there are potential issues surrounding LED lights, which must be factored in when deciding where they should be used, and what kind of fixture is most appropriate for them. For example, around half of domestic and office LEDs were found to have higher flicker rates than alternative sources, meaning that they imperceptibly or noticeably flicker more. This must be taken into account by designers, who should choose LEDs with lower flicker rates, or avoid using them in public places where they may contribute to adverse health symptoms in a very small number of those regularly exposed. Those in procurement need to be very careful to include low flicker requirements in their specifications, and all specifiers need to be aware that if LED products are substituted by contractors or suppliers then flicker needs to be considered." Similarly, other studies have shown that blue light can mimic daylight and confuse the brains of humans and animals into delaying melatonin production, potentially disrupting the sleep and the circadian cycle.

> "Our LED lighting designers are expected to be more careful to adopt a holistic approach in their designs..."

Thus, our LED lighting designers are expected to be more careful to adopt a holistic approach in their designs.

Do send in your comments at miyer@charypublications.in

Mahadevan Iyer

Editor-In-Chief

> The successful publishing house is the one that can guess ahead, not the one that imitates the past.
>
> - Helen Jacobs

Single Issue: ` 100 / Annual Subscription: ` 1000

Printed, Published and owned by Mahadevan Iyer from 201, Premalaya, Opp. Telecom Factory, Deonar, Mumbai 400088 and Printed at Print Tech., C-18, Royal Ind. Est., Naigaum Cross Road, Wadala, Mumbai 400031. **Editor: P K Chatterjee**

Vol 56. Issue No. 6 • June 2016

Directors
Pravita Iyer
Mahadevan Iyer

Publisher & Editor-In-Chief
Mahadevan Iyer
miyer@charypublications.in

Editor
P K Chatterjee
pkchatterjee@charypublications.in

Editorial Co-ordinator
Nafisa Kaisar
nafisa@charypublications.in

Advertising Department

Director Advertisement
Pravita Iyer
pravita@charypublications.in

Advertising Manager
Yasmeen Kazi
yasmeen@electricalindia.in

Design
Nilesh Nimkar
charydesign@charypublications.in

Subscription Department
Nafisa Khan
sub@charypublications.in

Accounts
Dattakumar Barge
accounts@charypublications.in

Response Department
Sonali Pugaonkar
mktg@*charypublications.in*

Electrical India is also available online on www.electricalindia.in. For online enquiries contact at: *dgmarketing@charypublications.in*

OFFICE ADDRESS

Editorial, Subscription and Advertisement:
201, Premalaya, Next to Cafe Coffee Day, Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Tel.: (022) 2507 3300 / 01
www.electricalindia.in

Editor: P K Chatterjee

To connect with the best up to 550 kV just think Brugg Cables.

Easy-to-install, sturdy, proven – Does this sound like what you need in power cable accessories? Then Brugg Cables has your answer. We fit every brand, technology and budget for Accessories up to 500 kV, 2500 mm^2. In fact, it would be hard to find a more affordable way to handle network expansions than with our transition joints. It's time you connect with the best.

Brugg Kabel AG, Klosterzelgstrasse 28, 5201 Brugg
Phone +41 (0)56 460 33 33, Fax +41 (0)56 460 35 36
E-Mail info@brugg.com, www.bruggcables.com

BRUGG CABLES
Well connected.

contents

Vol. 56 | No. 6 | June 2016

ARTICLES

© PK Chatterjee

In today's energy networks, transformers have a major role to play. This issue of Electrical India focuses on several aspects of their construction, management, fault detection etc. The representative photograph on cover is a distribution transformer, which was clicked by the Editor in Thailand.

FOCUS

Transformers, Transformer Oil Lamination & Stampings

INTERVIEW

T P Singh
Country Manager
Flir Systems India Pvt. Ltd.

DEPARTMENTS

Over Five Golden Decades of dedicated service to Power Sector

For over five decades now, one name has facilitated Applied Research in electrical power engineering, enabling Testing and Certification of electrical Power Equipment as an Independent Third Party Agency - CPRI. The Institute is renowned Internationally as a reputed brand and well-recognised for its quality and excellence. CPRI is also adequately equipped with advanced infrastructure to handle Collaborative Research with Academic Institutions and Training to Utilities/Industry.

CPRI

TESTING & CERTIFICATION

- State-of-the-art Test facilities for High Power Short Circuit, Ultra High Voltage, High Voltage testing of Transformers and Switchgears, Cables and Capacitors, Transmission Line Towers, Material characterisation, Seismic Qualification, Power System Studies, Energy meter testing.
- Four Short Circuit testing facilities
- Facilities for testing equipment of 800kV/1200kV rating
- Evaluation of Vibration Characteristics
- Protocol testing for Power System Automation
- Refrigerator and Air-Conditioner test facility

RESEARCH

- Center of excellence for undertaking Collaborative and advanced Research in Power Sector
- Sponsored Research Projects of relevance to Power Sector
- Coordination of National Perspective Plan Projects

CONSULTANCY SERVICES

- Smart Grid initiative - Design and Development of Pilot Project for BESCOM
- Third Party Independent evaluation agency for Energy Accounting and SCADA/DMS Consultant for R-APDRP
- Third Party Inspection and Supervising work under RGGVY scheme
- Diagnostics & Condition Monitoring of Power Equipment
- Consultancy in Power System Studies, Real Time Simulation of Power System Controls, Power System Protection Audit
- RLA and R&M, Energy Efficiency & Audit Services
- Third Party Inspection Services

TRAINING

- Customised Training Programmes
- One year course on Testing & Maintenance of Electrical equipment

ACCREDITATIONS

- **Accredited as per ISO/IEC 17025:2005**
- **Member - Short Circuit Testing Liaison(STL)**
- **Corporate Member in DLMS UA, UCA IUG**
- **ISO 9001:2008 Certification for Research and Consultancy activities**

3MV, 150kJ Impulse Voltage Generator

केन्द्रीय विद्युत अनुसंधान संस्थान

CENTRAL POWER RESEARCH INSTITUTE

(Autonomous Society under Ministry of Power, Govt. of India)
Prof. Sir C.V. Raman Road, Sadashivanagar P.O,
P.B. No.: 8066, Bangalore - 560 080, INDIA
Ph: +91-80-2360 2329 Fax: +91-80-2360 1213
E-mail: suhas@cpri.in / kamala@cpri.in
Website: www.cpri.in

Your Trusted Partner in Testing and Research in Power Sector

2500MVA Short Circuit Generator

1200kV CVT under test

1200kV Insulator String testing

Erection of Tower for Testing

Cable Testing

CPRI UNITS: BHOPAL, HYDERABAD, NOIDA, NAGPUR, KOLKATA, GUWAHATI

Indian Transformer Market Is Striding Ahead

P K Chatterjee (PK)

> The current Indian market for electrical transformers is bound to witness a healthy growth...

Although the current union government has put in their utmost effort to drag India out of the mark of a power starved country, the situation is yet to change and it will take at least five more years. It is not the case that India truly suffers from a very big shortfall in power generation, but inadequate power Transmission and Distribution (T&D) is posing the greatest challenge.

According to a recent survey report by the Market Research Reports, Inc., "Inadequate power evacuation infrastructure has been the biggest drag on the overall power sector in India. For years, adding generation capacity remained top priority which led to significant gaps between power that could be produced and power that could be evacuated and supplied to the last mile power consumer. Inadequate power evacuation infrastructure has also limited transfer of power from power surplus areas like the Eastern Region to power deficit states in Southern Region."

The report exemplifies that in the state of Tamil Nadu, inadequate power evacuation infrastructure has made wind power generators back down – as a result full potential of installed wind power capacities in the state remains untapped. Increasing installation of renewable energy capacities in almost every state in India would put tremendous stress on existing transmission infrastructure and would entail significant investments in setting up new transmission projects that's resilient to accommodate these unpredictable sources of power generation.

The Market Research Reports' findings also state, "Roughly ~7 MVA of power evacuation capacity is required for every 1 MW of power generation and this would translate to requirement of about 1923 GVA for the existing installed capacity of 275 GW, however, currently the overall power evacuation infrastructure is about 1100 GVA, which means gap of nearly 823 GVA. Also, significant upgradation of existing substations will be done to bridge this gap and additional 700 GVA new capacity will be added to accommodate 100 GW of new power generation of capacities slated to be commissioned over next 5 years.

As presence of transformers is must for any T&D system, the current Indian market for new electrical transformers is bound to witness a healthy growth. Also, the current initiatives taken by the union government and some state governments to replace the age-old transformers with the latest ones will boost the replacement market parallelly.

P. K. Chatterjee

{ The future of Publishing is about having connections to readers and the knowledge of what those readers want.
- Seth Godin }

Please e-mail me your views at pkchatterjee@charypublications.in

SIEMENS

Engineered with TIA Portal

SIMATIC Safety Integrated – Integrated Added Value

SIMATIC Controllers

Siemens offers the right controller for all automation requirements through scalability and consistency of its functions.

The SIMATIC Controller portfolio includes Basic, Advanced, Distributed and Software Controllers:

- The SIMATIC S7-1200 Basic Controller for small to medium-sized applications
- The SIMATIC S7-1500 Advanced Controller for medium-sized to complex applications
- The SIMATIC ET 200SP Distributed Controller for distributed applications
- The SIMATIC S7-1500 Software Controller for PC-based applications

Time for something new?

Benefit from the new generation of SIMATIC Controllers and the higher productivity, efficiency and availability they provide. Siemens will be by your side during the transition.

For more information, call us on 1800 209 1800 or visit us at www.siemens.com/controller

For life cycle support for products, systems and solutions, call us at 1800 209 0987 or email us at ics.india@siemens.com

siemens.com/controller

Tata Power installs solar street lights in the villages around Haldia

Tata Power community Development Trust (TPCDT) Haldia team installed Solar Street Lighting Systems in the public places of Khanpur, Champi and Basulia villages of Haldia. The public places were selected in consultation with the community people.

The objective of this initiative was to provide sustainable lighting to the villagers, and enable them to navigate the village roads at night, thereby, preventing road accidents. During Tata Power's various interactions with the community, the villagers expressed concerns about frequent load sheddings that resulted in dark and unlit roads at night, many areas of village not having any lighting system, making it difficult for them to navigate and sometimes causes safety threats also. To bridge this gap, Tata Power community Development Trust (TPCDT) installed 17 Solar Street Lighting Systems in the roads and public places of three villages of Haldia.

Speaking on this initiative, Abhijit Ain Das, Chief, Haldia Station, said, "It is Tata Power's endeavour to improve the quality of life of its communities. This initiative enables us to light up lives through the use of renewable energy sources such as solar power. These measures are a part of the company's sustainability agenda and are a step forward towards achieving a greener environment. We believe in making solar energy accessible and affordable to everyone, especially to those who do not have access to electricity."

Letter to the editor

Subject: Fuel Cells

Dear Mr. P.K. Chatterjee,

It was an interesting and timely article you have written on the future of Fuel Cells. Thanks for the same. As an industrialist, I want to enter the manufacturing of Fuel Cells of latest technology.

Recently IISc has improved the storage capacity of Hydrogen, for which they are applying for a patent. Such innovations and those you have discussed in your article are encouraging and making the future of these new energy sources safe and cost effective.

Could you please guide me to contacts and sources in my endeavour regarding the latest technology, know-how and commercial aspects of such projects for the manufacture of Fuel Cells under Small and Medium business enterprise.

Thanking you in advance,

G. Venkatesh
CEO, GLOBETEK

Editor's reply:

Dear Mr. Venkatesh,

Intertek offers a wide range of consultancy and advisory services for fuel cell components and systems, and works with developers, manufactures and applications experts.

Ceres Power also offers partnership.

You may also contact Centre for Fuel Cell Technology, ARCI (International Advanced Research Centre for Powder Metallurgy and New Materials).

All the best for your venture!

Regards,
PK
Editor, ELECTRICAL INDIA

Ujjain Nagar Nigam puts LED luminaires on Agar Road

Keselec Schréder has been associated with Ujjain Nagar Nigam in providing Remotely Controlled Smart LED Street Lights at Agar Road in Ujjain.

Keselec Schreder, an Indo – Belgian Joint venture, has installed close to 250 Voltana LED luminaires intergrated with its OWLET Telemanagement system.

Owlet is a telemanagement system for monitoring, controlling, metering and managing outdoor lighting.

Based on open technologies – it saves energy, reduces greenhouse gas emissions, improves outdoor lighting reliability and lowers the maintenance cost. Operating state, energy consumption and failures are reported and stored in a database with exact timestamp and geographical location.

LED luminaires on Agar Road...

Each LED lumianire is fitted with a Lumen Controller (LuCo), which is controlled by a central master controller named Segment Controller (SeCo).The Lumen Controller interacts with the segment controller via wireless technology (ZIGBEE). Each segment controller controls about 120 luminaires. Each individual light point can be switched off/on or dimmed at any time. With the use of internet all the prescribed data of the luminare are stored in the central server and dimming/ ON/OFF commands can be executed in seconds from across the globe.

Comprehensive range of surge protection solutions

NEW LINE

Surge-Trap®

Lightning current arresters and surge protective devices
Type 1, Type 1+2, Type 2 and Type 2+3 SPD's to EN/IEC 61643

Mersen India Pvt Ltd
(EP Activity)
Plot no 19, 4th Cross,
Bommasandra Industrial Area,
Bangalore- 560099
Email: sales.ep.india@mersen.com
Tel: +91 80 27834005/4006
Website: www.ep.mersen.com

Download the new Surge-Trap® brochure on:
ep.mersen.com

MERSEN
Expertise, our source of energy

Cabinet apprised of a GFA on RE cooperation with UAE

The Union Cabinet chaired by the Prime Minister Narendra Modi was apprised of a General Framework Agreement (GFA) on Renewable Energy (RE) Cooperation between India and the United Arab Emirates (UAE).

The GFA was signed, in New Delhi on 11th February this year during the state visit of Crown Prince of UAE, Mohammed bin Zayed bin Sultan Al-Nahyan.

The objective of this GFA is to establish the basis for a framework through which extensive projects, investments, other forms of commercial endeavours, cooperation in research and development in renewable and clean energy, and knowledge sharing platforms could be enacted on the basis of mutual benefit, equality and reciprocity between the parties.

The GFA aims at cooperation between India and the UAE in the field of new and renewable energy technologies.

It will provide multiple opportunities for exploring potential Renewable Energy (RE) projects for investments; continue cooperating in the International Solar Alliance; exploring avenues of cooperation in Research And Development (R&D) in renewables; developing knowledge-sharing mechanisms – through which to build upon the human capital of the parties; exploring establishing a joint fund between the parties to facilitate investment: forms of cooperation as mutually agreed by the parties.

(L2R) Prime Minister Narendra Modi greets Crown Prince of UAE Mohammed bin Zayed bin Sultan Al-Nahyan

Goyal delivers keynote address at dbAccess Asia Conference 2016

While delivering the keynote address at Deutsche Bank's dbAccess Asia Conference 2016 in Singapore, on 23rd May, 2016, Union Minister of State (IC) for Power, Coal and New & Renewable Energy, Piyush Goyal said that the biggest achievement of the government was changing the mind-set of the people and instilling confidence that India can change for the better. He remarked that pessimism and cynicism have been replaced by optimism, hope and confidence.

During the address, he briefed about the various steps taken by the government to improve energy access, rapid scaling up of renewable energy, integration of renewable energy in the grid, enhancing grid reliability and the massive opportunity presented by the untapped demand in the Indian market.

He outlined the steps being taken to achieve energy access and mentioned about programmes – like the LED programme for enhancing energy efficiency, National Solar Mission and UDAY (Ujwal Discom Assurance Yojna) programme.

(L2R) Piyush Goyal and Tharman Shanmugaratnam

The minister was hosted to a lunch by Singapore's Deputy Prime Minister and Coordinating Minister for Economic and Social Policies, Tharman Shanmugaratnam. He also delivered the Keynote Address at the India-Singapore Energy Technology & Investors Meet, which was jointly organised by the High Commission of India, FICCI, Singapore Manufacturing Federation (SMF) and The Institute of South Asian Studies (ISAS).

Power minister states solar power target of CPSUs

While framing the Scale-up Plan for 1,00,000 MW of Grid Connected Solar Power by the year 2022, it was envisaged that the Public Sector Undertakings will contribute around 10,000 MW of Grid Connected Solar Power.

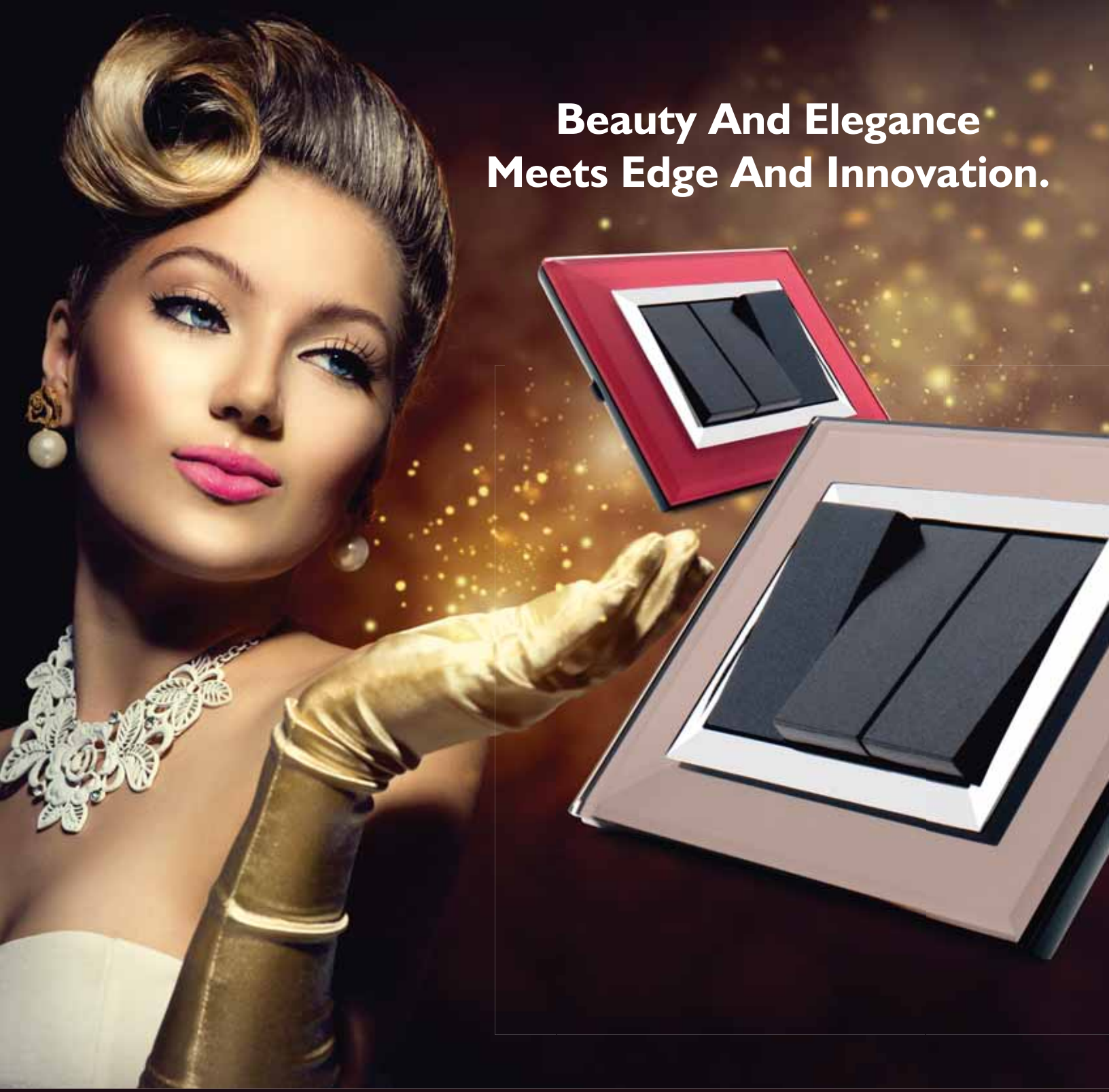
This was stated by Piyush Goyal, Minister of State (IC) for Power, Coal & New and Renewable Energy in a written reply to a question in the Rajya Sabha recently. Further, 36 Central PSUs have given their commitments to develop 18,988 MW of Renewable Energy projects, as part of their Green Energy Commitment.

In a reply to another question, the details of power generated, as on 31-3-2016, from various Renewable Energy Sources is given below:

Source	**Power Generation** (in Billion Units)
Wind	33.03
Solar	7.45
Small Hydro Power (up to 25 MW)	8.33
Bio Power	16.95
Total	65.76

Source: Central Electricity Authority, Ministry of Power, New Delhi

The minister further stated that the government has up-scaled the target of renewable energy capacity to 175 GW by the year 2022, which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro power, the minister added.



LIFETIME GUARANTEE

PRESENTING MYRAH BEVELLED GLASS & LIQUID GLASS PLATES.
Indulge in a collection of sleek designs that gives your living spaces an unparalleled contemporary look. Available in various colors, revel in the smooth feel of real glass plates with perfect finish and smooth edges.

For a more futuristic look, choose from **Myrah Mirror** or **Myrah Edge Metal** plates with sharp contrasting chrome edge

• **Switches** • **Lighting & Luminaires** • **MCB & RCCBs** • **Wires & Cables**

GreatWhite®

THE FUTURE OF BRIGHT

www.myanchor.in

Jadavji Anchorwala Enterprise

ABB India, Welspun Energy accelerated India's solar power growth

ABB in India and Welspun Energy, have together installed about 700 MW of solar PV projects across several states in India like Punjab, Rajasthan, Gujarat, Maharashtra, Karnataka and Tamil Nadu. This includes a key project of 52 MW for Maharashtra State Generation Company at Baramati, which was the first ever PPP (Public-Private Partnership) project in the industry, in the country.

"By setting up large scale solar capacities across the country, we are supporting India's developmental needs through clean energy. This is essential if we want to power our industries sustainably and meet our renewable energy targets. We chose ABB as a bankable partner owing to its leadership in

Image Courtesy: ABB

Solar panels by ABB...

inverter technology, strong local presence and a robust service network, which has helped us to synchronise our plants in a very short time, whilst meeting our robust quality standards. ABB offers quality, reliability, efficiency and a well entrenched network, all of which are critical to minimising the long-term risks of solar installations," said Vineet Mittal, Managing Director, Welspun Energy.

ABB is a well known global supplier of solar photovoltaic (PV) inverters and over half the 5.1 GW inverters installed in India are from ABB. Inverters form the heart of any solar installation. They are critical for maximising the conversion of the DC (Direct Current) power captured by solar panels to electricity in a usable format that can be connected to the grid. ABB has supplied its reliable PVS800 central inverters to Welspun Energy's solar projects. The inverter has one of the highest efficiencies available in the market.

Gamesa to inaugurate its new blade factory in India in September

Gamesa, a global technology company in wind energy, has achieved a fresh milestone in its growth strategy for India by building a new blade factory in the town of Nellore, in Andra Pradesh, one of the country's fastest-growing wind markets. With enough capacity to manufacture 500 MW a year, the facility has been configured to produce the G114-2.0 MW class S model, a turbine custom-designed for wind conditions in India. The company plans to inaugurate the factory, which will employ 400 people, in September 2016.

"The start-up of this new facility evidences our industrial pledge in India and our commitment to developing the country's wind power and broader manufacturing infrastructure," said Ramesh Kymal, Gamesa's CEO in India. "By opening our third factory, we are stepping up our operations in a priority region for Gamesa, while generating wealth via job creation and purchases from local suppliers," he added.

BEL targets aggressive growth in the Luminaires business

Bajaj Electricals Limited (BEL), the over 75-year-old Indian company, with seven strategic business units – Appliances, Fans, Luminaires, Lighting, Morphy Richards, EPC and Exports, is now targeting aggressive growth in the luminaires business for the FY 16-17 through LEDs (Light Emitting Diodes).

Announcing a wide range of innovative LED lighting systems for commercial and industrial segments, the company has recently hinted at a strong growth in the lighting business this financial year. Introducing its sub-brand – .nxt upgrade, BEL has showcased its new range of technologically advanced and highly efficient

(L2R) R Sundararajan, President (Luminaires) and Shekhar Bajaj, Chairman & MD, BEL

range of LED luminaires for the applications like IT/ITES, Modern work spaces, Pharmaceuticals, Retails, Industrial and Smart City Lighting. The company is driving the UPGRADE programme that will help customers upgrade to the latest and technically advanced .nxt LED products.

These products, made in India, are to bring a digital revolution in the lighting solutions. As trend is moving towards the concept of smart buildings involving energy efficiency controlling HVAC/Lighting/Utilities of buildings is taking prominence. BEL has taken the lead in creating offerings of Digital Ceiling Solutions, whereby bringing a common digital platform for lighting, building automation system and services. The platform covers LED lighting, Fire detection, Cameras, Ceiling Speakers and all sensors using wireless technology, which makes flexible and scalable ceiling.

Behtar ElectriKAL ke liye!

CHALEGA CHALEGA
15 SAAL* CHALEGA!

CFLs also available

LED BULBS | LED TUBES | LED PANELS

70% SAVINGS

Finolex LED

NOW AVAILABLE, A NEW RANGE OF LED PRODUCTS.

Regd. Office: 26-27, Mumbai-Pune Road, Pimpri, Pune - 411018, India
Tel: 020 27475963 | **Fax:** 020 27470344 | **Email:** sales@finolex.com | **Visit us at:** www.finolex.com | **CIN:** L31300MH1967PLC016531

*Based on 2.7 Hours usage per day in an open fitting.

GE Power, Partners convened a summit in New Delhi

GE in partnership with Mint and Hindustan Times recently convened distinguished members from the Government of India, policy leaders and industry experts to discuss the country's evolving electricity landscape and explore pathways towards a modern, affordable, reliable and sustainable energy future. Among the most prominent topics of discussion, there were energy efficiency and digital solutions for India, which were shown to have the potential to drive enormous value across the entire electricity value chain.

Addressing the gathering, Piyush Goyal, Minister for Power, Coal and New and Renewable Energy, Government of India said, "The Future of Electricity in India depends on affordability, sustainability and energy security. To supply 24X7 Power for All at a highly affordable price in the near future, we are keen to use the latest technology to achieve the fine balance between conventional and renewable power. India provides a huge opportunity for all players with a level playing field and I welcome all global players to invest in India's energy sector."

To improve well-being and boost economic development, the GoI is targeting large capacity additions – 100 GW alone between 2017 and 2022. The International Energy Agency estimates that India's installed power generation capacity is likely to surge from just under 300 GW today to over 1000 GW by 2040. These goals were a key focus area for discussion at the Future of Electricity Summit.

Paul Simons, Deputy Executive Director, International Energy Agency, while talking about India's energy outlook, said, "India will be the single most important contributor to global energy growth up to 2040, for conventional as well as renewable power. This presents a huge opportunity in power generation, transmission & distribution as well as in enhancing energy efficiency."

Sterling and Wilson buys stakes in two companies of STC group

Sterling and Wilson (S&W), part of Shapoorji Pallonji Group and one of India's leading Solar EPC with over 1,000 MW of solar projects on ground, has acquired 51% stake inSTC Group, an Italian gas based power generation business, to expand its gas based power plant portfolio in key markets.

Presently S&W has a presence in the diesel and solar power sector. This acquisition will enable it to establish a strong foothold in the gas power plant segment globally – where STC Power has domain knowledge and capability of executing gas-based power generation projects including gas-based combined cycle power generation projects up to 200 MW capacity.

Sterling and Wilson has bought 51% stake in STC Power and 55% stake in Co.Stell, two operating companies of STC Group. STC Power is an EPC contractor of medium sized power plants between1 and 200 MW.


Khurshed Daruwala

Elaborating the strategy behind the acquisition, Khurshed Daruvala, MD, Sterling and Wilson states, "STC acquisition will allow S&W to make our first forays into Europe. More importantly, the financial strength and geographical reach of S&W combined with the strong heritage of STC will enable us to provide total turnkey EPC solutions to our customers in Europe, Middle East, Africa and India – it lays the platform for this association to make Sterling and Wilson a significant global player in the gas based power plant business. The other opportunity for the group would be to use the expertise of STC to cater to the huge demand in India for converting waste to energy."

TPREL completes acquisition of 30 MW wind farm in Maharashtra

Tata Power Renewable Energy Limited (TPREL), a 100% subsidiary of Tata Power, has completed acquisition of 100% shareholding in Indo Rama Renewables Jath Limited (IRRJL), which is a 100% subsidiary of Indo Rama Renewables Limited (IRRL). IRRJL has a 30 MW operating wind farm in Sangli District of Maharashtra. The wind farm, which is fully operational since July 2013, has a long-term power purchase agreement with Maharashtra State Electricity Distribution Limited and is registered under the Generation Based Incentive scheme of Ministry of New & Renewable Energy.

With this acquisition, Tata Power's total generation capacity now becomes 9,213 MW and current operating non-fossil based capacity at 1,704 MW.

The company has operating WIND capacity of 647 MW spread across six states of Madhya Pradesh, Maharashtra, Gujarat, Tamil Nadu, Karnataka and Rajasthan. Further, TPREL has an additional 500 MW of wind and solar capacity under development in the states of Gujarat, Andhra Pradesh, Madhya Pradesh, Karnataka and Telangana.

Speaking on achieving this milestone, Rahul Shah, CEO, TPREL, said, "Tata Power has set an aggressive target of 20,000 MW of total capacity by 2025 – and have recently revised the share of non-fossil based capacity up to 30-40% of its total generation capacity. This

acquisition of the 30 MW operational wind farm will enhance and increase its clean energy footprint. As a company, we are seeking similar opportunities to acquire operating wind and solar plants, apart from our own organic growth pipeline, to rapidly grow our generation portfolio."

Great Wall Electrical

ISO9001 ISO14001 OHSAS18001

Green Safe High-Efficient

Telecom & Solar PV Application

DC BREAKER

DC CONTACTOR

Dealers Enquiry Solicited

RATED 0.4-126kV COMPLETE SET SWITCHGEAR EQUIPMENT & MV.LV. ELECTRICAL COMPONENTS.

GSC3 Series of New AC Contactor

GSB2 Series of Miniature Case Ciricuit Breaker

GSM1 Series Molded Case Circuit Breaker

GSW1 Universal Circuit Breaker

EVH1–24 Indoor AC High–vacuum Circuit Breaker

EVH4–15/T6300–80F Indoor AC Generator Vacuum CircuitBreaker (Fixed Type)

I–AX(KYN79) Movable Metal–enclosed Switchgear Equipment

ELH1–126/T2500–40
Gas–insulated Metal–enclosed Switchgear Equipment（GIS）

Lanzhou Great Wall Electrical Co., Ltd

http://www.chinagwe.com

Tel/Fax : +86-938-2236692

AXON ELECTRIC CORPORATION

488 B, VITC Export Bhavan, 1st Floor, 4th Phase, 2nd Stage, Peenya Industrial Area, Bangalore - 58 Ph : 080 28362424 ; Mobile : 09880392429

Contact Person : Kiran Kalal | E-mail : sales@axonelcorp.com

Contact Person : James Zhu | E-mail : james.zhu@lzgwe.com

www.axonelcorp.com

Raj Acharya to become the dean of the Indiana University

Raj Acharya

He joined Penn State as Department Head of CSE in 2001...

Raj Acharya, Director of the School of Electrical Engineering and Computer Science and former Head of the Department of Computer Science and Engineering (CSE), will be leaving Penn State University in July to become the Dean of the School of Informatics and Computing at Indiana University, where he will start new engineering programmes in the school, offering degrees in computer engineering, cyber physical systems, neural engineering, molecular engineering, bioengineering, nanotechnology and environmental engineering.

"Raj Acharya's inclusive, interdisciplinary and international vision makes him the ideal leader for the school at this exciting period in its development. He has deep experience in bringing faculty together to create new programmes as well as in bringing together existing programmes and inspiring people to work together in new ways," said Lauren Robel, Indiana University's Provost and Executive Vice President.

Acharya joined Penn State as Department Head of CSE in 2001. When CSE joined the Department of Electrical Engineering in the spring of 2015, he was named Director of the newly formed School of Electrical Engineering and Computer Science. During his tenure at Penn State, Acharya helped in moving the department's research expenditures from 64th in the nation to 8th by securing a $48 million award from the U.S. Army Collaborative Research Alliances, a $10 million National Science Foundation Expedition award and a $35 million U.S. Army Network Sciences Center.

Kim Metcalf-Kupres joins the Board of Directors of Oshkosh Corporation

Kim Metcalf-Kupres

She was appointed as Johnson Controls' first ever CMO in May 2013...

Oshkosh Corporation has appointed Kim Metcalf-Kupres to its Board of Directors as a new, independent Director. She is Vice President and Chief Marketing Officer for Johnson Controls. With this addition, the Oshkosh Board voted to increase its size to 13 Directors, 12 of whom are independent.

"We are pleased to welcome Kim as the newest member of the Oshkosh Corporation Board of Directors. Kim is a champion of strategic deployment, innovation, and commercial excellence and her experience in channel management, business development and strategic marketing will assist our business and global expansion initiatives. In addition, she believes strongly in focusing on the customers' needs, understanding market dynamics and creating new technologies, all consistent with the Oshkosh Corporation MOVE strategy," said Richard M. Donnelly, Chairman, Board of Directors, Oshkosh Corporation.

Kim was appointed as Johnson Controls' first ever Chief Marketing Officer in May 2013. She directs strategy, innovation and business transformation, along with sales, marketing and communications functions across the enterprise. She is also a founding member and long-time sponsor of the Women's Resource Network at Johnson Controls, and actively engaged in gender parity work sponsored by the World Economic Forum.

Jan De Witte to take over as the CEO of Barco

Jan De Witte

He will join Barco's Core Leadership Team in June 2016...

Barco, the global technology company, has appointed Jan De Witte, a former corporate officer of the General Electric Company, as CEO-designate.

Jan will join Barco's Core Leadership Team in June 2016 to effectively take over as CEO as of 1st October 2016 following the planned retirement of Eric Van Zele, present CEO of the company. Van will continue to serve on the Board of Directors to ensure continuity of leadership and strategic focus for the company.

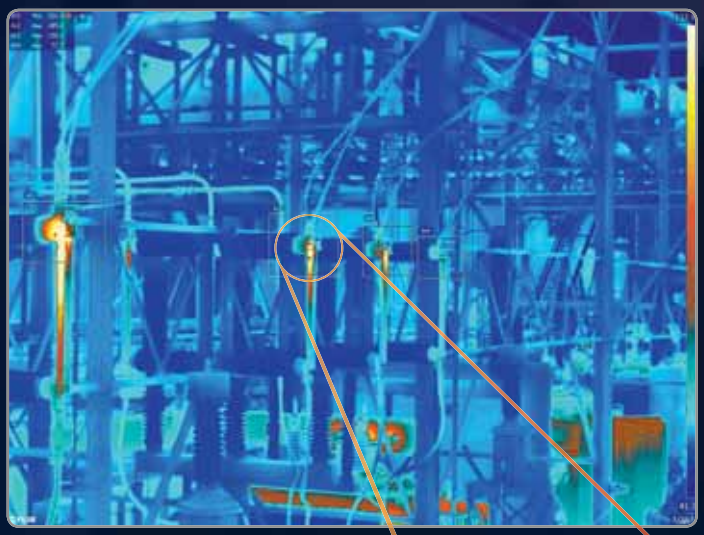
Charles Beauduin, Chairman of the Board, commented, "Under Eric's leadership, Barco became a global market and technology leader as well as a more focused and leaner organisation. His drive for strategic innovation and customer intimacy has helped harness Barco's entrepreneurial culture and shift the company's strategic direction towards more value-added software-enabled and networked solutions. The board is looking forward to continue to benefit from his insights and contributions to ensure Barco's future success."

"Following a thorough review process, the board determined Jan De Witte to be the right candidate to continue to strengthen Barco's global leadership aspirations. Jan's experience in leading global organisations combined with his background in value-added software and services make him the right executive to move Barco forward into its next phase of growth. Given his proven track record of developing new markets, driving operational efficiencies and managing product development, the board is confident that Barco, under Jan's leadership, will continue to deliver sustainable profitable growth."

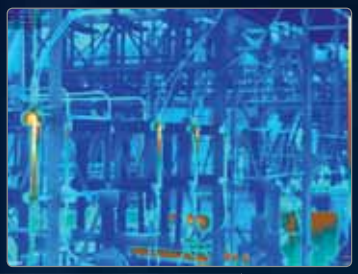
THERE'S NOT ENOUGH SPACE HERE FOR THE FULL ULTRAMAX™ STORY.

ONLY ROOM FOR A FEW GOOD EXAMPLES.

There's much more you'll want to know about how well FLIR's stunning new UltraMax resolution works and the difference it could mean to your inspections.



WITH ULTRAMAX



WITHOUT ULTRAMAX

ULTRAMAX AT 8X ZOOM

NEW T460

NEW T660

EXCLUSIVELY ON ALL THE LATEST T-SERIES CAMERAS

WWW.FLIR.IN/T-SERIES

Images used for illustrative purposes only.

For more details call us on: +91-11-4560 3555 or write to us at flirindia@flir.com.hk

FLIR Systems India Pvt. Ltd.
1111, D Mall, Netaji Subhash Place, Pitampura, New Delhi – 110034
Fax: +91-11-4721 2006 | Website: www.flir.in

FLIR®

The World's Sixth Sense®

Weak Semiconductor Market Affects The Stepper Motor Market

During the recent years, the demand for miniature stepper motor has increased, owing to its growing penetration in electronic products with size constrain...

Image Courtesy: www.jvl.dk

According to a report by P&S Market Research, titled Stepper Motor Market Analysis, Development and Demand Forecast to 2022, the global stepper motor market is expected to grow from an estimated $1,654.1 million in 2015 to $2,172.5 million in 2022, growing at a CAGR of 3.8%.

The advancement in stepper motor technology, in addition with increasing demand of waterproof stepper motors is expected to boost the demand of stepper motor system during the forecast period. During the recent years, the demand for miniature stepper motor has increased, owing to its growing penetration in electronic products with size constrain.

Permanent Magnet (PM) stepper motors are the preferred selection for high power applications, such as navy propulsion and industrial drive applications. The technical advancements, such as design of variable flux PM stepper motor facilitate high power applications with high accuracy and control. The demand for hybrid stepper motors is expected to grow in the medical equipment industry. Hybrid stepper motors are used in an array of medical equipment, including surgical hand tools, ventilation equipment, and medical pumps.

The demand for automation solutions in packaging and labeling industry has grown significantly. Modern stepper motor integrated packaging machineries are more efficient, reliable and productive at a reduced cost, which is a trend witnessed in the global stepper motor market. Waterproof stepper motors have facilitated corrosion free operation of motors used in the food and beverage packaging industry, which is another trend observed in the global market.

The growth of the stepper motor market has been affected from a weak semiconductor market in Japan, slow economic growth in Europe, along with overproduction in China. In terms of revenue, the market is expected to witness slower growth during the forecast period, compared to the current growth of the stepper motor market.

Some of the major companies operating in the global stepper motor market include Nippon Pulse Motor Co. Ltd., Schneider Electric SE., ABB Ltd., Applied Motion Products Inc., Delta Electronics Inc., Sanyo Denki Co. Ltd., National Instruments Corporation, Nidec Corporation, Oriental Motor Co. Ltd., Faulhaber Group, and Lin Engineering LLC.

Lightning & Surge protection

hakel®

Lightning Current Arrester
TYPE 1 / CLASS I

Lightning Current &
Surge Arrester
TYPE 1+2 / CLASS I+II

Surge Arrester
TYPE 2 / CLASS II

Surge Arrester
TYPE 3 / CLASS III

Surge Arrester + EMC/EMI
Filter

Coaxial Surge Arrester

Surge Protection Devices
for Information
Technology Systems

Equipotential Bonding

www.hakel.com
www.hakel.in

hakel®

Hakel spol. s.r.o.
Bratri Stefanu 980
500 03 Hradec Kralove
Czech Republic
t: + 420 494 942 300
f: + 420 494 942 303
e: info@hakel.cz
w: www.hakel.com

APS

Allied Power Solutions
T - 4, 5 & 6, Third Floor,
Pankaj Plaza - 3, I.P. Extn.,
Patparganj, Delhi - 110 092 (INDIA)
t: +91 11 2224 7322
e: info@alliedpowersolutions.com
w: www.alliedpowersolutions.org
Bengaluru: +91 98869 63195, 98860 08218
Kolkata: +91 83348 95599

CTs In Electrical Diagnostics

The double-clamp method in use...

The versatility and performance of Current Transformers (CTs) mean that many of the instruments used for testing and diagnostics of electrical insulation and earthing can be made smaller, lighter, safer, more reliable and less expensive...

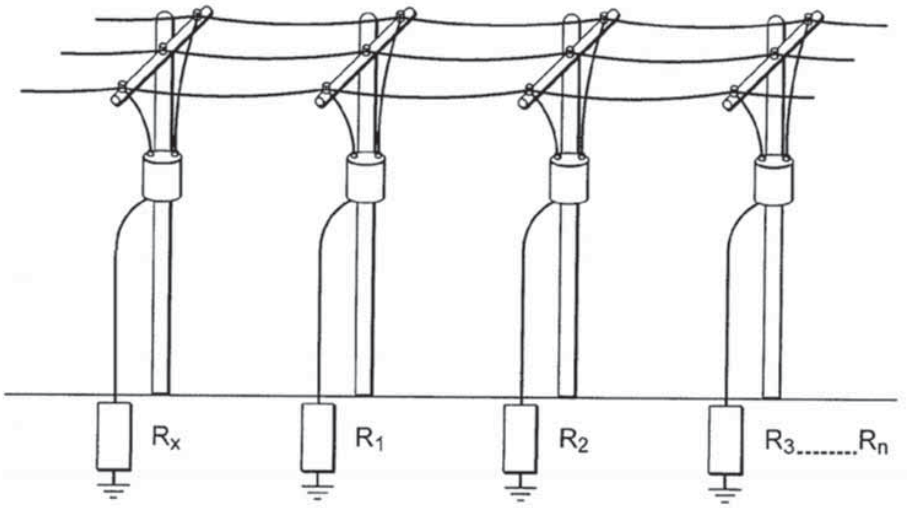


Fig. 2: An electrical installation with multiple earthing points...

In this article, we consider the role of Current Transformers (CTs) in earth resistance measurement. CTs are very useful in the diagnostics of earth or ground resistance. A large building or installation can have multiple earthing points (Fig. 4). Each earthing electrode needs regular inspection. The equivalent electric circuit is such that all the earth resistances are connected in parallel. If there are sufficiently many branches, the circuit simplifies to a single resistance in a loop, and just three branches allow good indication of problematic earth point.

For instance, let us assume that a good electrode has a resistance of 1 Ω and a faulty value is 10 Ω. There are two good electrodes and one faulty electrode. Then measurement at a good electrode will give Rx = 1 + 1||10 = 1.9 Ω, but measurement at the faulty electrode will give Rx = 10 + 1||1 = 10.5 Ω. Therefore, the faulty electrode is easily identified. The values are more accurate with more parallel branches.

The measurement would be very simple (applying Ohm's law) if it could be carried out directly. However, direct measurement is not possible because this would mean introducing a break in the loop shown in Fig. 5b. This is undesirable for safety reasons, because if a fault occurred in the installation while the loop was broken, large potential could appear and could endanger the operator or any other personnel in the vicinity of the equipment. Moreover, after re-connection there could be still doubt about the quality of connection.

A method is therefore needed where the measurement can be carried out in a non-invasive way. This can be achieved with clamp-on current transformers (Fig. 6). One of the greatest advantages of these devices is that they can be clamped around a conductor without breaking the current path and accurate measurements of AC currents can be made.

Even contactless resistance measurement simplifies to the application of Ohm's law. Under normal conditions the resistive component of impedance is dominant; capacitive and inductive contributions can be neglected. Therefore, voltage applied to the circuit generates a current that is inversely proportional to the resistance. Measuring AC with a clamp-on CT is fairly easy. It requires only the CT and an ammeter connected to its output. The difficulty lies in the application of a known voltage to a continuous circuit. However, this can be achieved by using a voltage transformer (VT).

A CT without anything connected to its output is in fact a step-up VT. So, if the secondary winding of such a transformer is driven with AC voltage, then the device becomes a step-down VT.

The CT shown in Fig. 6 has a ratio of 1000:1 so an AC of 1 A in the primary cable produces 1 mA of the output current. But the same device can be used as a VT, and if driven from the secondary side the ratio is still 1000:1, so 1 V applied to the secondary winding will induce 1 mV in the primary cable. Combining VT and CT allows the measurement of resistance value in the loop.

For this particular instrument the voltage applied is 30 V at 128 Hz. If the loop resistance is 1 Ω, this will generate a loop current of 30 mA, which will be stepped down to 30 μA by the CT. The test instrument can measure the voltage applied to the VT and the output current of the CT, and the ratios of the VT and CT are constant. Hence, in this case the loop resistance can be calculated as:

$Rx = VVT \div (ICT \cdot 1000 \cdot 1000)\ \Omega$

where: VVT = voltage applied by the instrument to the VT and ICT = output current from the CT as measured by the instrument.

It is also possible to integrate both transformers (VT and CT) into a single device. This instrument operates on the same principle as that discussed above, with two small differences: a higher operating frequency is

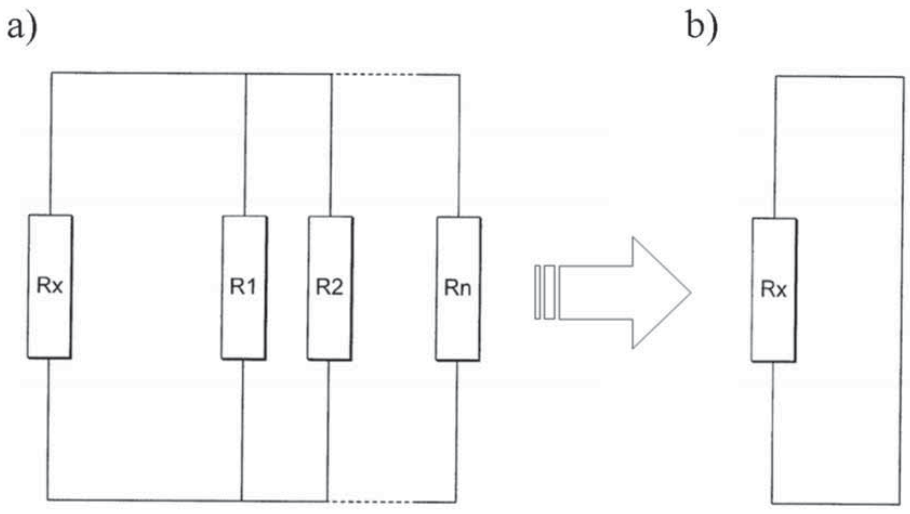


Fig. 03: Equivalent circuit of installation with multiple earthing points (a) and simplified equivalent circuit (b)...

Fig. 4: An example of a clamp-on CT...

used because the cross-section area of the cores is smaller, and there is an additional magnetic shielding between the internal VT and CT to improve measurement of small currents in the proximity of the energised VT core.

The resistance range is from 0.05 Ω to 1500 Ω. Thus, the CT has to be able to detect currents from less than 20 µA to 1 A, because the induced loop voltage is at the level of 30 mV.

Such measurement must be performed in the presence of much greater leakage currents, which might be present due to the connection to the 50 Hz (or 60 Hz) network.

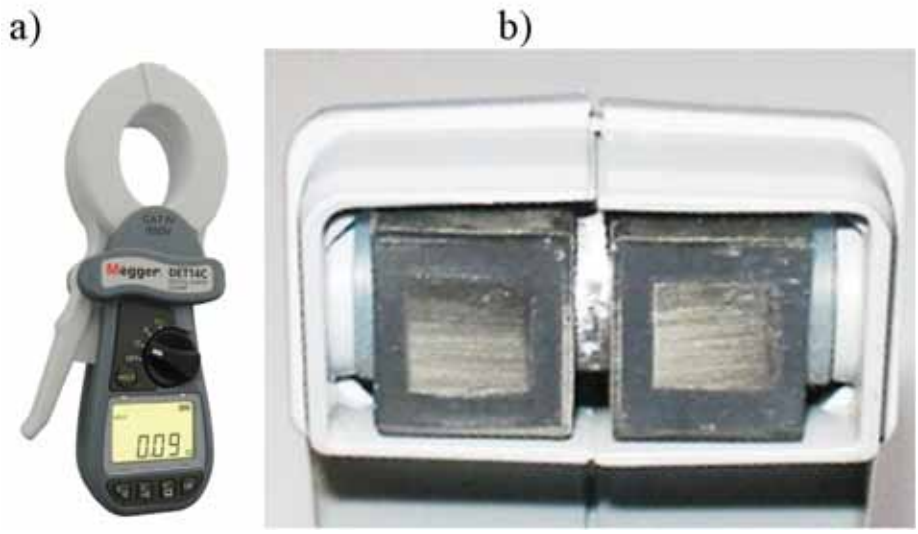


Fig. 6: An integrated double-clamp instrument, and a close up of the jaws...

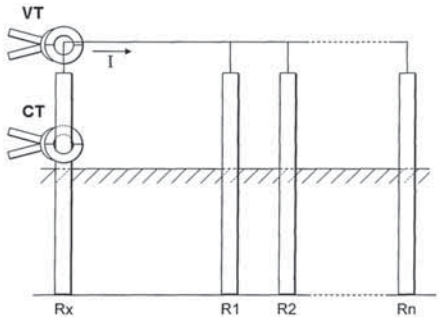


Fig. 05: Principle of the double-clamp method...

Summary

Current transformers are used for precise measurements relevant to safety and reliability in electrical installations.

Two examples were discussed in a series of articles. The first shows the use of current transformers in portable appliance testing where the leakage current in non-isolated devices needs to be detected differentially at the level of 0.0001% or 1 ppm (10 µA in 10 A). Only current transformers are capable of performing such measurement with sufficient accuracy without using very expensive instrumentation or components.

The other application is a contactless measurement of earth resistance with multiple grounding electrodes.

A current transformer in normal mode is used for current detection. Voltage is injected by driving a current transformer from its secondary side so that it behaves like a voltage transformer. The loop resistance can be thus calculated from the known voltage and measured current. The two transformers (voltage and current) can be integrated into a single instrument, to produce an easy-to-use handheld device.

In essence, the versatility and performance of current transformers mean that many of the instruments used for testing and diagnostics of electrical insulation and earthing can be made smaller, lighter, safer, more reliable and less expensive.

Dr Stan Zurek
SMIEEE
Manager
Magnetic Development
Megger

BIS accredited for Distribution Transformer Testing as per IS : 1180 – 2014
Empaneled Laboratory for BEE Star Labelled Distribution Transformer

Short Circuit Test upto 4 MVA, 33 kV Distribution Transformer

Lightning Impulse Test upto 220 kV, 100 MVA Power Transformer

Transformer Testing & Evaluation Services :

- Distribution Transformer as per IS:1180-2014
- Power Transformer as per IS:2026 & IEC:60076
- Paper Covered Copper & Aluminum Conductors
- High Voltage Bushings (upto 66 KV) & Insulators (upto 245 kV)
- CRGO Steel Laminations
- Evaluation of Solid Insulating Materials (Paper/Pressboard/ Laminated wood and boards/ Cork sheets/ etc.
- Transformer Oil (New & In-service) & Dissolved Gas Analysis (DGA)

Field and Diagnostic Services for Transformers :

- Condition Monitoring by Capacitance and Tan Delta Measurements
- Measurement of No-Load and Load Loss at Site upto 100 MVA, 220 kV
- Harmonic Measurements of Magnetizing Current
- Online Condition Monitoring by Acoustic Emission Method
- Third Party Testing (220 kV, 100 MVA) using calibrated Instruments at manufacturer's works
- Third Party Testing of Distribution Transformers at Utility Stores
- Noise Level Measurement
- Furan Analysis and Degree of Polymerization (DP) of cellulosic (Paper & Pressboards) insulating materials in Transformers

BIS accredited DT Testing (as per IS:1180-2014) Laboratory at :

- **ERDA Makarpura, Vadodara (upto 2.5 MVA, 33 KV)**
- **ERDA (West), Rabale , Navi Mumbai (upto 200 KVA, 33 KV)**

ELECTRICAL RESEARCH & DEVELOPMENT ASSOCIATION
Toll Free No. : 1800 233 2668
e-mail : bd@erda.org | web : www.erda.org

Ralf Preu, Jan Nekarda Receive 2016 Joseph von Fraunhofer Prize

At the annual meeting of the Fraunhofer-Gesellschaft on May 10, 2016 in Essen, the Joseph von Fraunhofer Prize was presented to Ralf Preu and Jan Nekarda for their innovative development...

©Dirk Mahler/Fraunhofer

In order to manufacture high efficiency solar cells in series production, Dr. Jan Nekarda and Dr. Ing. Ralf Preu (L2R) developed the Laser Fired Contact (LFC) process...

Photovoltaics and wind energy are major building blocks in the energy transformation, which is one of the biggest challenges society faces in the coming decades. “The total amount of electric energy from photovoltaic sources is more than 250 terawatt hours, approximately equivalent to the amount produced by 30 nuclear power plants. In order to help meet international climate objectives, the amount of photovoltaic power newly installed each year will have to increase by ten times over the next 15 years. On the whole, solar technology will have to become more efficient and cost-effective in order to meet the demands of this market,” explains Dr.-Ing. Ralf Preu, Division Director of PV Production Technology and Quality Assurance, at the Fraunhofer Institute for Solar Energy Systems ISE in Freiburg.

The researcher and his colleague Dr. Jan Nekarda have already made an important contribution to climate protection with the development of Laser-Fired Contact (LFC) technology, enabling the manufacture of more efficient solar cells at lower cost. At the annual meeting of the Fraunhofer-Gesellschaft on May 10, 2016 in Essen, the Joseph von Fraunhofer Prize was presented to Ralf Preu and Jan Nekarda for their innovative development. “We are delighted to receive this distinguished prize, which is not only a recognition of our work but also shows the innovative strength of the German and European photovoltaic industry,” says Dr. Ralf.

Today most solar cells are equipped with a wide-surface metallic contact, covering the entire backside of the silicon wafer and allowing electricity to flow from the cell to the electrode. This configuration however limits efficiency. A more high-performance alternative, discovered in 1989, is the Passivated Emitter and Rear Cell (PERC) technology.

In contrast to conventional cells, this technology includes an additional reflective layer on the backside of the cell and thousands of electric contact points. The LFC process developed by the Fraunhofer researchers has enabled the first industrial mass production of PERC solar cells.

Series production of highly efficient cells

A very thin non-conductive layer is deposited on the underside of a PERC solar cell between the contact layer and the wafer. Acting as a mirror, this layer reflects the share of sunlight not absorbed when penetrating the wafer back into the silicon wafer.

Since the front side also reflects this light back into the wafer, it is also captured in the silicon wafer and the efficiency level of the solar cell increases. Drawing the electricity from the wafer requires many small apertures in the non-conductive layer in order to establish contact between the electrode metal and the silicon wafer. The LFC procedure creates each of these approximately 100,000 contacts per wafer with a single laser pulse.

“The challenge was to coordinate the pulses in such a way that contact is completely established, while damage to the silicon is kept to minimal levels. Here it’s crucial that the laser light effect is limited between 50 and 2,000 nanoseconds,” explains Dr. Jan Nekarda, Group Manager

at the Fraunhofer ISE. An innovative system for guiding the laser beams makes it possible to create all the contacts in approximately one second.

"PERC solar cells made this way have an improved efficiency level of 1% absolute. With today's solar cell efficiency of approximately 20%, that's about 5% relative. We gain an additional 2% in the system, which means we increase the overall energy yield by 7%," Ralf reports.

The efficiency level is of enormous importance since the majority of costs in photovoltaics are directly proportional to surface area. "Where we need 100 square metres of solar cells today, in the future we'll only need 93 square metres to produce the same amount of electricity. This not only means less silicon, but also less module material, less material in the systems and ultimately also savings in terms of planning costs."

The Institute Director Prof. Eicke Weber was visibly pleased about the recognition received for photovoltaic research at Fraunhofer ISE. He points out the potential looming in the expanding global PV market, "In Germany, the present growth rate of PV installations is wholly inadequate to realistically achieve the targeted energy transformation.

On the international level, however, there is a fast growing multi-billion dollar market, which is supplied with first class technology from internationally leading German PV plant and equipment manufacturers."

Successful implementation in industry

Solar cell manufacturers can easily and inexpensively integrate the laser procedure in existing production processes. According to information, Hanwha Q Cells has already made 20 million cells – using LFC technology since beginning production. Companies around the world have in the meantime put PERC technology into mass production.

Ralf is excited to report, "In the current year alone manufacturers have invested more than 200 million Euros in the implementation. This finally means the establishment of the next evolutionary stage of the silicon solar cell."

Ralf and Jan were awarded the 2016 Joseph von Fraunhofer Prize for their role as initiators and drivers of this change. The jury based the award among other things on the fact that "the researchers` development helps German companies continue to succeed in the highly competitive photovoltaics market." Together with a colleague, they also received the European science prize "Innovation Award Laser Technology 2014."

Significance Of Transformer Oil Monitoring

It is of vital importance to monitor the condition of transformer oil. Periodic testing of transformer oil is necessary to ensure safe, economical, trouble free and undisturbed power supply...

The powerhouses may be far away from the load centers as in the case of hydro powerhouses – or they may be in the midst of populated areas as in the case of steam powerhouses. The transmission network is inevitable. Long and high voltage transmission lines are necessary to transmit huge blocks of power from the sources of generation to the load centers, to interconnect power-houses for increased reliability of supply, greater system stability and lesser standby power plant and hence cheaper electric energy. In between the powerhouses and receiving substations, and the ultimate consumers, no. of transformers having capacity of hundreds of MVA to hundreds of KVA or even less (distribution transformers) are installed. At sending end step-up transformers and at receiving end step-down transformers are installed. Anything going wrong anywhere with any transformer, a very huge area will be affected. Therefore, it becomes very important to monitor the transformer health, which is responsible for uninterrupted power supply. The transmission lines and circuit breakers also contribute for the same, but practically the weak link is transformer. As we all know, the petroleum-based mineral insulating oil is used in transformer as a coolant and as a dielectric medium, i.e., the oil is used for giving cooling effect as well as for providing insulation. Supposing everything else is healthy for a transformer except oil, which is not a part of workman-ship for manufacturing a transformer, the contaminated oil or the deteriorated oil can lead to tripping of transformer or failure of transformer or in the worst case bulging / bursting of transformer. So, it is of vital importance to monitor the condition of transformer oil. Periodic testing of transformer oil is necessary to ensure safe, economical, trouble free and undisturbed power supply. Oil in a transformer serves the double purpose of insulation and cooling. All oils are generally good insulators, but animal and vegetable oils are not suitable for use in transformers because these tend to form destructive fatty acids that attack fibrous materials which are normally used as winding insulation. The oil which is extensively used is called transformer oil and is a mineral oil obtained from fractional distillation of crude petroleum.

The insulating oil used for transformers meet the following requirements

a. Provide a high electric strength.
b. Permit good transfer of heat.
c. Have low specific gravity - In oil of low specific gravity particles, which have become suspended in the oil will settle down on the bottom of the tank more readily and at a faster rate, a property aiding the oil in retaining its homogeneity.
d. Have a low viscosity - Oil with low viscosity, i.e., having greater fluidity, will cool Transformers at a much better rate.
e. Have low pour point - Oil with low pour point will cease to flow only at low temperatures.
f. Have a high flash point.
   The flash point characterizes its tendency to evaporate. The lower the flash point the greater the oil will tend to vaporize. When oil vaporizes, it loses in volume, its viscosity rises, and an explosive mixture may be formed with the air above the oil.
g. Not attack insulating materials and structural materials.
h. Have chemical stability to ensure lifelong service.

Various national and international specifications have been issued on insulating oils for transformers to meet the above requirements.

The permittivity of transformer oil is 2.5. As per Indian Standard specification, the breakdown strength of new transformer oil when treated must be at least 50 KV RMS. when measured with the help of two spherical electrodes of 12.5 mm diameter and with a gap spacing of 4 mm. However, the breakdown strength is greatly reduced due to the presence of impurities like moisture, gas bubbles, solid particles etc. A major disadvantage of the transformer oil is its sludging. Sludging means slow formation of semi-solid hydrocarbons due to heat and oxidation.

Sludge is formed more quickly in the presence of bright copper surfaces. These sludges get deposited on the transformer windings, tank walls and at the bottom of the tank. Being bad conductor of heat, sludges greatly reduce the heat transfer from the windings to the oil and increase the temperature of the windings. Moreover, sludges block the cooling tubes and further increase the temperature of the transformer and may make the transformer unusable due to overheating. Sometimes to prevent sludging, certain chemicals called inhibitors are added to the transformer oil.

Inspite of many excellent properties, as it is inflammable (flash point-140ºC; due to fire hazard, C.B. manufacturers discontinued manufacture of BOCBs). To avoid the risk of fire and explosion, synthetic transformer oils are developed. Manufacturers started manufacturing other oil (liquid), which is fire retardant having flash point more than 250ºC. It is a chemical fluid. Its trade name is ASKAREL; generic name is

The breakdown voltage test for insulating oil...

PCB (Polychlorinated Biphenyl). Its dielectric strength is greater than mineral oil and its permittivity is 4.5, which is nearly equal to those of solid insulating materials.

However, a major disadvantage is that under the influence of power areas, this gets decomposed and forms hydrochloric acid, which is a greatly corrosive and toxic substance.

Though it is costly and not having comparative excellent properties like transformer oil, for years together the industries were using it - particularly PAPER industries - because of its high flash point.

But since last few years when it has been known that PCB is toxic which is very dangerous for human health, its use is stopped. Except India, all countries of the world have BANNED use of PCB and Govt. has passed orders to industries to replace ASKAREL liquid of transformers by conventional transformer oil in phased manner within a specified period of few years. Even in India, supply of transformers with ASKAREL liquid is discontinued. Government has allowed the industries the use of PCB only for topping up purpose in existing transformers. Multi-national companies purchase transformer oil only after confirming in writing (obtaining certificate) from oil manufacturers that it is not containing PCB.

Oil deterioration

Deterioration of oil begins from the moment it is filled in the transformer due to ageing and oxidation. The oil produces undesirable products like acids, sludges, moisture etc. The transformer oil is liable to deteriorate under normal operating conditions.

In some applications, oil is in contact with air. It is hence prone to oxidize, accelerated by the presence of catalysts.

Consequently, the oil darkens in colour and the acid in it begins to increase, thereby increasing sludge and consequently causing other electrical properties such as dissipation factor tan d to increase, ultimately hindering the life of transformer.

Transformer oil is petroleum based (Hydrocarbon) mineral oil. Till end of 1968, total requirement of transformer oil in the country was imported. 1968 was the golden year when first Indigenous transformer oil was produced in our country. Oil manufacturers purchase raw oil from refineries, which abstract it from crude oil. Though it is mineral oil, as more than 90% of oil is used in transformers and hence the name 'Transformer Oil.' It is like **Dalda Ghee**. Dalda is a brand name of vanaspati ghee. Dalda has become such a popular that almost all the shopkeepers will join word Dalda with other brand name. (Arun Dalda Ghee, Sagar Dalda Ghee, etc).

Three type of transformer oils are available:

Paraffinic base

Aromatic base

Naphthenic base.

Naphthenic base transformer oil is more stable compared to others. Today we are going to discuss transformer oil terminology and then testing of transformer oil in details.

Transformer oil terminology

According to Practicing Engineers, jargon of wordings - IS 335, PART – III, CLAUSE – B (i);

Basic Function of Oil & Engineers' concern - Controlled temperature – efficient cooling.

- **Insulating property**: – Should not interfere with any part. Therefore, it must be completely free from dirt, dust, fibers, moisture and other solid matters.
- Dust, dirt and moisture are enemies of electricity, remove them.
- Should be stable against oxidation at working temperature of 90 deg. C
- Right viscosity and thermal conductivity to be an efficient coolant.
- Should not have a tendency to dissolve any matter.
- Operating Engineer would perhaps be knowing standard values for these terms but often wonders what it means in practical life.
- Density of oil is 0.89 gr/cm^3 at 29.5 °C.

Specification of insulating oil

Certain properties of insulating oil are very important.

These are:

- Low viscosity.
- Low pour point.
- High flash point.
- Excellent chemical stability.
- High electrical strength.

There are also some other properties which might be less important, but for which it would nonetheless be desirable to have some say in their determination.

These include:

- High specific heat.
- High thermal conductivity.
- Good impulse strength.
- High or low permittivity, depending on intended use.
- High or low gas absorbing, depending on intended use.
- Low solvent power.
- Low density.
- Good arc quenching properties.
- Non-toxic.

Static electrification of transformer oil

When insulating oil flows through insulation ducts in power transformers, charge separation occurs at the interface of paper and oil. As a result the insulating oil and the surface of the solid materials become charged and dielectric breakdown is possible within the oil or at the interface of insulating materials. At least dozen field failures of large forced oil cooled power transformers have been found. These failures were not attributed to any specific transformer design or type of oil.

Useful information about the trend of change in the oil (can be known from its colour and odor):

COLOUR OF TRANSFORMER OIL	OIL QUALITY CLASS
Pale Yellow	Good oil
Yellow	Proposition A oil
Bright Yellow	Marginal oil
Amber	Bad oil
Brown	Very bad oil
Dark Brown	Extremely bad oil
Black	Oil in disastrous condition

- Cloudiness in oil may be due to suspended moisture or sediments such as iron oxide or sludge.
- Dark Brown coloured oil may indicate the presence of dissolved asphaltenes.
- A Green colour indicates the presence of dissolved copper compounds and a rapid deterioration of oil may be expected.
- Acrid acid smell indicates the presence of volatile acids, which can cause corrosion.
- The mineral hydrocarbon oil obtained from raw petroleum degrades through various processes.

Gas	Less than 4 years in service (PPM)	4-10 Years in Service (PPM)	More than 10 years in service (PPM)
Hydrogen	100-150	200-300	200-300
Methane	50-70	100-150	200-300
Acetylene	20-30	30-50	100-150
Ethylene	100-150	150-200	200-400
Ethane	30-50	100-150	800-1000
Carbon Monoxide	200-300	400-500	600-700
Carbon Dioxide	3000-3500	4000-5000	9000-12000

Oxidation process begins when a small quantity of oil combines chemically with the dissolved oxygen in the oil (from air) resulting the formation of traces of organic acids. Carbon dioxide (CO_2) is liberated predominantly during oxidation.

The direct breakdown of oil by arcing results in cracking of oil.

The aromatic content of the oil breaks down into simple hydrocarbons gas and hydrogen.

Acetylene and Methane are major constituents. Other hydrocarbon gases may also be liberated due to cracking.

OIL should withstand

i. 30kV for one minute for oil in drum.
ii. 40kV for one minute for oil in equipment. Short circuit current should be more than 20 m.a. above 15 kV. It is limited to 1.0 Amp max. In both the cases, withstand time is one minute.

D.S. of oil should be increased to 40 kV for one minute by filtration before transferring to electrical equipment.

Permitted water content (in PPM)

OIL	Up to 145 kV	>145 kV
New Oil	20	15
Oil in service	35	25

Generally a sample of 300--400 ml of transformer oil is taken. The electrodes may be of brass, copper, bronze or stainless steel. Diameter should be 12.7mm or 36 mm ± 0.02mm. These should be immersed in oil to be tested at 40 mm oil depth.

If stirrer is not provided with testing kit, after collecting sample of oil, the jar is put aside for at- least 20 minutes during which air bubbles mixed with oil will come on the top surface and oil will give correct B.D. strength.

The voltage rise of the apparatus should not be more than 2 KV per Sec. The auto trip relay acts in 0.02 sec after breakdown.

Generally 6 readings are taken at 1min. interval and the average of 6 is taken to give the dielectric strength of oil.

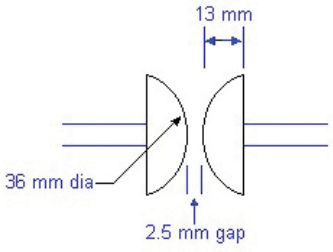
Relevant is

IS 335-1971-1983-1983A-1983B-1983E -1983F
IS 1448-1967-1970-1976-1977
IS 6103-1971
IS 6104-1971
IS 6162-1971
IS 6262-1971
IS 12177-1971-1987

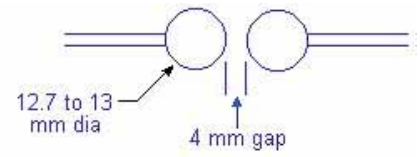
Oil alternatives

- Large transformers to be used indoors must use a nonflammable liquid or be Dry Type, i.e., having no fluid.
- Prior to about 1970, polychlorinated biphenyl (PCB) was often used as a dielectric fluid since it was not flammable. However, under incomplete combustion, PCBs can form highly toxic products, furans, etc. Due to the stability of PCB and its environmental accumulation, it has not been permitted in new equipment since late 1960's in the United States.
- Today, nontoxic, stable silicone-based or fluorinated hydrocarbons may be used, where the added expense of a fire-resistant liquid offsets additional building cost for a transformer vault. Other less-flammable

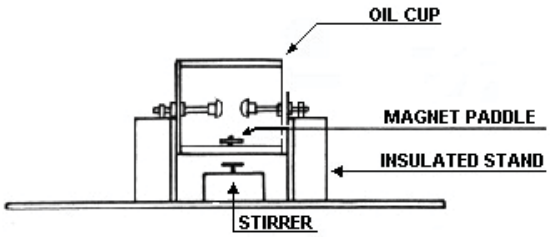
OIL TEST



(A) 13 mm wide 36 mm dia balls
Gap between two balls - 2.5 mm
(± 0.02 mm)



(B) 12.7 to 13 mm dia balls
Gap between two balls - 4 mm
(± 0.02 mm)



OIL JAR ARRANGEMENT

Moisture present in oil - free, suspended or dissolved affects performance of transformer. Dielectric strength of oil is the voltage in kV at which breakdown occurs in transformer oil. Test procedures and value (As per IS 6712)...

Laurentiu-Viorel Badicu
Product Manager

We help you feel good about your power transformer health

When it comes to the condition of power transformer insulation, we realize that you need the complete picture to assess the risk of failure and outage. That is the thought behind our on-line monitoring solution for power transformers. It provides you with a continuous assessment of all relevant dielectric data during normal operation. Insulation defects can be repaired at an early stage and more efficiently to keep your power transformers running longer.

www.omicronenergy.com/transformer

OMICRON

TESTING METHODS & STANDARDS OF TRANSFORMER OIL

SPECIFICATION OF NEW INSULATING OIL
(LOW VISCOSITY TYPE TRANSFORMER OIL)

No.	Characteristics	Test Method	IS: 335-93	
			MIN.	MAX.
1	Appearance	A representative sample oil shall be examined in a 100mm as thick layer at 27° C.	The oil shall be clear and transparent & free from suspended matter / sediments.	
2	Density at 29.5 °C.- g/cm³	IS: 1448 (P:16) -1977	-	0.890
3	Kinematic viscosity at 27° C - CST	IS: 1448 (P:25) -1976	-	27
4	Interfacial tension at 27° C. N/M	IS: 6104 -1971	0.04	-
5	Flash Point, P.M.C.C., °.C.	IS: 1448 (P:21) -1970	140	-
6	Pour Point, °C.	IS: 1448 (P:10) -1970	-	-6
7	Neutralization Value (a)Total acidity, mg, KOH/g.	IS: 1448 (P:2) -1967	-	0.03
	(b)Inorganic acidity/alkalinity mg., KOH/g		NIL	
8	Corrosive Sulphur	Annex B	Non- Corrosive	
9	Electric strength (BDV) (a)New unfiltered oil kV (RMS) (b)After filtration, kV (RMS)	IS: 6792-1992	 30 60	 - -
10	Dielectric dissipation factor (tan delta) @ 90° C.	IS: 6262-1971	-	0.002
11	Specific resistance, ohm-cm. (a)At 90° C (b) At 27° C.	IS: 6103-1971	 35 x 1012 1500x1012	 - -
12	Oxidation Stability (a)Neutralization value, after oxidation, mg KOH/g (b)Total sludge after oxidation, % by Wt.	Annex C	 - -	 0.40 0.10
13	Ageing characteristics after accelerated ageing (open beaker method with copper catalyst). (a)Specific resistance, ohm-cm (i) At 27° C. (ii) At 90° C. (b)Dielectric dissipation factor (tan delta) @ 900 C. (c)Total acidity, mg KOH/g (d)Total sludge, value, % by Wt.	IS: 12177-1987 IS: 6103-1971 IS: 6262-1971 IS: 1448 (P:2) –1967 Annex A of IS - 12177	 2.5x1012 0.20x1012 	 - - 0.20 0.05 0.05
14	Presence of oxidation inhibitor	IS: 13613 - 1992	The oil shall not contain antioxidant additives.	
15	Water content, ppm	IS: 13557-1992	50	

India's Lighting Company

Interior Luminaires

Landscape Luminaires

Environmental Luminaires

K-LITE

40 YEARS OF CREATIONS

Discover the power of the Lion.

K-LITE

K-LITE INDUSTRIES

D-10, Ambattur Industrial Estate, Chennai - 58.
Tel : 26257710, 42281950, Fax : 26257866
Cell : 95000 79797, 95000 85511
Email : info@klite.in
www.klite.in

fluids such as canola oil may be used, but all fire-resistant fluids have various drawbacks in performance, cost, or toxicity compared with mineral oil.

Synthetic oil

- SYNTHETIC OIL ARE ASKAREL OIL, MIDEL OIL, R-TEMP OIL, ENVIROTRON OIL & SILICON OIL, ETC.
- IT HAS HIGHER FLASH POINT.
- USED IN FIRE PRONE AREAS & HIGH RISE BUILDINGS.

Tips for trans. oil health

- Highest temperature should be recorded.
- Allowable temperature rise should not be crossed.
- Never compromise with quality.
- Keep temperature well within the limit.
- Schedule should be prepared for filtering.
- Team work will help a lot.
- On line monitoring should be adopted.
- Attempt should be made for opportunity maintenance.
- Limit for temperature rise should be monitored.
- Loading on transformer should be monitored.

V. G. Patel
A veteran electrical engineer and educator
He rendered 40+ years of service to Torrent Power, Ahmedabad

Jay B. Thakar
An entrepreneur in solar energy sector
An enthusiast of the Renewable Energy Sector

Online Monitor For Transformer DGA

Real-time monitoring of the dissolved gas content in transformer insulation oil allows a utility to diagnose any emerging faults quickly and reliably...

Any transformer downtime leads to substantial financial losses and to energy shortfalls for national grids. The Vaisala Optimus DGA Monitor for Transformers solves many current problems in transformer maintenance. Repairs and replacements can take months, greatly increasing associated business interruption costs.

Efficient condition monitoring is one of the only means of proactively mitigating the risk of transformer downtime. Furthermore, real-time monitoring of the dissolved gas content in transformer insulation oil allows a utility to diagnose any emerging faults quickly and reliably, and plan their maintenance activities better.

Dependable data, no false alarms

"Approximately 50% of power transformer faults can be detected with the right online monitoring tools, meaning that severe failures can be prevented. But nobody wants monitors that give false alarms or require regular maintenance. So, we created a product that does not," says Product Manager Juhani Lehto at Vaisala Controlled Environment.

Thanks to its careful design and the patented technology, the Vaisala Optimus DGA Monitor for Transformers does not give false alarms. It carries an IR sensor based on Vaisala core measurement technology and components manufactured in Vaisala's in-house cleanroom. It uses vacuum gas extraction, which gives a fully representative sample and means no data fluctuation due to oil temperature, pressure, or type. Hermetically sealed and protected optics prevent sensor contamination, and long-term drift is eliminated with a unique autocalibration functionality.

Vaisala Optimus DGA Monitor…

Installation in less than two hours

The Vaisala Optimus DGA Monitor is designed to be installed in less than two hours – just by connecting the oil, power and communications.

Browser-based user interface brings ease of use, as no additional software is needed. In case of a disturbance such as power outage, self-diagnostics enables automatic recovery.

The Optimus has a robust construction with stainless steel pipes and temperature controlled housing, and it is rated IP66. The hermetically sealed structure tolerates vacuum and pressure variation, and its magnetic pump and valves mean superb performance and durability in any environmental conditions. There are also no consumables to service or replace.

FIRE SAFE

PROVEN UP TO 400kV

PROTECTS THE ENVIRONMENT

SAVES MONEY

MIDEL

ESTER-BASED

TRANSFORMER

FLUIDS

midel.com
+91 (0)11 6517 7114 -16
midelsales@mimaterials.com
@midelfluids

[MIDEL®]
SAFETY INSIDE

a product of
M&I MATERIALS

Keeping An Eye On Transformer Health

On-line dielectric condition monitoring of bushing and transformer insulation is essential for managing transformer health. MONTRANO continuously monitors the condition of insulation in bushings and transformers...

Dielectric flashover of insulation in bushings and transformers is one of the most frequent causes of failure in power transformers. Aging insulation progressively degrades to the point that it can no longer withstand electrical stress.

This can cause bushings to explode, transformer destruction and long outages for repair.

On-line dielectric condition monitoring of bushing and transformer insulation is therefore essential for managing transformer health.

These online assessments ensure safe, reliable operation during the intended service life of transformers. The MONTRANO on-line monitoring system from OMICRON continuously assesses the dielectric health of bushings and transformers under load. The system records changes in capacitance (C), dissipation/power factor (DF/PF), partial discharge (PD) and transient over-voltages. These are primary indicators of insulation breakdown, which can lead to dielectric failure in bushings and transformers.

Advanced warning of pending failures

Detailed trend charts show you the dielectric state of insulation over time. Early warnings and alarms indicate the severity of negative trends.

This enables you to assess the risk of failure and plan corrective action early to extent transformer service life.

Reliable online results

The system is designed to minimise the misleading impact that changes in grid unbalance (phase shifts) can have on C and DF/PF measurements. It achieves this by using the individual phases of a nearby voltage transformer as an absolute measurement reference. The resulting accuracy enables reliable comparison with recommended supplier reference values to determine bushing insulation condition.

Additionally, the monitoring system employs advanced noise suppression using UHF signals and a unique gating technique for reliable PD source recognition. This enables the system to effectively separate external noise, like corona, from harmful PD.

Web-based data access

A convenient web interface enables you to view data at any time to determine the actual dielectric condition of insulation in bushings and inside the transformer. The interface also allows you to schedule monitoring, set alarm and warning thresholds and check system status.

MONTRANO provides trend data to assess the dielectric health of bushings and transformers...

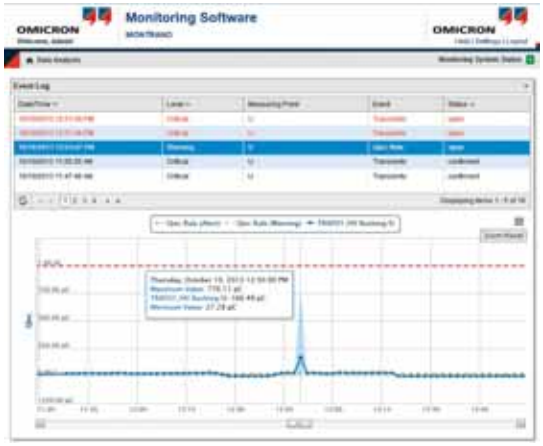
Expert monitoring support

A dedicated team of HV engineers at OMICRON provides you with expert service and support, such as onsite consulations to evaluate monitoring requirements; system installation, setup and training; as well as assistance with data evaluation and assessment reports.

Factbox – MONTRANO

- Continuous condition assessment of bushing & transformer insulation
- Absolute C, DF/PF monitoring for comparison with acknowledged standards
- Advanced noise suppression for reliable PD source detection
- HV transient recording at bushings for effective impact correlation
- Detailed trend data for modern transformer health management.

www.omicron.at/montrano



MONTRANO provides detailed trend charts that show the dielectric state of insulation over time. Early warnings and alarms indicate the severity of negative trends...

MONTRANO in use

The MONTRANO on-line monitoring system is installed at various power utilities around the world. Customer feedback has been positive about this innovative monitoring system for bushings and power transformers.

"The system was able to confirm the existence of Partial Discharge (PD) in one of our transformers. This confirmed earlier DGA results. Many other systems and techniques had been tried previously, but MONTRANO was the only system to successfully prove that the PD was real. The detailed phase resolved analysis of the results carried out by OMICRON has also indicated specific locations which could be the source of the PD."

– Mr. Colin Feely
Plant Maintenance Engineer
Powercor Australia Ltd.

"Before we started to use MONTRANO, it was not possible for to us to monitor the condition of transformers continuously.
Now with the monitoring system in place, the results that indicate possible defects can be correlated quicker.
The ability to see transient over-voltages at transformer bushings with MONTRANO also offers us new possibilities to assess transformer condition."

– Erwin Vögel
Voralberg Energienetze GmbH
Austria

About OMICRON

OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Demand Increases In Spot Power Market

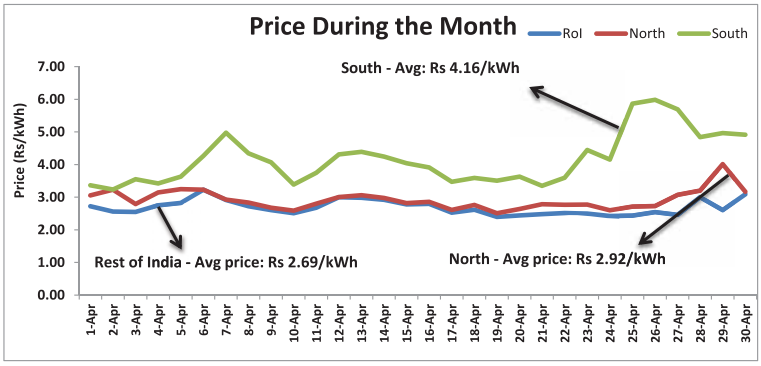
The market on an overall basis remained buyer friendly in April 2016. On an overall basis, IEX lost 10 MUs per day due to congestion, almost 11% more than 9 MUs per day lost in March...

The spot power market at IEX traded over 115 MUs on a daily average basis in April'16, highest ever since the inception of the market in the year 2008. A total of 3,465 MUs were traded in April, an increase of about 13% over 3,078 MUs traded in March. Average daily purchase bids were 6,151 MW while sell bids were 7,164 MW, an increase of about 14% and 5% respectively over the previous month.

{1 MU = 1 Million kWh (GWh)}

Thus, the market on an overall basis remained buyer friendly. Despite rising temperature and high power demand across the country, the average Market Clearing Price (MCP) in April was Rs 2.91 per unit. The average Area Clearing Price (ACP) – the price at which settlement takes place, were as below:

- ACP in North-East, East and West: Rs 2.69 per unit, 12% increase over March.
- ACP in North: Rs 2.92 per unit, 12% increase over March.
- ACP in South: Rs 4.16 per unit, 17% increase over March.



Congestion

On an overall basis, the Exchange lost 10 MUs per day due to congestion, almost 11% more than 9 MUs per day lost in March. The ER->SR and WR->SR interconnections were congested about 77% of the time and ER->NR and WR->NR interconnections were congested 36% of the time during the month.

Volumes

- Total Sell bids: 5,158 MUs
- Total buy bids: 4,428 MUs
- Total Cleared Volume: 3,465 MUs
- The Northern and Southern States were Net Buyers while the Eastern, Western and North-Eastern States were Net Sellers. The table below gives the average daily buy-sell picture at regional level for April'16 vis-à-vis March'16:

REGION	Average Daily BUY (MW)			Average Daily SELL (MW)			NET
	April'16	March'16	Change (%)	April'16	March'16	Change (%)	
North East	85.32	105.80	↓ -19%	218.00	126.81	↑ 72%	SELL
East	842.93	607.25	↑ 39%	964.26	835.10	↑ 15%	SELL
North	1821.34	1598.46	↑ 14%	999.49	738.99	↑ 35%	BUY
West	1333.63	1171.34	↑ 14%	2344.15	2182.76	↑ 7%	SELL
South	729.55	654.27	↑ 12%	286.87	253.45	↑ 13%	BUY

Participation

1,046 participants traded in the spot market on an average daily basis.

The highest participation was on 21st April, 2016 when 1,093 participants traded on the exchange.

Term-Ahead Market

About 122 MUs were scheduled during the month across all segments of the Term Ahead Market - Intraday, Day Ahead Contingency, weekly and Daily.

Contextually, IEX is India's premier power trading platform. Currently, IEX operates Day-Ahead Market (DAM) and Term-Ahead Market (TAM) in electricity as well as Renewable Energy Certificate (REC) Market.

The Exchange provides a transparent, demutualized and automated platform enabling efficient price discovery and price risk management for participants. IEX is approved and regulated by Central Electricity Regulatory Commission (CERC) – and has been operating since 27 June, 2008.

Technology of Measurement... defined

Our Metering Product Range

- Digital Panel Meters
- Multi Function Meters
- Load Mangers & Demand Controllers
- Single / Three Phase, Whole current counter/LCD type meters
- LT Trivector Meters
- Prepaid Metering Solution
- LPR (Zigbee) Metering Solution
- Data Acquisition & Billing Solutions

HPL serves wide range of metering solution with the commitment to modern technology. Offers range of meters with its Digital Panel Meters, Digital Energy meters, Multifunction Meters, Load Managers, Demand Controllers, Power Quality Meters with Metering solutions based on the wired and wireless technology such as Zigbee, GSM/GPRS etc.

Other Product Range


ébrit Range of Digital Panel Meter


Dual Source Multi-function Load Manager


Emfis range of Multi-function Meter


Power Factor Control Relays


LCD Mini


Trivector Meter

ISO-27001:2005 ISO-9001:2008 ISO-14000:2004

Ab roshan ho khushiyaan

HPL

www.hplindia.com

Thermal Performance Of Distribution Transformers

This article illustrates the thermal behaviour of transformer with respect to the temperature rise test – and also discusses various factors that influence the test results. The article is also focusing on the causes for transformer failure and with certain remedies to overcome them...

Transformers are one of the more expensive equipment found in a distribution network. The transformer's role has not changed over the last decades. With simple construction and at the same time mechanically robust, they offer long term service that on an average can reach a quarter century. When transformers operate, they tend to generate quantities of heat. The conversion of the energy inside the transformer is the reason for this heat. The generated heat varies with the load that is applied to the transformer. The higher the load, the higher will be the generated heat, which is due to the copper windings and also due to the core losses that occur during the operation of the transformer.

The primary classification would be according to the thermal insulation material. The first classification is the oil filled transformers, which use mineral based oil with cellulose paper in their insulation. Such types of transformers are usually inexpensive and they have various applications. However, oil-filled transformers display an evident weakness which is their flammability, consequently there extreme caution should be taken when such transformers are installed and maintenance operations are performed. Oil-transformers are generally restricted to outdoor installations and their indoor installations have to be monitored with great caution. The second classification based on thermal insulation is the dry category of transformers which do not make use of mineral oil for their insulation. The most common means of insulation of this type of transformers is to use a moisture resistant polyester sealant. Most often the highest quality of this type of transformers is achieved through the use a sealant that is applied with a process known as the Vacuum Pressure Impregnation (VPI). Transformers manufactured with this method will display high resistance to chemical contaminants. On the other hand, the performance of dry transformers under overload is limited and in such conditions the temperatures usually peak sharply above the standardised temperature range. For dry transformers in order to perform over the rated load, additional cooling fans have to be installed with the purpose to accelerate the dissipation of heat through forced convection.

Thermal performance

In transformer, the windings have a solid insulation of refined paper, and highly refined mineral oil is the insulating and cooling medium for the entire transformer. The core, windings and insulation all have specific thermal capabilities. Losses in the winding and core cause temperature rises in the transformer, which is transferred to the insulating oil. Failure to limit these temperature rises to the thermal capability of the insulation and core materials can cause premature failure of the transformer. The generation of heat cannot be avoided and consequently there is a standard limit that is given to a particular transformer in regard to the rise in the heat. The aforementioned limit varies from transformer to transformer – and depends on the material that is utilised in the transformer. The standardised safety regulations and the thermal dependency of other elements that are adjacent to the transformer and work along with it also have to be taken into consideration. Different cooling elements exist today that are utilised to regulate the heating of the transformer. A transformer is rated at the power output the transformer can continuously deliver at rated voltage and frequency, without exceeding the specified temperature rise. This temperature rise is based on the thermal limitations of the core, winding and insulation. Design standards express temperature limits for transformers in rise above ambient temperature. The use of ambient temperature as a base ensures a transformer has adequate thermal capacity, independent of daily environmental conditions.

Transformer heating

The amount of loss is dependent on transformer load current, as well as oil temperature. DC resistance loss increases with increasing temperature, while other load losses decrease with increasing oil temperature. All of these factors are considered in calculations of thermal transformer performance. The basic method for cooling transformers is transferring heat from the core and windings to the insulating oil. Natural circulation of the oil transfers the heat to external radiators. The radiators increase the cooling surface area of the transformer tank.

The increased number of radiators certainly makes the temperature rise to fall and same has been proved. Forced air cooling is commonly applied on large power transformers, using fans to blow air over the surface of the radiators, which can double the efficiency of the radiators. Both the IEEE and the IEC established standard designations for the various cooling modes of transformers. The IEEE has adopted the IEC designations given below. The designation completely describes the cooling method for the transformer, and the cooling method impacts the response of the transformer insulating oil to overload conditions. The cooling Class designations used in IEEE standard C57.12.00 and in previous revisions and the corresponding new designations are provided below in table 1.

Table 1: Cooling class designations

Present designations	Previous designations
ONAN	OA
ONAF	FA
ONAN/ONAF//ONAF	OA/FA/FA
ONAN/ONAF/OFAF	OA/FA/FOA
ONAN/OFAF	OA/FOA
ONAN/ODAF/ODAF	OA/FOA/FOA
OFAF	FOA
OFWF	FOW
ODAF	FOA
ODWF	FOW

Loading transformers beyond nameplate rating

There are different reasons why transformers become overloaded or why utilities may choose to overload them beyond their nameplate ratings. One reason is because the load demand has caught up or surpassed the transformer capacity and additional capacity is needed. Due to the complexity and exposure of the power system, no matter how well it is designed, failures are going to occur. It is the primary function of protective equipment to recognise such faults and isolate the faulted element from the rest of the system. This will cause the power flow to find new ways to reach the load demand. Transformers that find themselves on such paths might experience overloads beyond their normal capacity. It is possible to intelligently overload transformers to a rating that is still safe to operate by using the IEEE guide for loading of mineral-oil transformers IEEE C57.91. The guide outlines the risks, theory and calculations that make it possible to overload transformers. Understanding the aging of the insulation and how to calculate the hottest-spot winding temperature are of vital importance in order to know how much a transformer can be safely overloaded.

Thermal model for transformer

When a transformer is energized and loaded at ambient temperature (θa), dissipation caused by core losses, winding losses, stray losses in the tank and metal support structures are sources of heat which cause the transformer oil and winding temperature rise. The transformer oil is cooled by the radiator assembly and flows to the bottom of the cooling ducts to reach bottom oil temperature (θbottom). The transformer oil flows vertically upward the winding ducts and exits the winding ducts at the top winding duct oil temperature. The transformer oil enters the radiators at the top oil temperature in the main tank (θtop). IEEE Loading Guide has been used to calculate hotspot temperature. The bottom and top oil temperature are measured during temperature rise test in manufacturer's plant. In the same process the average oil temperature rise is calculated, and the average winding temperature is obtained by resistance variation. These thermal parameters are used to construct the thermal model of oil-immersed transformer, as shown in Figure.1. In this model, the hot-spot temperature is the sum of ambient temperature, top oil temperature rise (Gθtop), and hot-spot to top oil temperature gradient (GθH= H.g), where H is hot-spot factor and 'g' is thermal gradient between winding and oil average temperatures.

This diagram is based on the following assumptions:

- The change in the oil temperature inside and along the winding is linearly increasing from bottom to top.
- The increase in the winding temperature from bottom to top is linear with a constant temperature difference 'g'.

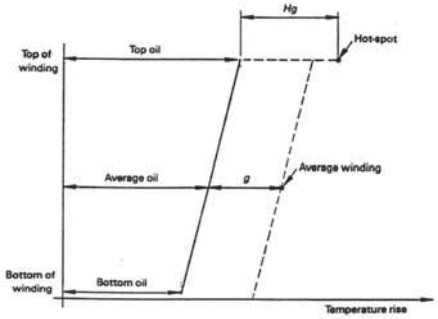


Fig. 1: Thermal model of oil-immersed transformer...

- At the top of the winding HST is higher than the average temperature rise of the winding. The difference in the temperature between the hot spot and the oil at the top of the winding is defined as H.g, where H is a hot spot factor. It may be vary from 1.1 to 1.5, depending on short circuit impedance, winding design and transformer size.

How does temperature affect the life of a transformer?

Temperature is one of the prime factors that affect a transformer's life. In fact, increased temperature is the major cause of reduced transformer life.

Further, the cause of most transformer failures is a breakdown of the insulation system, so anything that adversely affects the insulating properties inside the transformer reduces transformer life.

Such things as overloading the transformer, moisture in the transformer, poor quality oil or insulating paper, and extreme temperatures affect the insulating properties of the transformer.

Most transformers are designed to operate for a minimum of 20-30 years at the nameplate load, if properly sized, installed and maintained. Transformers loaded above the nameplate rating over an extended period of time may have reduced life expectancy.

Transformers with lower temperature rise often use windings with lower resistance. The low resistance per unit length of copper allows lower temperature rise transformers to be built without unnecessarily building a bigger transformer. For example, an aluminium-wound transformer coil requires conductors with approximately 66% more cross-sectional area than a copper-wound transformer coil to obtain the same current carrying capacity.

IEEE standards and temperatures

It is clear that the temperature produced by the transformer losses can affect the life span of the insulation.

To ensure the longevity of the transformer, transformer manufactures must guarantee that their designs are capable of operating within specified standards.

But what are the guaranteed temperatures limits stated by the standards?

The operating limits are bounded by the ambient temperature, the average winding temperature, and the maximum winding hottest-spot temperature.

According to the IEEE C57. 12.00 standard, power transformers are rated on a maximum ambient temperature of 40°C, and the average ambient temperature shall not exceed 30°C in a 24-hour period.

This standard also states that an average winding rise of 65°C shall not be exceeded when the transformer is operated at its rated load (kVA), voltage (V), and frequency (Hz).

In other words, based on the ambient temperature criteria, the average temperature of the winding cannot exceed 65°C above ambient, when operated at rated conditions.

Maximum hottest-spot winding temperature cannot exceed a value of 80°C above ambient. The IEEE C57.91states that under a continuous ambient temperature of 30°C, the maximum hottest-spot winding temperature should not exceed110°C.

The Snow Leopard is an 'Apex Predator.'
We are the 'Brand Leader' in our market sector.

mecc alte

Totally Focused. Totally Independent.

A free spirit

Mecc Alte is the world's largest independent producer of alternators and our independence means a great deal to us. It means that we're free to do what we think is best for our customers and that we have total control over our sales, distribution and every single component we use. It also means that we never compete with our customers in the end market.

We also happen to be totally committed to offering our customers the highest levels of global support. That's why our customers know that we'll always go that extra mile for them. Wherever they are.

All of these reasons go some way to explaining why so many of our customers see us as... the natural choice for alternators.

The world's largest independent producer of alternators 1 – 5,000kVA

www.meccalte.com

Mecc Alte India PVT LTD, Plot No. 1, Talegaon Dhamdhere, S.O., Tal. Shirur, Dist. Pune - 412208, Maharashtra, India

T: +91 2137 619619 F: +91 2137 619699 E: info@meccalte.in

Test methods for temperature-rise determination

It may be agreed, in special cases, to perform a test with approximately rated voltage and current by connection to a suitable load. This is mainly applicable to transformers with low rated power.

Test to steady state by short-circuit method

During this test the transformer is not subjected to rated voltage and rated current simultaneously, but to the calculated total losses, previously obtained by two separate determinations of losses, namely load loss at reference temperature, and no-load loss .The test set up is shown in figure 2.

The purpose of the test is two fold,

1. To establish the top oil temperature-rise in Steady-state condition with dissipation of total losses.
2. To establish the average winding temperature rise at rated current and with the top oil temperature rise as determined above.

This is achieved in two steps:

Total loss injection

First the top oil and average oil temperature-rises are established when the transformer is subjected to a test voltage such that the measured active power is equal to the total losses of the transformer.

The test current will be above rated current to the extent necessary for producing an additional amount of loss equal to the no-load loss, and the winding temperature rise will be correspondingly elevated.

The oil temperature and cooling medium temperature are monitored, and the test is continued until a steady-state oil temperature rise is established.

The test may be terminated when the rate of change of top oil temperature-rise has fallen below 1 k/h and has remained there for aperiod of 3 h.

Rated current injection

When the top oil temperature rise has been established, the test shall immediately continue with the test current reduced to rated current for the winding combination connected.

This condition is maintained for 1h, with continuous observation of oil and cooling medium temperatures.

At the end of the 1h, the resistances of the windings are measured, after a rapid disconnection of the supply and short circuits.

Fig.2: General Test set up for Temperature rise test...

The values of average temperature of the two windings are determined from the resistances. During the period with rated current the oil temperature falls. The measured values of winding temperature shall therefore be raised by the same amount as the average oil temperature-rise has fallen from the correct value.The corrected winding temperature value minus the cooling medium temperature at the end of the total losses injection period is the winding average temperature-rise.

The average winding temperature shall be determined using the value of resistance at the instant of shutdown. In this case, when making power shutdown, connecting the DC power supply and measuring the winding resistance, the winding temperature goes down, resulting in the lower measurement of the winding resistance compared to the instant of power shutdown. The fall of the resistance from power shutdown to measuring winding resistance is calculated by the extrapolation as indicated below in figure 3.

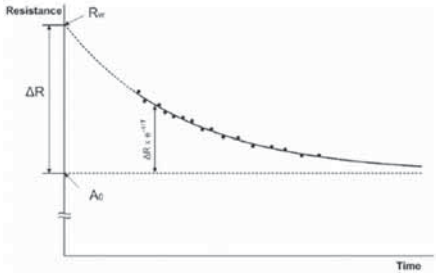
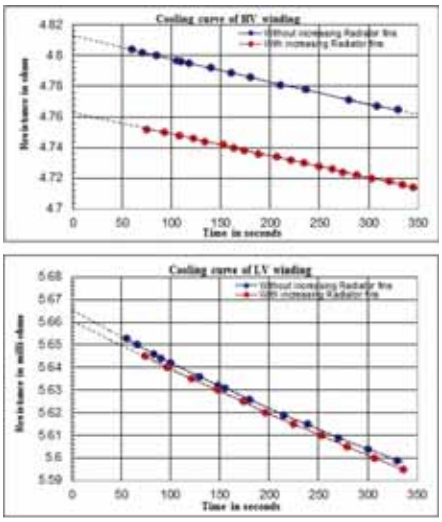


Fig. 3: Extrapolation method to predict winding rise...

It has been proved experimentally that extra cooling provided by addition of radiators for a 250 kVA, 11/.433 kV drastically reduces the winding temperature rises up to 8 deg.C on both LV and HV windings during temperature rise test. Test results can be seen by comparison given in graph 1.



Graph1: Control of temperature rise by radiator fins...

Determining winding hot spot

The hottest-spot winding temperature is the principal factor in determining life due to loading. The temperature cannot be measured directly because of the hazards in placing a temperature detector at the proper location because of voltage. Standard allowances have, therefore, been obtained from tests made in the laboratory and the insertion of thermocouples is represented in figure.4.

Fig. 4: Location of sensors to predict hot spot temperature...

The hottest-spot copper temperature is the sum of the temperature of the cooling medium, the average temperature rise of the copper, and the hottest-spot allowance. The hottest-spot allowance at rated load is 10°C for transformers with 55°C average winding temperature rise by resistance and 15°C for transformers with 65 °C average winding temperature rise by resistance.

Innovative Cable Solutions

SOLAR DC CABLES

TUV 2PfG 1169/08.2007 certified PV1-F cables
Annealed Tinned Copper
XLPO Insulation and XLPO Sheath
Zero halogen Low Smoke
Electron Beam Cross Linked
Ultra Violet Rays and Ozone resistant
Rated for 1.8 KV DC operation
Max operating Temperature 120°C
Cable Life > 25 years

Rodent proof cables also available

WIND MILL CABLES

Largest Supplier of Wind Mill Cables in India
1.1 KV LT to 33 KV HT Rubber flexible cables for Nacelle application designed to withstand high torsion conditions
Flexible PCP and FRLS CSP, CPE sheath options
Electron Beam or Chemical cross linking options
Good UV and Ozone resistance and Fire performance
Reduced bending radius Aluminium Rubber insulated cables
XLPE Insulated 1.1 KV to 33 KV cables
Medium Voltage Covered conductors

Our Esteemed Customers

Azure Power · Welspun Renewables · ALFA · vikramsolar · NTPC · adani · susten · RenEn · Orient Green Power · SunEdison · HINDUSTAN POWER · EMMVEE · Schneider Electric · Shapoorji Pallonji · RaysExperts · L&T Construction Solar Projects · WAAREE · swelect · BELECTRIC · ACME · TMEIC · REHPL · LANCO · Chemtrols Solar · Gamesa · ReGen · LEITWIND · GARUDA VAAYU · SUZLON · KENERSYS · inoxWIND · WIND WORLD

Other Product Range:

E-Beam

Solar PV Cables,
Wind Mill Cables,
Ship Wiring Cables,
Locomotive Cables,
Control & Flexible Cable,
PVC Winding wires,
Automotive Wires,
Specialty Cables.

ELECTRICAL

PVC Cables UPTO 1.1KV,
XLPE Cables UPTO 33KV,
ABC Cables upto 33kv,
Instrumentation Cables,
Concentric Core Cables,
Flexible cables & wires,
FR/FRLS/LSOH Cables,
Under Water Cables,
Fire Survival Cables.

ELASTOMER

Trailing Cables,
Locomotive Cables,
Ship Wiring Cables,
EPR, Silicon & EVA Cables.
Wind Mill Cables,
Welding Cables,
LFH Cables & Wires,
Fire Survival Cables,
Mining Cables.

TELECOM

Optical Fiber Cables,
Armored Optic Fiber cables,
Railway signaling cables
Indoor Telephonic Cables,
Composite Cables with OFC,
Fire Survival Cables OFC,
Cat3/Cat 5 LAN Cables,
Torpedo Cables,
Tow Cables.

APAR INDUSTRIES LTD.(Unit : Uniflex Cables)
12/13, Jyoti Wire House, O. Veera Desai Road, Andheri (West), Mumbai - 400 053 Phone: 022-26740001/2/3 Fax: 022-26740600 Email: info.cable@apar.com Web: www.apar.com

The Hot Spot Temperature (HST) value depends on the ambient temperature, the rise in the Top Oil Temperature (TOT) over the ambient temperature, and the rise in the winding HST over the top oil temperature.

Therefore, the Hot Spot Factor (H) in IEC 60076-2 appeared to be 2.0. In order to estimate the transformer life accurately, the hot spot temperature or hot spot factor detected by the paper winding should be applied to the IEEE and IEC standards. The thermal imaging of transformer during temperature rise gives index for heat distribution as shown in the figure 5. The losses gradually increase the temperature, damaging the insulation and overheating the core hence causing the failure.

The following are the common reasons of transformer failures due to losses.

High ambient temperature

External ambient will influence the result of the temperature rise test.The ambient temperature of the installation site should always be specified when ordering a transformer.

The failure could result in the overheating of the transformer coils leading to deterioration in the coil insulation and resulting in a complete failure of the transformer coil.

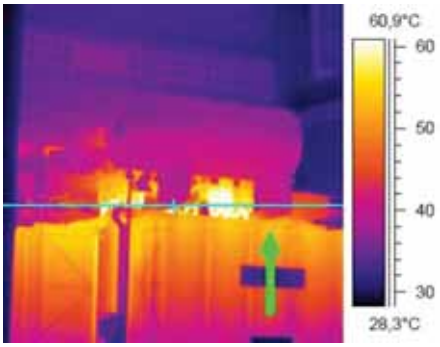


Fig. 5: Thermal imaging of transformer under TR test...

Inadequate airflow & cooling

Transformers will dissipate two types of losses, No load losses, which are iron (Fe) losses and Fullload losses which are Copper (Cu) and iron losses combined, in larger transformers these can be substantial, it is therefore essential that adequate space around the transformer or enclosure is left, to allow a natural free flow of air.

Sufficient ventilation should also be supplied to allow for a constant change of air in and around the transformer/enclosure. Failure to do so can result in the ambient air temperature dramatically increasing and consequent result in transformer failure.

Overloading

Transformers are designed to work at a given load to exceed that rating and due to harmonic loads will result in an increase in temperature. This increase in temperature will cause a rapid deterioration in the coil insulation and cause a complete failure of the transformer coil.

Cooling

The winding copper maintains its mechanical strength up to a few hundred degrees Celsius. The transformer oil does not degrade considerably below around 140°C however paper insulation deteriorates greatly if its temperature rises above about 90°C. The cooling oil flow must, consequently, guarantee that the insulation temperature is kept below this temperature as much as possible. It is by all means possible, often times with little effort, to lower the average temperature through a well-targeted intervention into the cooling system control. In extreme cases, i.e., at high ambient temperatures and questionable design of the internal cooling system, it might even be sensible to change over to a water cooling system, if it promises to lower the overall system temperature by 10-15K. The cooling methods can be either internal or external, which includes oil natural, oil forced, air natural and air forced.

The oil is moved by the thermosiphon effect through the windings. A suitable temperature difference must be achieved between the upper and the lower part. The difference is often about 15-25K by internal cooling methods. The temperature difference is mostly about 10 K by external cooling.

Conclusions

In this article, a review was made by analysing and discussing the existing studies with effect of temperature rise and factors influencing on oil-transformer aging. A condition monitoring system is considered to be essential to ensure reliability and sustainability of the transformer. At the same time, the manufacturers have to make progress in controlling the generation and the dissipation of the losses as well as using traditional or higher-temperature materials. Thus, they have to develop new calculation tools based either on simple analytical methods or using thermal modelling. Today with modern cooling systems, the effect of solar heat flux can be reduced, but the temperature is a limiting factor that should not exceed from a predetermined value.

Since, in most apparatus, the temperature distribution is not uniform, that part which is operating at the highest temperature will ordinarily undergo the greatest deterioration. Therefore, in aging studies, it is usual to consider the aging effects produced by the hottest spot temperature important.The aging pattern of the distribution transformer under extreme conditions is under further study.

S. Arjuna Rao
Engineering Officer
CPRI

G. Girija
Engineering Officer
Short Circuit Lab
CPRI

Manikandan N
Junior Research Fellow
Short Circuit Laboratory
CPRI

Swaraj Kumar Das
Joint Director
Head of Short Circuit Laboratory
CPRI

HIGH QUALITY FOR YOUR MACHINERY

MGM VARVEL
POWER TRANSMISSION

MGM brake motor main features

- TEFC 3-ph asynchronous brake motor (0.09kW-130kW)
- AC 3-ph brake (no rectifier) or DC brake on request
- Oversized brake disc for higher brake torque, longer life and reduced maintenance
- Fine and easy brake torque adjustment (as standard)
- Very quick brake reaction time
- Frequent START/STOP cycle applications
- Manual brake release (as standard)
- Hexagonal hole on non drive end of the shaft for manual rotation
- Single speed or two speeds motors
- All motors designed for inverter duty

VARVEL production lines

- RS-RT worm gearboxes: 28 to 150 mm centres. One stage worm, helical/worm and double worm.
- RD helical gearboxes: 50 to 2300 Nm. Two and three stages.
- RN parallel shaft gearboxes: 180 to 3300 Nm. Two and three stages.
- RO-RV bevel/helical gearboxes: 180 to 3300 Nm. Three stages.
- RG precision planetary gearboxes: 10 to 230 Nm. One and two stages.
- VR dry friction speed variators: IEC63 to IEC90 1 to 5 stepless speed range, 300 to 1500 rpm.
- VS planetary speed variators: IEC71 to IEC112 1 to 5 stepless speed range, 200 to 1000 rpm.

A new generation of electric motors and gearboxes for power transmission quality from the alliance of two dynamic italian companies.
For those who want quality.

MGM-VARVEL Power Transmission Pvt Ltd

Ware House No. G3 and G4 • Ground Floor • Indus Valley's Logistic Park • Unit 3 • Mel Ayanambakkam • Vellala Street
Chennai - 600 095 • Tamil Nadu, INDIA • Phone: +91 44 64627008 • info@mgmvarvelindia.com • www.mgmvarvelindia.com

REGIONAL OFFICE: KOHLI TOWERS • 4th Floor, Dapodi • Near Bharat Petrol Pump • Pune - 411012

Interview

"Choosing a wrong or low resolution product may be dangerous..."

Thermal Imaging is one of the best technologies that has been a boon for the non-destructive testing methods. FLIR Systems brings innovative sensing solutions into daily life through their thermal imaging and other systems. In an e–interview with Electrical India, T P Singh, Country Manager, Flir Systems India Pvt. Ltd. is describing the thermal imaging process and its applications in industry to P K Chatterjee. Excerpts...

Q How important is it to spot the problem before that puts the activities (in an industrial or commercial or residential environment) in a standstill condition?

A Preventive Maintenance using Thermal Imaging Camera may be one of the fundamental activities to keep the substation running without major shutdown problems due to over heating of components. This technology can help in measuring exact temperature of an object from a safe distance without touching or taking a shutdown.

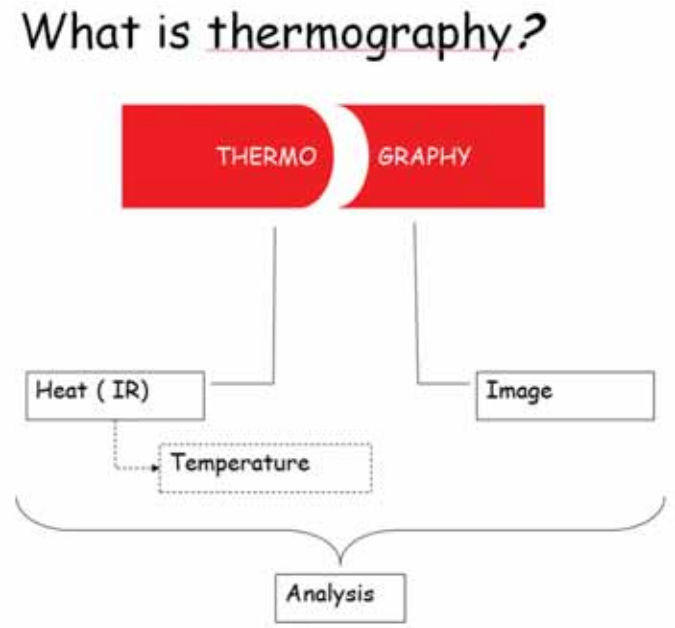
Q How does the thermal imaging technology work?

A Thermal Camera is a complex, very highly technical device, which converts IR radiations to electrical signals. Then these signals get processed by the electronics part of this device that produces the thermal Image of the object seen. The complete process has been explained by way of diagram in the next page. Light is not required at all in this process.

Q What are the key applications of this technology in electrical sector?

A In electrical field, this amazing technology can be used for multiple applications as listed and explained below:–

a. Substation Monitoring for Predictive Maintenance of all connectors
b. Transformers



c. Predictive Maintenance of other Critical Installations include:
   i. Inspection of Cables and Joints
   ii. Inspection of exposed cables
   iii. Visualisation of SF_6 leakage
   iv. Visualisation of Hydrogen gas leaks in Real time

Q Could you please give an idea of the range of thermal imagers that Flir offers in India?

A We have a complete range of products. Starting from Innovative Clamp meter with IGM to a very sophisticated high resolution camera with more than 7 Lakh pixels. We have more than 50 different products to offer for Electrical Utilities' applications.

Q What is the best and cheapest handheld instrument that you offer for smart electricians who offer small-scale service (say) for residential or commercial premises?

A We have multiple options to choose from, based upon requirement/application. Models like TG 130, TG 165, C2, CM 174, Ex series, Exx series and T4xx series are available in start and mid segment. The range starts from INR 19,999 plus tax and goes up to INR 18 Lakh for this starting range.

Q Is there any versatile pocket device that can be used for energy waste, structural defects, plumbing clogs, HVAC issues and other problems?

A Yes, our new innovative C2 is available, which can easlily go into pocket and has storage and touch screen facilities.

Q Could you please tell me about your Research & Development activities?

A FLIR has always been in the forefront for many innovations in this industry – including the first Clamp meter with IGM technology, pocket size Thermal Camera and ergonomics. We spend good amount of money every year on R&D – and results have been great products with innovative design and affordable price points.

Q How do you extend support to your customers?

A We have a service setup in Delhi to help customers to get proper after sales support.

Q What would you like to communicate to your potential buyers?

A The main message from my side will be to choose right product for your application. If the object is smaller and distance is longer, a good high resolution Thermal Camera is required for accurate measurement.

The main technical name to choose a product keeping this requirement in mind is IFOV (Instantaneous Field of View). Choosing a wrong or low resolution product may be dangerous as it may not see potential problems – and hence the main purpose behind using time, money and energy on Predictive Maintenance may go waste.

inter solar

connecting solar business | INDIA

25 1991–2016 YEARS OF INTERSOLAR

India's Largest Exhibition and Conference for the Solar Industry
Bombay Exhibition Centre, Hall 1, Mumbai

- Network with over 11,000 potential business contacts from the solar industry
- Stay up to date with the latest trends and technological developments
- Boost your brand visibility with an established B2B event

OCT 19–21 2016

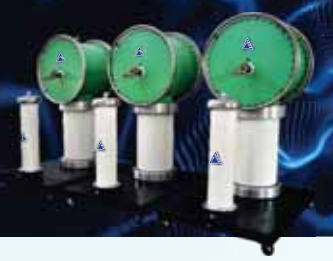
www.intersolar.in

with special exhibitions

ees INDIA

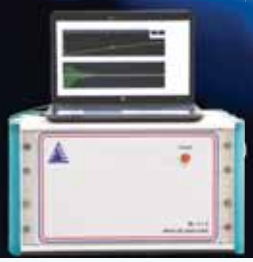
HUSUM Wind India

KVTEK THE MOST RECOGNIZED NAME IN INDIA *for* HIGH VOLTAGE TEST SYSTEMS

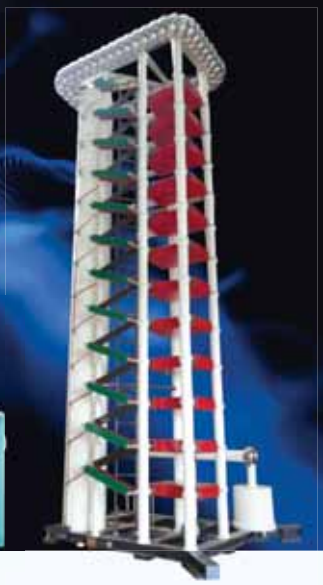


TRANSFORMER LOSS MEASURING SYSTEM

GRID SYNCHRONIZED SOLAR POWER INVERTERS



IMPULSE ANALYZER

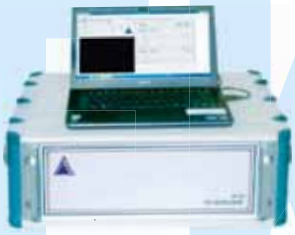


IMPULSE VOLTAGE TEST SYSTEM

PRODUCT RANGE

- Impulse Voltage Generator
- Digital Impulse Analyzer
- Recurrent Impulse Calibrator
- Recurrent Impulse Generator
- HV AC Series Resonant Test Set
- HV AC Dielectric Test Set
- Partial Discharge Detection Test Set
- RF Shielded Room
- Capacitance & Tangent Delta Test Set
- Transformer Loss Measuring System
- Static Frequency Converter
- AC/DC Kilo Voltmeter
- AC/DC Hipot Tester
- CT/PT/CVT Test Set
- Online Moisture Absorption System
- Bushing Monitor
- Grid Synchronized Solar Inverter
- Online Dissolved Gas Analyzer

KVTEK ALSO UNDERTAKES CONSULTANCY FOR DESIGNING HV LABS SUITABLE FOR PD & IMPULSE TESTING



PARTIAL DISCHARGE TEST SET

HV AC SERIES RESONANT TEST SYSTEM

APPLICATIONS

- Routine and Type Testing by Electrical Equipment manufacturers of Power & Instrument Transformers, Cables, Switchgears, Motors and Generators.
- Test Labs for conducting Third Party testing.
- Utilities for conducting residual life assessment test and regular maintenance tests.
- Educational Institutes.

STATIC FREQUENCY CONVERTER

OUR SERVICES

- Upgrade, update and refurbish existing Test Systems.
- Erections, commissioning, repair and re-commissioning.
- Operational training of Test Systems and Measuring Instruments.
- Design of High Voltage and High Current Components and Devices.

MAKE IN INDIA

For further details & quotation please contact:

KVTEK Power Systems Pvt. Ltd.

(An ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007 Certified company)

283-286, Sector-8, IMT Manesar, Gurgaon-122050. **Tel. :** +91 124 4971300 (Multiple Lines)

Fax : +91 124 4971301; **E-mail :** sales@kvtek.in; **Website :** www.kvtek.in

Reduction Of Losses

Image Courtesy: www.bhartielectricals.com

Bharti Electricals' IS2026 tested distribution transformer…

Technical losses in Distribution Transformers (DTs) occur because of the physical nature of the equipment and infrastructure of the power systems, i.e., I^2R or copper loss – in the conductor cables, transformers, switches etc., High Technical Losses (No Load & Load losses) persist in DTs of all major utilities across India – and their losses are very high when compared to the Ideal losses for the same capacity...

Power Distribution in India is facing severe challenges. Predominant among them are high network failure rates, technical losses, PQ issues, customer dissatisfaction and high costs for asset upgrade & maintenance. Distribution Transformer (DT) is a key asset of the distribution network. Among the installed 4 Million DTs in India (as per CEA statistics), 6-8 lakhs DTs fail every year resulting in high financial losses. The losses in DTs can be primarily attributed to the following reasons:

- The DTs are very old and have exceeded their operational life but are still being used
- Operations and Maintenance (O&M) of the DTs and other network assets is not followed as a rigorous and robust practice
- Utilities, especially Public Discoms and Franchisees, have limited budget for network upgradation and maintenance
- Losses due to poor standard of equipment

Further, technical losses in DTs occur because of the physical nature of the equipment and infrastructure of the power systems, i.e., I^2R or copper loss – in the conductor cables, transformers, switches, etc. High Technical Losses (No Load & Load losses) persist in DTs of all major utilities across India and their losses are very high when compared to the Ideal loses for the same capacity.

DT loss reduction through 'active' repairs

What is active repair?

Currently the most prevalent form of maintenance that takes place in Indian utilities is a breakdown repair during a fault occurrence. Across all major distribution utilities including private players, DTs are repaired when they fail or get damaged. However, considering the high technical losses on DTs, which are much greater than the ideal loss levels, DT repairs happening only at the time of breakdown/failure result in huge loss of energy.

Active repairs is a method through which DTs can be repaired even before a breakdown/ failure incident occurs, to significantly bring down the high technical losses (No Load and Load) to near ideal levels.

Active repairs involve augmentation or replacement of the active materials in a DT – Core and Winding, depending on the condition and design of the DT.

Depending on the No Load and Full Load losses, DTs can be categorised under 6 permutations and combinations, which drive the 3 types of active repairs.

Six DT categories are derived using Lower Threshold (P1) of 20% and Upper Threshold (P2) of 40%, for both No Load and Full Load loss levels (i.e. the existing loss levels compared to P1 and P2 above the Ideal loss levels), which have been arrived at in consultation with various DT experts and manufacturers.

Against each case, an action has been mapped from 5 unique actions. For Case 1, where the No Load and Full Load losses are both within 20% of Ideal loss levels, any active repairs, though can help reduce the technical losses further, are generally not economically viable.

For case 6, where both No Load and Full Load losses exceed 40% than the Ideal loss levels, any attempt to bring down these technical losses through active repairs may not be effective. In such cases, entire DT replacement may be the only viable option.

For any of the technical losses (No Load or Full Load) ranging in the 20 to 40% bracket from Ideal loss levels (Case 2 to 5), above mentioned active repair type and corresponding action can help bring down the respective technical losses to near Ideal loss levels.

Though DT technical loss reduction can also be achieved through replacement of the DTs altogether, the cost of new DTs do not justify the savings from loss reduction.

Especially in the scenario, where utilities generally have limited CAPEX and other operational budget, benefits from technical loss reduction through active repairs of DTs outweigh its cost many times over.

Types of active repairs

Aside from normal maintenance activities, the following two types of active repairs can be useful for upgrading transformers:

- Core Augmentation
- Winding Augmentation/ Replacement

Core or Winding augmentation is an approach to increase a transformers useful life. At the same time, it also improves its no load and load loss characteristics. Augmenting a transformer means upgrading the transformer by adding more cooling methods to fulfill the growing energy requirements. DTs can be modified to take increased load potential by maximising the efficiency at which excess heat is dissipated from the main core and windings.

Upgrading a transformer instead of purchasing a new unit is more cost effective, minimises disruptions to site operations and increases expected useful working life as well.

Business case for active repair

As per our study of one power distribution utility in India, which has over 4.5 lakhs consumer connections, 2,800 DTs across various capacities from 10 to 630kVA, aged from very recent procurements to as old as 1927. Most of the DTs are of 200kVA followed up 315kVA and 100kVA capacities.

Based on No Load & Full Load loss data availability of good set of DTs (some around 10 % DTs) and other key parameters like downtime losses, loading of DTs and power purchase cost growth rate it is observed that existing technical losses of DTs is very high when compared to the Ideal loses for the same capacity. For 200kVA capacity DTs, which form 50% of total DTs, the difference in total Technical Losses

Case	Existing No Load loss above Ideal No Load Loss	Existing Full Load loss above Ideal Full Load Loss	Active Repair Type	Active Repair Action
1	< 20%	< 20%	-	No Work required
2	< 20%	> 20%	1	Only Winding Replacement
3	> 20%	< 20%	2	Only Core Material Addition (With limited winding augmentation)
4	> 20%	Between 20% and 40%	3	Winding Replacement + Core Material Addition
5	Between 20% and 40%	> 40%	3	Winding Replacement + Core Material Addition
6	> 40%	> 40%	-	DT Replacement

from ideal values is more than 0.6 units per hour per DT. For some other capacities, the losses are as high as 1.63 units per hour. This results in staggering INR 21.12 Cr technical loss on DTs every year for the utility, despite being one of good managed and lower AT&C loss utilities.

If active repairs on DTs are done for this utility based on the guidelines mentioned in Section 2.1, Gross opportunity (savings from technical loss reduction) for the utility comes to INR 91.5 Cr, in a period of 10 years.

Against these, the cost of Active repairs (including cost of one-time Health Diagnostics, regular preventive maintenance, periodic oil change and filtering, future breakdown repairs, installation and transportation of DTs etc.) is estimated to approx. INR 21.1 Cr, which results in a Net savings opportunity of INR 70.4 Cr.

Even after considering a Finance cost of INR 7.96 Cr to fund the active repairs, the Net additional profitability is INR 62.5 Cr for the utility, with a ROI of 150% and Payback period of 2.74 Years.

This case is however still limited considering the 10 years timeframe considered for the utility. For other utilities with continued business perpetuity, like the state Discoms, the business case can be much bigger and much more attractive. The financing for such Energy Efficiency intervention can likely come through some form of programmatic financing.

Need for integrated player in DT management

Given the scenario, it is likely that a third party with capabilities in transformer maintenance and repairs, energy management and finance could play a significant role in the management of DTs going forward. This could be a Managed Service Provider (or MSP) who is a dedicated third party company (it can be a DT manufacturer or service provider), procuring and managing Distribution Transformers for a utility based on agreed Service Level Agreements (SLAs). This MSP can help restore the technical losses to near Ideal levels and add huge value in terms of loss reduction savings and manage DT assets with best practices.

Benefits

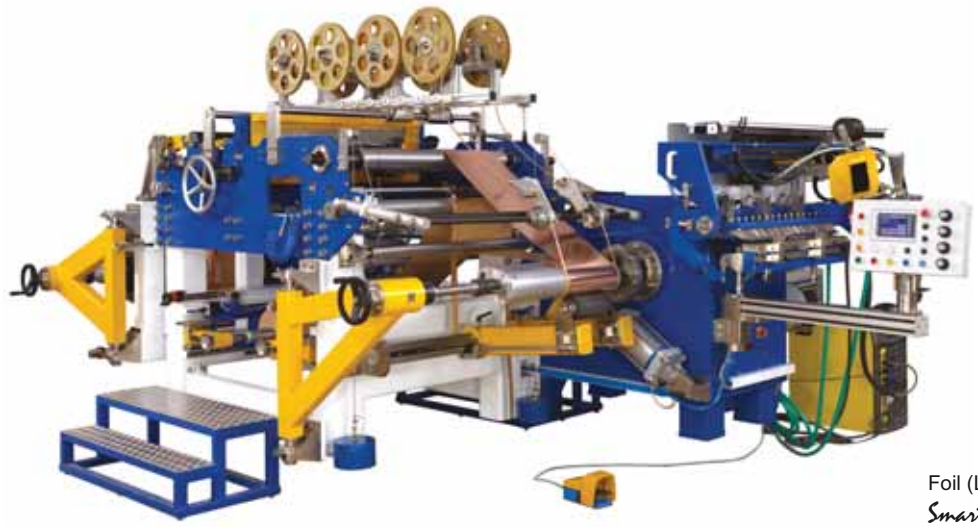
- Single agency ownership across life cycle of DT Management (from Procurement, O&M, Repairs, Scrapping etc.)
- Defined and agreed upon SLAs, and payments tied to performance of MSP. Some key parameters and its commitment by MSP are mentioned below:
  - To maintain technical losses for all DTs within maximum 10% of ideal loss levels
  - To ensure timely replacement / repair happens from inventory in case of any failure/breakdown
  - Reduction in DT Failure/Breakdown Rate
  - Regular maintenance
  - Detailed reporting of DTs maintained, DTs repaired, etc.
- Reduce and maintain no load and load losses for all DTs within maximum 10% of Ideal loss levels
- To ensure a minimum DT failure/breakdown rate (e.g. within 2% in our business case with a utility)
- Regular maintenance, oil change and timely repairs
- Additionally, MSP could also support functional uptime of other assets tied to DT like Energy Meters, Capacitor Banking etc.
- Detailed reporting of DTs maintained, DTs repaired, etc. by MSP

Source: International Copper Association India (ICAI)

Synthesis TRANSFORMER WINDING MACHINES

Automatic HV Coil Winding Machine
with Graded Layer Insulation
Smart Winder® GLI-400

Microprocessor-based Semi-Automatic
HV Coil Winding Machine
Smart Winder® Optima 1450-S



Foil (LV Coil) Winding Machine
Smart Winder® FLV-800

Our other Products:

- Semi-Automatic HV Coil Winding Machine
- Condenser Bushing Winding Machine
- PT Winding Machine
- Automatic HT & CVT Winding Machines
- Power Transformer Winding Machines

Synthesis Winding Technologies Pvt. Ltd.

#14/A, Shanthipura Road, Electronic City, 2nd Phase,BANGALORE-560100. INDIA Phone: +91-80-3028 2035/ 2020/ 2036.
E-mail: marketing@synthesisindia.com **Visit us at: www.synthesisindia.com**

Looking At The Transformer Kraft Paper

In the construction of a transformer, the most vulnerable is the paper insulation. The paper insulation begins to degrade from the day of installation. In this article, the importance of kraft paper and its process of manufacturing such as preparation, wet washing, pulping, screening, cleaning, refining, blending etc., have been presented...

Transformers play an important role in providing a reliable and efficient electricity supply – and represent the most critical equipments in electric power transmission and distribution systems. In the early days, only a few insulation materials were known for low temperature superconducting power applications. Paper was one of the first insulation materials used in high voltage technology. Of all the materials used in the construction of a transformer, the most vulnerable is the paper insulation. It comprises a combination of cellulose fibers of Kraft paper and an impregnating material, which may be a compressed gas, a liquid or vacuum. Kraft paper (a wood-pulp paper) is employed extensively in the electric power industry for insulating HV apparatus, such as transformers, capacitors and cables. The dielectric properties of such a system depend on the distribution of moisture, the applied voltage and its frequency, temperature and the density of the paper. In order to obtain the required electric strength, several sheets are stacked or rolled together. The thermal contraction of paper is low enough and elastic elongation at low temperatures is reasonable without leading to mechanical problems. Moreover, paper is very cheap compared to plastic tapes. Consisting of cellulose, the paper insulation begins to degrade from the day of installation. Once the paper degradation has occurred, it cannot be reversed. It can however be slowed down.

Paper life = Transformer life

Heat and moisture are the most commonly known factors in the degradation of the paper insulation, for each rise of 8 deg. C – the life of the paper insulation is halved (due to ageing), similarly each time the moisture content doubles the paper life is reduced by half (due to loss of mechanical strength).

During the life of transformers, contaminants also build up in the oil and are deposited in the paper, these are the by-products of the oxidation process and the effect on the paper life becomes more aggressive as the buildup increases.

As paper ages due to heat, it polymerizes, (the molecules become shortened as chemical / physical changes take place). As polymerization occurs compounds known as Furans are released and from this an assessment of the overall condition of the paper (cellulose) can be made.

New paper installed in a transformer has a DP (Degree of Polymerization) of about 1000. The degree of polymerization has a directly proportional relationship to the mechanical strength of the paper. 1000DP = 17,500 psi (+/- 120MPa). As paper loses its mechanical strength, it becomes more likely to fail. It is widely accepted that the loss of 75% of the tensile strength = the end of paper life. The effects of accelerated trials on transformer insulating paper subjected to a constant heat, which shows the non linear deterioration of the paper to slow down over time. In normal operation, most transformers have a fluctuating heat profile and this, as well as other factors such as moisture and contaminant build up in the oil / paper, seriously affects the life of the paper. This is because these other factors cause the loss of mechanical strength leading to premature failure: -

- Moisture content of the paper
- Build up of oxidation by products

At any given point in the life of the paper insulation, the level of moisture and contaminant build up will have a detrimental effect on the paper's mechanical strength, and thus the transformer's life. The effects of moisture and contaminant build up on paper strength. As the buildup of contaminants increases so the rate of paper deterioration accelerates. Although an analysis may show a reasonable residual life in terms of the DP (Degree of Polymerization) the actual life remaining will be much less due to the loss of mechanical strength. As the paper becomes weaker, the probability of failure increases and the effect of failures can be more dramatic. Maintaining the paper insulation in a healthy condition is the surest way to maximise the life of a transformer and minimise the risk of failure!

"Restore the oil and decontaminate the paper = extend the transformer life"

Process of manufacturing of kraft paper

In general, the following steps are involved in Paper Making process:

- Raw Material Preparation
- Wet Washing
- Pulping (Cooking of Raw Material)
- Washing, Screening and Cleaning
- Refining
- Blending and Stock Preparation
- Paper Making
- Finishing and Packing

A. Raw material preparation

In the case of agricultural residue, raw material received from the sources requires conditioning for preparation of pulping. Straws and Bagasse received from the fields contained dust, fine particles (other than raw material), pith and so many other undesirable materials. These non-fibrous materials require to be separated from the raw material before pulping. In case of Bagasse, dry depithing is carried out to remove pith which is non-fibrous material. For this process, Depither is installed. For Wheat Straw, Deduster is being used to remove dust, sand etc. In case of Sarkanda, a Cutter is installed to cut it in small pieces of around 10-12 mm in length to have proper penetration of the Chemicals. Other undesirable materials like Bitumen/Plastic Bags, Laminated, rotten etc. which are harmful for paper making have also been removed.

B. Wet washing

Agro based materials like Wheat Straw, Bagasse and Sarkanda came for Wet Cleaning after thorough cuttings and dry Dedusting through Deduster, Depither and cutter. Even after dry dedusting, lot of dust, sand, solids etc. remain adhere to the raw materials. Even some of the inherent Silica and Chemical like chloride which are soluble, get dissolved and taken out through washing processing. In wet cleaning System, raw material is passed through water vat and mechanically beating/ thrashing is done to de-attach sand, soil and kept for some time to get Chemicals in the raw-materials dissolved and some of the inherent silica and then wet raw material is passed through Equa separator to remove free flowing water and further passed through screw press to get desired solid percentage of raw-material suitable for cooking process.

C. Pulping

It is proven that for Paper making only fibrous material – particularly cellulose – is required and there is a need to remove non-fibrous constituent like lignin, pentasons, Resin, Pectin etc. For this, all non-fibrous components require delignification by cooking. Generally, cooking is done by soda process in which mainly Caustic Soda is used in the percentage of 10-12% for Kraft Paper and 14-16% for White Grade of Paper. Raw-Material combined Wheat Straw, Bagasse; Sarkanda etc. are cooked in Globe Digester under steam pressure of 6-7 Kgs /Cm^2 and temperature of 160-165 Deg C.

The Globe Digester is rotated for 4 Hours for re-action of this process – and then it is blown in Blow Tank to segregate the excess steam and Pulp. In further steps Pulp is screened to remove undesirable material including uncooked fiber, if any. After screening, the Pulp is passed through Single Disc Refiner to give mild refining to make homogenous slurry to have better and proper washing in washing section.

D. Washing, screening and cleaning

In Washing Section, all undesirable components; which are in liquid form including spent caustic liquor; are removed through filtration process. Then pulp is passed through Double Disc Refiner to make homogeneous slurry for smooth further processing and sent for Screening.

E. Refining

After thorough Washing, Pulp is collected in a Storage tank and finally Pulp is refined through Double Disc Refiners and Tri Disc Refiners to make the pulp suitable for paper making and to impart better fiber bonding condition – which improves the physical strength of the paper. Similarly cut and dedusted jute is cooked in Globe Digester in the same manner to remove lignin, wax, oil etc. and to make the jute softer for pulp making. Cooked Jute is chopped through Chopper Breaker and some refining is also given in the same process as well. Washing also takes place applying drum washer in between. This pulp is again screened through 6 mm hole Johnson Screen and passed through number of Centricleaners to remove sand and other impurities – which remain with the Pulp. This Pulp is thickened and refined through Tri Disc Refiner to impart desired physical strength to the Pulp. The Waste Paper does not require any cooking before pulping. It is directly slushed in Hydro Pulper in presence of Water and Mechanical thrashing. This material is also passed through Screening System to two stage i.e., turbo separator and refiner. All three types of Pulp which are kept separately sent for blending in Stock Preparation.

F. Blending and stock preparations

Different types of Pulp i.e., Agro, Jute and Waste Paper are taken in the measuring tank in desired proportion according to the quality of Paper to be made. In the same Chest some Chemicals and additives are added like around 0.4% Rosin, 5% Alum and 0.2% additives to impart physical and chemical properties to the Paper. The Pulp is kept for 30-35 minutes for re-action before sending for further processing. Next step is taken to make pulp more homogenous using Refiners i.e., refining is done through Tri Disc Refiner, Cleaning through Nos. of Centricleaners Bottles in three stages to remove uncooked, undesirable, sand, fines etc. from the pulp if any. Screened Pulp is passed through Pressure type Screening Equipment which has got 2.6 mm perforation which works on centrifugal force to remove longer fiber which is undesirable for Paper making. The accepted Pulp is taken on Paper Machine and rejected Pulp is taken separately for further processing to remove the rejects from the System.

Paper making section

For Paper making Paper Machine is having a number of different sections, which has got different functions like: -

A. Head box

Head Box is Equipment which receives cleaned pulp from the Stock Preparation and discharge on fourdrinier machine which has got wire mesh for sheet formation and the filtration of the fiber. The main function of the Head Box is to deliver the Pulp on the fourdrinier in such a manner so that the fiber can be spread across the width and on Machine direction uniformly.

B. Fourdrinier

Fourdrinier section consist a forming board, Hydro Foils, Suction Boxes, Table Rolls etc. Pulp poured on the Wire in the consistency of 1% fiber and 99% Water. Over and above, this fourdrinier is supported with wire mesh and number of drainage elements. During formation of Sheets, Water drainage takes place in control manner to have uniform and strong paper sheet. Basically, fourdrinier work is to form a proper uniform fiber sheet by draining the Water. The Pulp slurry at inlet is 1% consistency and at the outlet of the fourdrinier the consistency is raised to 20 to 22% by using gravitational discharge of Water by employing hydro foil and table rolls. More Water is removed through Vacuum Suction Boxes.

C. Top wire

It is used to impart extra strength by fine sheet formation and lamination in wet condition. Top Wire consists of all Components similar to the Fourdrinier. By using top wire, low strength of raw-materials is being used which contribute in keeping lower cost of production and giving better quality of product.

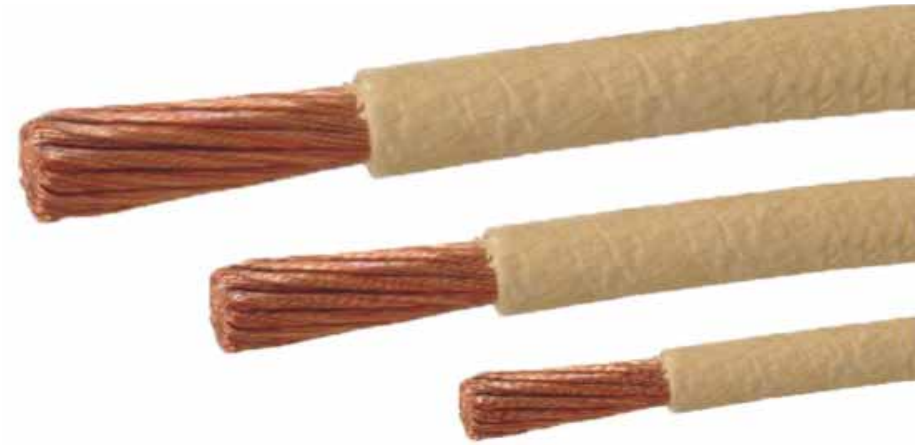
D. Presses

Formed sheet with the consistency of 22% passed through in between two heavy rolls under 70 Kgs. linear pressure to make paper sheet compact and to remove Water to make it drier. Similar type of Presses are installed in 3 stages, where application of load goes on increasing up to 200 Kgs. of linear pressure at the third Press – and finally Paper dryness is achieved about 42 - 43%.

Dryer Pressed paper sheet with the moisture of 57-58% is passed through a number of cylindrical dryer cylinders that are heated through steam to evaporate water to make the Paper dry. At the moisture of around 45%, the paper sheet is passed through M.G. Cylinder to impart one side glaze to the Paper, which is basic requirement of Semi Kraft Paper. At last, numbers of Dryers are used to dry the Paper to 6-8% moisture contents.

E. Dryer section

Pressed paper sheet with the moisture of 57-58% is passed through a number of dryer

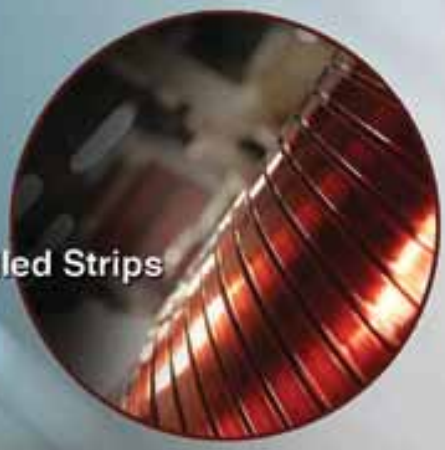


Multi paper covered copper conductor for transformers...

PRECISION WIRES INDIA LIMITED

SOUTH ASIA'S LARGEST MANUFACTURER OF WINDING WIRES

Enamelled
Round Winding Wires



Enamelled Strips

Continuosly Transposed
Conductors (CTC)

Rectangular
Taped Conductors

- Present manufacturing capacity of about 35,000 MT / annum
- ISO 9001, ISO 14001, TS 16949 and various UL certifications
- Wide range of prestigious clients in India and abroad
- State of the art plant and equipment
- Stringent quality and process control
- Approved by PGCIL, NTPC, RDSO and others

PRECISION

Phone:+91-22-2436 0089 Fax: +91-22-2437 0687
Email : marketing@pwil.net
Website: www.precisionwires.com

MILAN
WINDING WIRES

cylinders which are heated through steam to evaporate water to make the Paper dry. At the moisture of around 45% the paper sheet is passed through M.G. Cylinder to impart one side glaze to the Paper, which is a basic requirement of Semi Kraft Paper. At last, numbers of Dryers are used to dry the Paper to 6-8% moisture contents.

F. Finishing and packaging

Finally the Paper is wound on Pope Reel and sent for Slitting Rewinder to cut it in small sizes in Reel Form as per the requirements.

Types of paper

A. Epoxy - impregnated paper

As per Atkinson & Thomas in April, 1967, Epoxy-impregnated paper offers a solid insulation system having good thermal stability, high dynamic and static strengths both through and between laminations, high dielectric strength and little change in power factor with temperature and voltage. It has good chemical and moisture resistance, and high impermeability to gases and liquids. It is a resin-rich (approximately 70%) material offering one of the few solid insulation systems that is void-free, resulting in high corona-inception voltages.

B. Polypropylene paper

Headings, Buntin & Wesselhoft checked the properties of polypropylene paper in December, 1972 for possible use as an insulating material for power transmission cables carrying electric stresses excess of 500 kV for replacement of Kraft Paper. It has been recognised for some time that oil-impregnated cellulose paper will not be a useful insulating material for cables carrying in excess of 500 kV because of prohibitive dielectric loss heating and excessive increase of insulation thickness. In order to reduce dielectric losses, increase dielectric strength, and hence reduce insulation thickness in oil-filled cables, the cellulose paper has to be replaced by some properly chosen synthetic material that exhibits better dielectric properties than cellulose paper does. Such material should also have sufficient mechanical strength – and it should be compatible with liquid impregnants. Paper-like structures obtained from such polymeric materials as polyphenylene oxides and polyolefin's have shown considerable promise as replacements for cellulose paper in cable insulation. While polyphenylene oxides exhibit many attractive properties for the contemplated use in oil filled cables, they are not yet available as an industrial product with fixed specifications.

C. Thermally upgraded insulating paper

Headings As per Akira Miyoshi in September, 1976 Kraft paper is used for insulation in oil-immersed equipment such as transformers. While it has given satisfactory performance on electrical and mechanical properties, thermal degradation occurs due to temperature rise in operation. Examples of these kinds of the Kraft paper are cyanoethylated Kraft paper and amine modified Kraft paper. But Miyoshi tested the kraft paper for upgradation by immersing it in new synthetic insulation oil, alkyl-naphthalene oil, and they concluded that the Kraft paper and cyanoethylated Kraft paper are less aged in alkyl-naphthalene oil with air present than in conventional mineral transformer oil with air present.

D. Multilayer stack dry kraft paper

Paper has a cellular structure, and the thickness of each sheet varies across the sheet, several sheets are stacked or rolled together to obtain the required electric strength. A sheet of paper is a bonded layered network of randomly-arranged short fibers, lying mainly in the plane of the sheet, with a denser core and rough outer layers of less-dense material. When first a mechanical load is applied to a stack of sheets at atmospheric pressure, the total thickness decreases, as some of the air between the fibers is expelled and the fibers at the interfaces between sheets bed down in the mat. This reduction in thickness (compression) increases with increasing mechanical pressure and increasing dwell time of the load. Under vacuum, the rate of compression increases, as air and adsorbed moisture are extracted.

E. Oil impregnated insulation paper

Nasrat & Kassem focused on the electrical and physical properties of oil impregnated insulation paper under different aging conditions in January 2013, and conclude that AC breakdown voltage of insulation paper used for power transformers slightly increased at low temperature. According to them Oil filled power transformers have a composite liquid-solid insulation structure, where the oil-impregnated papers are used for both mechanical and electrical purpose. Oil impregnated papers gradually age due to thermal stress, moisture and acidity; and their degradation affects the lifetime of the power transformers. Water content is an effective parameter in the mechanical properties of insulation paper and is inversely proportional to the tensile strength. Thermal aging at 110°C, 130°C and 150°C drastically affected the electrical and mechanical performances of mineral oil impregnated papers. Breakdown voltage decreased by 14.11% for 0.4 mm thickness of paper insulation, when temperature increased from 110°C to 150°C. Tensile strength resisted to a certain extent to impregnation of paper for long times at low temp, but it is very much affected by high temperatures.

Power cables with paper-impregnated insulation with lead sheath...

Conclusion

In the research work, it is concluded that Kraft paper is the backbone of Transformer Insulation system. It passes through different processes from raw material to finished product.

Researcher have developed different types of papers for the alternate of kraft paper but still kraft paper is the best choice because of its cost and easily availability.

Vishavdeep Jindal
GZS-PTU Campus
Electrical Engineering Department
Bhatinda, India

Jashandeep Singh
Rayat Bahra Group of Institutes
Electrical Engineering Department
Patiala, India

Product Range for Nuclear\Power

MICROTEX®
Standby-Power

4	OPzS	200
5	OPzS	250
6	OPzS	300
6	OPzS	420
7	OPzS	490
6	OPzS	600
8	OPzS	800
10	OPzS	1000
12	OPzS	1500
16	OPzS	2000
20	OPzS	2500
24	OPzS	3000

TBS/OPzS
TUBULAR

CALCIUM-Plus™

Patent applied for - terminal bush design to eliminate cell cover bulging and crack due to plate growth which is a normal failure mode.

Standby-Power **OPzS** SERIES Stationary Cells in transparent SAN containers

For Nuclear Power plants, Electric Power Generation facilities, Petrochemical plants, Switchgear and control applications, Wind, hydro & solar photovoltaic, Large UPS Systems, Railway signaling, Telecommunications.

Manufactured by
Microtex Energy (P) Ltd
42, 2nd Main, 2nd Phase, Peenya Industrial Area, Bangalore-560 058, India
Tel : + 91 80 2839 2380, Fax : +91 80 2839 7243
info@microtex.in www.microtex.in facebook/microtex.energy

AREVA's PSDS Proves Its Effectiveness

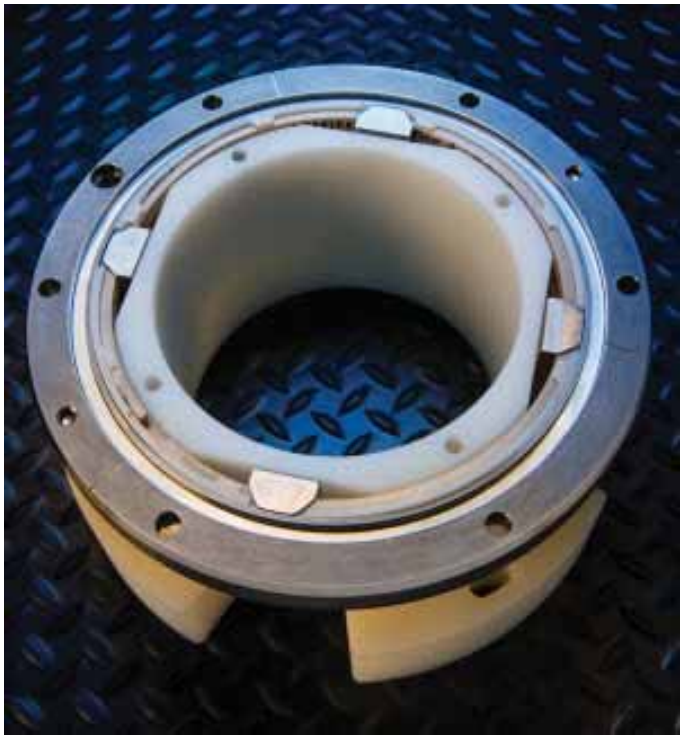
The PSDS tested product had been operating since April 2014 in the South Texas Project (STP) Electric Generating Station's Unit 1 reactor...

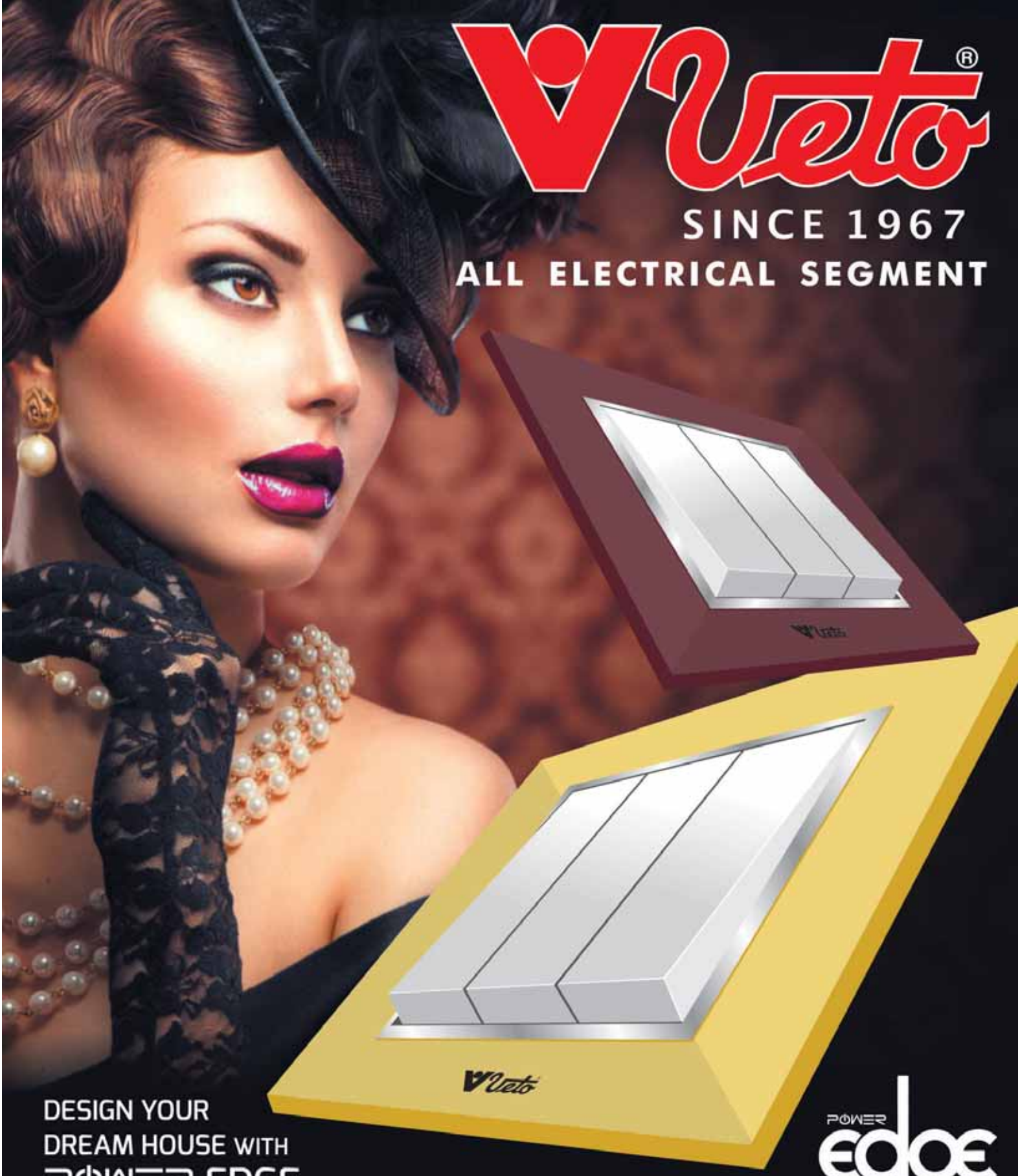
AREVA's Passive Shutdown Seal (PSDS) for reactor coolant pumps has successfully passed actuation testing after one operation cycle in a nuclear reactor. This testing confirmed the seal's ability to control leaks for an extended period in the event that the facility loses external power.

Other tests had previously verified that AREVA's PSDS withstood at temperatures and pressures representative of facility blackout conditions for more than one week. This additional demonstration of enhanced operational reliability and safety complies with the U.S. Nuclear Regulatory Commission's post-Fukushima recommendations.

"Our PSDS is a reliable, easy-to-install solution that helps reinforce plant safety. Successfully passing this rigorous test the first time without any design adjustments demonstrates our dedication to supplying our customers with high-quality products that continue to meet their standards for operational excellence," said George Beam, Senior Vice President of Installed Base Services at AREVA Inc.

The PSDS tested product had been operating since April 2014 in the South Texas Project (STP) Electric Generating Station's Unit 1 reactor. This product is part of AREVA's Safety Alliance program, which offers nuclear operators worldwide the most advanced products and services to ensure the safety of their plants. Following the completion of this actuation test, AREVA is now supplying additional PSDSs to STP for installation during scheduled maintenance.





VETO SWITCHGEARS AND CABLES LTD.

Regd. Off.: 506, 5th Floor, Landmark Building, Link Road, Andheri (W), Mumbai-400 053

Ph.: 0141-4100424 • Email : info@vetoswitchgears.com • Website : www.vetoswitchgears.com

WITH ISI MARK

Scan this QR Code on your mobile to check out the range of products from VETO

Lithium Market Fluctuations: What Will Be The Impact?

Lithium market fluctuations unlikely to significantly impact battery prices...

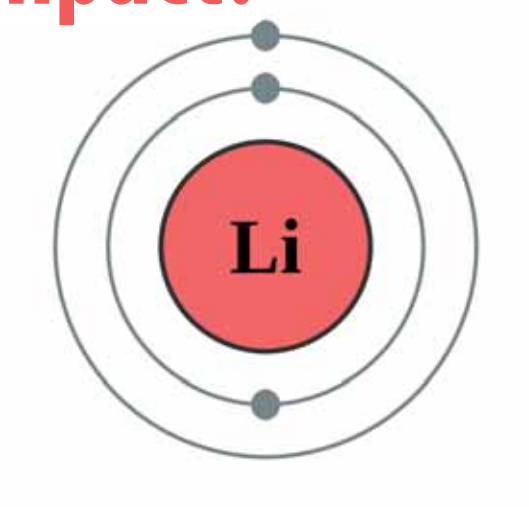


Image Courtesy: commons.wikimedia.org

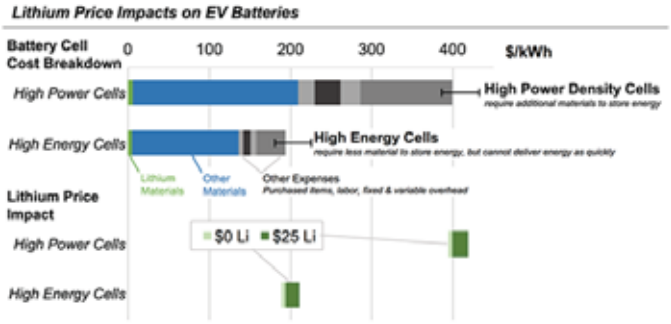
Global lithium prices have more than doubled over the last six months as battery producers scramble to secure purchasing rights from an increasingly consolidated number of lithium producers, who find themselves able to demand premium pricing as a result of a delay in bringing more lithium production capabilities online. This could be particularly concerning for the manufacturers of lithium-ion cells for electric vehicles.

To address this, a new Carnegie Mellon University College of Engineering study has found that even large increases in lithium prices are unlikely to significantly increase the cost of batteries or battery packs for end users such as vehicle manufactures or consumers, though some manufacturers may see reduced profit margins.

The Carnegie Mellon University team, whose study was published in the Journal of Power Sources, analysed multiple lithium-ion battery chemistries and cell formats to see whether extreme lithium price variations would have a substantial impact. They examined the impact on cell costs if lithium prices increased to $25/kg, more than four times the historical average, and found that lithium is a relatively small contributor to both the battery mass and manufacturing cost.

"Although the battery cost increases were the largest for high power-density cells, which require a lot of material inputs, cell costs never increased more than 10% even using the most extreme assumptions," says Rebecca Ciez, an engineering and public policy Ph.D. student.

While this is not a large percentage of total costs, it could be significant for lithium-ion battery manufacturers, like those who manufacture batteries for electric vehicles and operate on slim or negative profit margins. The paper also addresses a secondary issue: some investors urge researchers to come up with alternatives to lithium due to shortages.



"Lithium is plentiful, and our current sources are not the only sources of lithium – they are merely the cheapest. If prices do quadruple, it becomes, in principle, economical to extract lithium from sea water," says Jay Whitacre, Professor of Materials Science Engineering and of Engineering and Public Policy.

For battery manufacturers concerned about the long-term future of lithium-ion batteries, Whitacre says, "There are many other reasons to pursue different battery chemistries, but access to lithium resources is not one of them."

(This work was supported by a US National Science Foundation Graduate Research Fellowship.)

Active Harmonic Filter - PQSine™

for ideal Power Quality

Wall Mounted Design

Floor Mounted Design

Specifications :

- 12 IGBT's with 3 level Topology
- 32 bit Digital Signal Processor
- Selective Drive control algorithm
- Wall mounted and floor mounted construction
- Modular systems from 60Amp to 600Amps
- Independent operations of modules
- Compensation up to 50th Harmonic
- Ultra-fast response time 21µs
- 3phase-3wire and 4 wire configuration
- Voltage range 180V ~ 460V (4 wire) and 180V ~ 528V (3 Wire)
- Best suited for fast changing harmonic distortions
- Reactive power compensation against Capacitive and Inductive load
- Balancing of loads in all phases

Applications :

- Industries having Variable Frequency Drives, Inverters UPS, furnaces such as Paper, Steel Rolling, Textile, Garment, Software Parks, Automotive, Battery Manufacturing, Continuous Process Plants and Pharmaceutical Industries etc.
- Data centers, Hotels, Hospitals, Shopping malls and Office buildings
- Solar generation farms and Wind Turbines

Special features :

- Lowest active power loss (High energy efficiency >98%)
- High harmonic attenuation factor >98%
- True 4 wire system with full capacity 4th wire
- Neutral lead compensation of 3 * I_n
- Compliant with International standards

Customer Benefit :

- Simple installation
- User friendly menu operations
- Low life cycle cost

EPCOS India Pvt. Ltd. · A TDK Group Company www.global.tdk.com

Mumbai: 022-25 75 08 00 · Noida: 0120-4 50 58 01 · Kolkata: 033-24 19 88 15 · Bengaluru: 080 40390 600 · sales.in@epcos.com

ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 31.03.2016) (UTILITIES)

Region	Ownership/ Sector	Modewise breakup							Grand Total
		Thermal				Nuclear	Hydro	RES * (MNRE)	
		Coal	Gas	Diesel	Total				
Northern Region	State	17038.00	2879.20	0.00	19917.20	0.00	7502.55	651.06	28070.81
	Private	16606.00	108.00	0.00	16714.00	0.00	2478.00	7515.86	26707.86
	Central	12000.50	2344.06	0.00	14344.56	1620.00	8266.22	0.00	24230.78
	Sub Total	45644.50	5331.26	0.00	50975.76	1620.00	18246.77	8166.92	79009.45
Western Region	State	22800.00	2993.82	0.00	25793.82	0.00	5480.50	311.18	31585.50
	Private	36455.00	4288.00	0.00	40743.00	0.00	447.00	13386.97	54576.97
	Central	12898.01	3533.59	0.00	16431.60	1840.00	1520.00	0.00	19791.60
	Sub Total	72153.01	10815.41	0.00	82968.42	1840.00	7447.50	13698.15	105954.07
Southern Region	State	16882.50	556.58	362.52	17801.60	0.00	11558.03	488.37	29848.00
	Private	7670.00	5557.50	554.96	13782.46	0.00	0.00	15724.81	29507.27
	Central	11890.00	359.58	0.00	12249.58	2320.00	0.00	0.00	14569.58
	Sub Total	36442.50	6473.66	917.48	43833.64	2320.00	11558.03	16213.18	73924.85
Eastern Region	State	7540.00	100.00	0.00	7640.00	0.00	3168.92	225.11	11034.03
	Private	8731.38	0.00	0.00	8731.38	0.00	195.00	244.43	9170.81
	Central	14351.49	90.00	0.00	14441.49	0.00	925.20	0.00	15366.69
	Sub Total	30622.87	190.00	0.00	30812.87	0.00	4289.12	469.54	35571.53
North Eastern Region	State	60.00	445.70	36.00	541.70	0.00	382.00	253.25	1176.95
	Private	0.00	24.50	0.00	24.50	0.00	0.00	9.37	33.87
	Central	250.00	1228.10	0.00	1478.10	0.00	860.00	0.00	2338.10
	Sub Total	310.00	1698.30	36.00	2044.30	0.00	1242.00	262.62	3548.92
Islands	State	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	5.85	5.85
	Central	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub Total	0.00	0.00	40.05	40.05	0.00	0.00	11.10	51.15
ALL INDIA	State	64320.50	6975.30	438.57	71734.37	0.00	28092.00	1934.22	101760.59
	Private	69462.38	9978.00	554.96	79995.34	0.00	3120.00	36887.29	120002.63
	Central	51390.00	7555.33	0.00	58945.33	5780.00	11571.42	0.00	76296.75
	Total	185172.88	24508.63	993.53	210675.04	5780.00	42783.42	38821.51	298059.97

Source: Central Electricity Authority

Figures at decimal may not tally due to rounding off

Abbreviation:- SHP=Small Hydro Project (≤ 25 MW), BP=Biomass Power, U&I=Urban & Industrial Waste Power, RES=Renewable Energy Sources

Note :

1. RES include SHP, BP, U&I, Solar and Wind Energy. Installed capacity in respect of RES (MNER) as on 31.12.2015 (As per latest information available with MNRE)

*Break up of RES all India as on 31.12.2015 is given below (in MW) :

Small Hydro Power	Wind Power	Bio-Power		Solar Power	Total Capacity
		BM Power/Cogen.	Waste to Energy		
4176.82	25088.19	4550.55	127.08	4878.87	38821.51

2. Installed capacity of Andhra Pradesh has been bifurcated in the ratio of 53.89 and 46.11 among Telangana and New Andhra Pradeh respectively. Except the installed capacity of Thamminapatnam (300 MW), Simhapuri (450 MW) and Tanir Bhavi (220 MW) are shown in the state of New Andhra Pradesh.
3. * Koldam (1000 MW, four units) shares are provisional
4. Two units of Kondapalli Stg-II of 371 MW each taken in private sector in A.P.
5. IPP Panipuram (2x660=1320 MW) , Tied capacity of 270 MW with Telangana and balance capacity of 1050 MW has been shown in Andhara Pradesh
6. Two unis of 120 MW each of Amarkantak TPP, Chachai, MPPGCL has been retired and 240 MW capacity(Steam) has been deucted from state sector of Madhya Pradesh.
7. New Cossipore Generationg Station (2X30 MW and 2X50 MW Units) has been retired and 160 MW capacity(Steam) has been deucted from private sector of West Bengal.

Same power + Smaller transformer • Increase load capacity • Extend asset life • Improve fire safety

Tested. Validated. Proven.

Just a few of the ways to describe FR3™ fluid.

UL certified, rigorously tested over 250 times, and meets IEC and IEEE standards, FR3 fluid is chosen by utilities in more than 30 countries for improved total cost and performance advantages. That's over one million power and distribution transformers world-wide. Learn how FR3 fluid can benefit you. **Formulated for performance.**

FR3
ENVIROTEMP™ NATURAL ESTER FLUID

For more information contact:

Cargill India Pvt Ltd

14th Floor, Building 9A
DLF Cyber City, Phase III
Gurgaon 122 002,
Haryana, India

+ 91 124 4090489

Indiaenvirotemp@cargill.com

Cargill
A Cargill product

MANUFACTURER & EXPORTERS OF :

- ACSR,AAA & AA Conductors
- HT & LT Aerial Bunched Cables
- HT & LT XLPE UG Power Cables
- LT PVC Power & Control Cables
- Bare & Insulated Copper Conductors
- Airdac, Communication & Concentric Cables
- Solar Power Cables

Dynamic Cables Pvt. Ltd.
(Govt. Recognized export house)
- An ISO 9001:2008 Company -

www.dynamiccables.co.in | Info@dynamiccables.co.in

Telephone: +91 141 2332388, 2330766, 4042005

Neha Sharma: Sr. Manager(Mktg) Mob: +91 9001805444

Widely accepted by:

Major Discoms & EPC Contractors.
NTPC , PGCIL , BHEL and many more.
Power Utility Companies.
EPC Consultants.
Industrial Projects in India & Abroad.

Certified

JAIPUR • NEW DELHI • MUMBAI • HYDERABAD • KOLKATA

Forthcoming Events At A Glance

INTERNATIONAL

World Congress and Exhibition on Wind Energy

Venue: Berlin, Germany

Date: July 28th to 30th, 2016

Website: www.windenergy.omicsgroup.com

International Conference on Power and Energy Engineering

Venue: London, UK

Date: September 29th to 30th, 2016

Website: www.power-energy.conferenceseries.com

Electric Power & Renewable Energy Myanmar 2016

Venue: Myanmar Convention Centre, Yangon

Date: October 13th to 15th, 2016

Website: www.electricmyanmar.com

International Conference on Battery and Fuel Cell Technology

Venue: Dubai, UAE

Date: December 8th to 9th, 2016

Website: www.batterytech.conferenceseries.com

NATIONAL

Renewable Invest Madhya Pradesh

Venue: Courtyard Marriott, Bhopal

Date: 15th June 2016

Website: www.firstviewgroup.com

Workshop on Requirements of the National Electrical Code

Venue: UL India Pvt Ltd, Bangalore

Date: 17th June 2016

Website: T.: +91-80-41384400, Ext: 64524

Automation Expo 2016

Venue: Bombay Convention & Exhibition Centre

Date: August 22th to 25th, 2016

Website: www.iedcommunications.com

Renewable Energy India Expo

Venue: India Expo Centre, Greater Noida

Date: September 7th to 9th, 2016

Website: www.ubmindia.in/renewable_energy/home

4 Signs To Indicate Possibility Of Capacitor Malfunctioning In AC Systems

Capacitors mostly start getting damaged due to repeated voltage fluctuations (exposure to higher voltage)...

Presence of multiple capacitors in any HVAC system multiplies the chance of capacitor failure. Under such an event, the capacitance of one or more capacitors either goes down or completely disappears.

Generally, Compressor Motor Run Capacitor, Outside Fan Motor Run Capacitor, Indoor Blower Motor Run Capacitor and Start Capacitor are used in an ordinary air-conditioning system.

Capacitors mostly start getting damaged due to repeated voltage fluctuation (exposure to higher voltage).

Although, it is always suggested to call an authorised person to service the air-conditioning system, it is always helpful to have an idea of the possible fault in the system. The following four observations may help you to guess whether the AC set' malfunction is due to capacitor failure.

- Listen whether there is any clicking sound coming from the AC cabinet, if so probably some capacitor inside is failing.
- If the compressor motor capacitor malfunctions, the AC will not produce cooling effect.
- If the outside fan capacitor is not working properly, then also the compressor may fail to produce the cooling effect.

Image Courtesy: www.havells.com

Air Conditioner Dual Capacitors...

- When the indoor fan capacitor fails, air will not come out through the ventilation grill.

These are just suggestions for the user's basic understanding, it is always suggested to take assistance from an authorized person.

Special cables for robots

... more than 70 Chainflex® robot cables for three-dimensional movements from stock

±180° torsion angle, tested with up to 3 million cycles

No minimum order value.

The right cable for your requirements.

Chainflex®: cables for E-Chains® and robots.

igus®.in

plastics for longer life®

igus® (India) Pvt. Ltd.
36/1, Sy. No. 17/3
Euro School Road
Dodda Nekkundi Industrial Area - 2nd Stage
Mahadevapura, Bangalore -560048,
Karnataka, India
info@igus.in
Phone +91-80-45 12 78-00
Fax +91-80-45 12 78-02
www.igus.in

WIRE & CABLE INDIA 2016

6th International Exhibition & Conference for the Wire and Cable Industry

5 - 7 October 2016

Bombay Convention & Exhibition Centre
Goregaon (East), Mumbai, India

wire & cable

springmaking

fastener

Conference:

PCW 2016 Polymers in Cables & Wires

7 October 2016

Powered by:

POPULAR PLASTICS & PACKAGING
India's premier journal for the plastics, polymer and packaging industries

www.wire-india.com

In Association with:

MAKE IN INDIA

In co-operation with:

CII
Confederation of Indian Industry

Supported by:

wire Düsseldorf

Industry Partners:

IWCEA

IWMA INTERNATIONAL WIRE & MACHINERY ASSOCIATION

ACMAF

WCISA Wire and Cable Industry Suppliers Association

Held in conjunction with:

Metallurgy India

Tube India International

WELDING & CUTTING INDIA

Conference Organiser:

Colour Publications Pvt Ltd
The House of Many Mansions

For more information, please contact

Messe Düsseldorf India Pvt. Ltd.
Mr. Saurabh Chopra
Tel. +91 (0)11 4855 0065
Email: ChopraS@md-india.com

Messe Düsseldorf India

new

PX8000

Precision Power Scope

Where Power Meets Precision

The PX8000 brings together Yokogawa's world-leading expertise in power measurement with our long heritage in oscilloscope design to deliver a true test and measurement revolution: **the world's first precision power scope.** With the launch of the PX8000, R&D professionals need no longer compromise on their need for high-accuracy time-based power measurement, a need that conventional power analyzers and oscilloscopes were never designed to meet. As more and more innovation focuses on energy consumption and the integration of electronics into power-based systems, so more and more engineers are demanding accuracy and precision from their power measurement.

Features unique to PX8000:

- **Multifunction snapshots** - Up to 16 different waveforms – including voltage, current and power – can be displayed side-by-side, giving engineers instant snapshots of performance.
- **Detailed transient analysis** - The PX8000 supports the measurement of all power waveform parameters between precisely defined start and stop cursors.
- **Trend calculation** - The PX8000 has built-in functions for the direct calculation of variables, RMS and mean power values, to enable the identification of cycle-by-cycle trends.
- **De-skew compensation**

QUALITY ■ INNOVATION ■ FORESIGHT

YOKOGAWA

Yokogawa India Limited
Plot 96, Electronic City
Hosur Road, Bangalore - 560 100
Tel: 080-41586000 Fax: 080-28528856
Email: tmi.india@in.yokogawa.com
Web: www.tmi.yokogawa.com

Qualitrol offers smart transformer breathers

Excess humidity from the atmosphere may degrade a transformer bladder, oil and insulation system over time. This degradation causes unnecessary aging to the asset, reducing the overall life and performance. This can lead to additional maintenance or even premature and unexpected asset failure in the future

Qualitrol provides smart utility asset condition monitoring across the globe. It is one of the largest and most trusted global leaders for partial discharge monitoring, asset protection equipment and information products across generation, transmission and distribution. The company offers QUALITROL STB 100/200 Series of Smart Transformer Breathers.

The breather removes moisture from air entering oil-filled transformers or LTC conservators. The breather is automated to regenerate the silica gel desiccant at a user selectable time interval or Relative Humidity (RH) threshold. Alarming capability and communications reduce unnecessary breather maintenance costs over time. The silica gel may be regenerated many times without replacement due to internal heaters inside the unit that drive off accumulated water on a transformer exhale cycle.

For further information: www.qualitrolcorp.com

Greenheck expands energy control product line

Greenheck's line of Vari-Green energy control products has expanded with the introduction of the Vari-Green Drive (Model VGD-100), a factory-mounted and wired variable speed control for three-phase motors up to 10HP. Traditionally, most VFDs are mounted away from the fan motor, and as a result, voltage spikes can occur. Additional devices such as filters and reactors may need to be installed to mitigate possible damage to the motor. Internally mounted within the fan housing, the Vari-Green Drive virtually eliminates voltage spikes that can contribute to motor performance issues and motor failure.

The preprogrammed drive uses R3 filtering technology to significantly reduce electrical harmonics back into the building. No field installation or start-up is required saving contractors time. The Vari-Green Drive optimises energy savings and efficiency of ventilation systems in a variety of applications.

For further information: www.greenheck.com

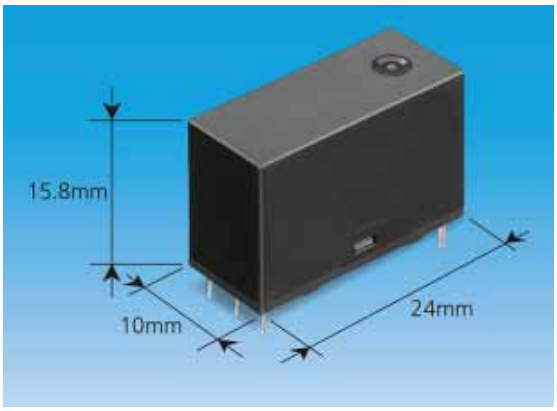
Larson offers temporary power distribution system

The Larson Electronics MGL-100C-480-15K-120-208Y-12X20 Temporary Power Distribution System converts 480 VAC three phase electrical current to 120V AC and 208Y AC 60hz. This power distribution system provides operators the ability to safely tap into and distribute 480VAC power from a variety of sources including generators and direct grid power. This portable substation is suitable for outdoor applications, with a fully potted transformer and Nema 3R load center. This power distribution system is configured to transform 480V 3 phase to 120/208Y.

This power distribution system is NEMA 3R rated and ideal for indoor/outdoor use and applications including but not limited to; construction sites, plant maintenance, plant turnarounds, hazardous location operations, shows, exhibits and shipyard operations.

For further information: www.larsonelectronics.com

Panasonic launches relay for smart switches



Panasonic Corporation has developed and will release this month a thin-design DW Relay (Inrush Low-profile relay) suited for remote-control applications such as smart switches and smart power outlets used in smart homes. The product conforms to overseas safety standards and responds to the growing demand for smart homes in overseas markets.

Features:

- Thin product height of 15.8 mm allows for compact-sizing with no loss of functionality for remote-control systems.
  - Dimensions (WxLxH) (mm): 10.0 × 24.0 × 15.8
    (Panasonic's conventional product* (WxLxH) (mm): 10.0 × 24.0 × 18.8)
    *DW relay (inrush type)
- Holding power of the coil is zero by adopting a latching function, contributing to reduce the power consumption of the remote control system.
- Conforms to overseas safety standards designed to enhance the safety and reliability of remote control systems
  - USA UL Standards, Canada cUL (CSA) Standards, Germany VDE Standards China's CQC certification is scheduled to be obtained (within FY2016).

Applications:

Remote-control systems for lighting, home appliances, etc.

For further information: www.panasonic.com

LED Bollards to provide vandal proof service

Efficient and cost-effective LED bollards with rotationally symmetrical illumination for ground surfaces. The photometric design of these luminaires is based on LED integrated with K-Lite's precision reflector module. Consistent implementation of a new technological development combined with the highest technical and structural quality have resulted in these state of art luminaires. These luminaires are characterised by their high luminous efficiency, extremely long service life and the uniformity of the degree of illuminance. These luminaires are available in Ø100 and Ø166, three different heights to suit the installation site. Their sturdy construction makes them especially suitable for areas in which considerable robustness is required to ensure vandal proof service.

- Extruded aluminium alloy housing through homogenization for durability and thermal management.
- Stainless Steel hardware used for long life and for easy of maintenance.
- Silicon EPDM gasket used for IP ratings and conforming to the safety and reliability requirements of the products.
- UV stabilized, non yellowing polycarbonate diffusers for better light transmission, vandal resistant and UV stabilisation.
- Finished with 60 micron thick polyester based powder coating for uniform deposition and excellent finish.
- CREE / OSRAM / NICHIA make LEDs, which are internationally recognized brands with higher lumen output are used for better illumination and longevity.

Application : For the illumination of footpaths, entrance areas, driveway, private and public areas.

For further information: www.klite-lighting-luminaires.com

ISA s.r.l., is a reputed manufacturer of high quality electrical test and measurement equipment since 1938. We have a state of the art manufacturing facility at Taino, a small but very beautiful town near Lake Maggiore which is around 50 km from the city of Milan, Italy.

We are a truly global company with our operations spread over more than 100 countries, either through our own resource centers or through fully trained Sales Representatives. We are recognized worldwide for our Innovative Products with Rugged Hardware and User-friendly Software. All our products are developed, designed and manufactured in compliance with International standards and are tested thoroughly to be used in severe working environment like HV / EHV substations and heavy industrial plants.

We also have comprehensive software called Test & Data Management Software (TDMS) which helps the customer in maintaining their data base and the management and analysis of the results obtained from the testing of their electrical assets.

In India, we have a subsidiary company, ISA ADVANCE INSTRUMENTS INDIA PVT. LTD., which was incorporated in September, 2012. Since our incorporation, we are growing exponentially. Our office and the support centre are based in NOIDA. We have good team of application engineers who are providing pro-active support to all our esteemed customer.

REGIONAL OFFICE - SOUTH ASIA

C-33, Ground Floor,
Sector-2, NOIDA-201301,
Uttar Pradesh, INDIA

T +91 120 4543853 / 54 / 4222712
F +91 120 4574772
Email info.asia@isatest.com

TDX 5000

CBA 3000

We have been catering to the niche market and are supplying our instruments to the following customers:

1.Power Utilities
2.Equipment manufacturers
3.Oil & Gas sector
4.Renewable Energy producers
5.EPC contractors and Electrical Consultants
6.Testing Service Companies

Our product portfolio includes different equipment for various applications like:

- **Multi-functional Test Kits for Power Transformer, Instrument Transformers etc. (STS Family)**
- **Automatic Three Phase Relay Test Kits (DRTS Family)**
- **Single Phase Secondary Injection Kits (T 1000 Plus / TD 1000 Plus)**
- **Circuit Breaker Analyzers (CBA 1000 / CBA 2000 / CBA 3000)**
- **Primary Current Injection Kits (T 2000 / T 3000 / eKAM / KAM)**
- **Automatic Tan Delta Test Kits (TDX 5000 / STS 3000 + TD 5000)**
- **Metal Oxide Surge Arrestor Test Kits (SCAR 10)**
- **Online Diagnostics & Measurement Systems.**

eKAM

DRTS 66

ElMeasure offers intelligent ACCL

ElMeasure has introduced an Intelligent Automatic source change over with current Limiter (iACCL). The compact product is built with high precision microcontroller that offers automatic changeover between main supply and generator supply.

iACCL allows supply from mains as long as the load current is below the programmed current. When the mains supply fails and the standby generator supply is on, it connects the DG power to each consumer in sequence & starts monitoring its load. Whenever the load current exceeds the allotment, power is automatically switched off for 10 seconds, and automatically restored. This cycle repeats for 5 times each time with double the time (20, 40, 80 & 160) and then enters into lockout mode until it is 'Reset' manually. This helps in protecting against over voltage from DG side. Its current limiting capabilities are ideally suited to the efficient utilisation of the standby generators frequently used in multi-storied apartments, commercial complexes etc.

Features:

- Microcontroller based automatic source changeover with neutral isolation
- DIN Rail/surface mountable for single phase and Surface mountable for 3 phase
- SMPS based design for low power consumption
- Intelligent re-connection once trip has occurred due to either over voltage or over load
- Manual Reset provision when in sleep mode for restoring power supply
- Energy, Current, Voltage measurement for DG & Current measurement for EB
- Programmable threshold setting for both source independently
- Over voltage protection for DG.

For further information: marketing@elmeasure.com

FLIR T640: a versatile thermal camera

FLIR T640 offers high performance thermal imaging with on-board 5MP visual camera, interchangeable lens options with autofocus, and large 4.3" touchscreen LCD. This thermal camera combines excellent ergonomics with superior image quality, providing the ultimate image clarity and accuracy plus extensive communication possibilities which makes it useful tool for predictive maintenance in power industry.

Features:

- Highest IR Resolution of 640 x 480 pixels,
- Multi-Spectral Dynamic Imaging adds visible spectrum definition to IR images in real time for excellent thermal detail to help you instantly recognize the problem locations
- Field of View of 45° x 34°
- GPS and Compass
- Programmable Button
- Wi-Fi Connectivity
- Accuracy of +/– 2°C or +/– 2%
- High Temperature Range up to 2000°C
- Scalable P-i-P and Fused Thermal Images
- Multiple Measurements – Report all the details with 10 measurement spots, 5+5 (boxes & circles), Delta T temperature differential, isotherm, and auto hot/cold markers
- METERLiNK connectivity , Annotation – Add voice comments via Bluetooth headset and text notes from the touchscreen keypad and
- Instant Report – Create PDF document directly from the camera.

For further information: flirindia@flir.com.hk

NEXT GEN
EQUIPMENTS PVT. LTD.

Electrical Test & Measuring Solutions

Turns Ratio Meter

Winding Resistance Meter

Automatic Transformer Observing System

Digital Microhm Meter

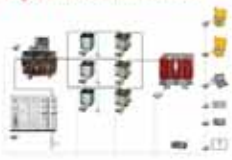
Raytech SWITZERLAND
M/s Raytech GmbH, Switzerland

EMJAK POWER
M/s EMJAKPOWER, Switzerland

epro
M/s Epro Gallspach GmbH, Austria

RISATTI INSTRUMENTS
Risatti Instruments Italian

Static Frequency Convertor (EPS)



STATOR TESTER

Automatic Transformer Test System

DIE CAST ROTOR TESTER

Cast Resin Standard PT

Standard CT

SURGE TESTER

OUR PRODUCT RANGE

- Winding Resistance Meter
- Turns Ratio Meter
- Digital Microhm Meter
- Contact Resistance Meter
- Motor Tester
- Standard Current Transformer
- Standard Voltage Transformer
- Transformer Loss Measuring System
- Automatic Transformer Test System
- Rotor Tester
- Static Frequency Convertor (EPS)
- Mobile EPS
- High Voltage PD Filters
- Coupling Capacitor/ HV Dividers
- Stator Tester
- Oil BDV Test Set
- Flash point Test Set
- Oxidation Stability
- Battery Analyzer
- Surge Tester

Branch Office: 35-B, Ashiana Duplex, Tandalja, Vadodara – 390012 , Gujarat

Ph : +91 9979888269, +91 9374904404, +91 9811004404 **Email** : info@ngepl.com

Regd. Office : 279-D, Defence Colony, Jajmau, Kanpur -208010, U.P.

Website: www.ngepl.com

Index to Advertisers >>

Company Name	Page No.
Allied Power Solutions	25
Apar Industries Ltd.	53
Axon Electric Corporation	17
Brugg Cables India Pvt. Ltd.	5
Cargill India Pvt. Ltd.	77
Central Power Research Institute	7
Dynamic Cables Pvt. Ltd.	77
Deep Sea Electronics India Pvt. Ltd.	83
Electrical Research & Development Association	29
Epcos India Pvt. Ltd.	75
Finolex Cables Ltd.	15
Flir Systems India Pvt. Ltd.	23
Greatwhite Global Pvt. Ltd.	13
Gupta Power Infrastructure Ltd.	3
Havells India Ltd.	21
HPL Electric & Power Ltd.	45
Igus India Pvt. Ltd.	79
Inter Solar 2016	58
ISA Advance Instruments (I) Pvt. Ltd.	85
Jindal Electric & Machinery Corp.	83
K-Lite Industries	39
Kloeckner Desma Machinery Pvt. Ltd.	IBC
Kusam Electricals Pvt. Ltd.	31
Kvtek Power Systems Pvt. Ltd.	59
Larsen & Toubro Ltd.	IFC
M&I Material India Pvt. Ltd.	41
M/s N Datta Electricals	83
Meccalte India Pvt. Ltd.	49
Megger Ltd.	19, 90
Mersen India Pvt. Ltd.	11
MGM Varvel Power Transmission Pvt. Ltd.	55
Mysore Thermo Electric Pvt. Ltd.	71
NextGen Equipment Pvt. Ltd.	87
Omicron Energy Solutions Pvt. Ltd.	37
Pepperl+ Fuchs (India) P. Ltd.	35
Presicion Wires Pvt. Ltd.	67
Scope T&M Pvt. Ltd.	89
Siemens Ltd.	9
Synthesis Winding Technologies Pvt. Ltd.	63
The Motwane Mfg. Co. Pvt. Ltd.	BC
Veto Switchgear & Cables Pvt. Ltd.	73
Wire & Cable India 2016	80
Yokogawa India Ltd.	81

E4.1L: low weight, easy assembly, cable-friendly design

Optimum use of installation space, light weight and high stability – these are just some of the benefits of the E4.1L energy chain from igus, which is now available in new heights and widths from stock. Compared to the E4.1, weight can be reduced by 30%, with this light version, meaning that the chain is well suited to highly dynamic applications. It was developed especially for unsupported applications; long gliding travels are also possible with the e-chain.

The E4.1L of the motion plastics specialist igus combines the strengths of different series of chains from igus and also has a design that is very kind to all the surfaces in contact with the cables. "Rounded edges of the crossbars and separators of the chain ensure a long service life of hoses and cables," explains Harald Nehring, authorised representative for e-chain systems at igus. "You can therefore call E4.1L an energy chain in which the moving cables feel at ease." In addition to the rounded surfaces that come in contact with cables, gridding and positioning scales are used for the best possible separation of the chain. Along with the easy assembly and high stability it displays its strengths especially in fast unsupported applications, such as in automation or in machine tools.

Technical tricks for design freedom

The simple snap-open mechanism of the crossbars in the outer and inner radius ensures a quick filling of the e-chain. The captive crossbars, which can be opened with a screwdriver, open by 115 degrees and latch into final position. If necessary, they can even be removed completely, placed again and closed by simply pressing in. The patented positive-fit tongue and groove of the chain links and the double stop dogs with large stop surfaces that allow a high degree of stability were carried over from the heavy duty E4.1 chain. Here a 'brake' also ensures a lower rolling noise and a very smooth chain travel. Due to the variable mounting of the outer links, the chain can be installed either with or without camber. This is a decisive advantage especially in limited installation space, such as in machine tools.

'Perhaps the best e-chain in the world'

Compared to E4.1, the application-oriented design of the E4.1 L could save so much mass that the chain is about 30% lighter. This brings an additional advantage: "In this way, users save not only a lot of drive power," says Harald Nehring. "It can also accommodate more hoses and cables in a given space envelope – all these advantages perhaps make the E4.1L the best e-chain in the world." The energy chain is now available from stock in more interior heights between 31 and 64 millimetres and new widths, as well as fully enclosed options for the protection against chips. As for the open energy chain, igus also has an ESD version and even a high-temperature option for the enclosed energy tube. EI

For further information: www.igus.in

SCOPE

Simple Solutions for Transformer Testing

TTRM 302 | TRM 50+

Transformer Turns Ratio Meter

- Precision Turns Ratio Meter suitable for both Single and Three phase Transformers in live EHV switchyards up to 765kV
- Measurement of Turns Ratio up to 20000, Excitation Current up to 2 A, Phase Deviation of ± 180°
- Selectable Voltage – 10V, 40V and 100V AC
- % Ratio Error, Automatic Vector group and Tap position detection, OLTC Control
- 5.7" Color TFT with Touchscreen, Inbuilt Memory and Thermal Printer
- CTrans TTRM PC software for data analysis
- Enclosed in ultra-rugged IP67 class molded case
- Ethernet for PC interface & USB for data back-up

Winding Resistance Measurement

- Measures DC winding resistance of Transformers, Generators, Motors etc. in live EHV switchyards up to 765kV
- Simultaneous measurement of all Primary & Secondary windings (6 channel) one time connection
- Selectable Test Current - 10mA to 50A, OCV 50V
- Automatic temperature correction for Al & Cu
- Automatic Back-EMF discharge, Demagnetization
- Optional OLTC test facility, Current v/s Time graph during tap change, all three phases simultaneously
- 5.7" Color TFT display with Touchscreen, Inbuilt Thermal Printer & Memory
- Ethernet for PC interface & USB for data back-up

*** Also look out for our other Transformer Testing Instruments consisting of**
Step Up Transformer/ Knee Point Tester, Oil Sampling Bottle, CT Polarity Tester, Insulation Tester, Hi-Pot, Partial Discharge kit

SCOPE T&M Pvt. Ltd.
402, Aurus Chamber, Annex A,S. S. Amrutwar Road, Worli, Mumbai 400 013, INDIA. Phone No: +91 (22) 4344 4244,
Email: marketing@scopetnm.com, Web Site : www.scopetnm.com

The MRCT is capable of testing CTs in a 765 kV switchyard.

MRCT

Relay and Current Transformer Tester

Reduce your ladder time. Make one connection and test all taps simultaneously with the new MRCT from Megger. Now you can measure saturation, ratio, polarity, winding resistance, burden and voltage simultaneously on all taps with no lead changes. With integrated insulation and single-phase relay testing, demagnetization functionality and automated test sequences, the MRCT is a small solution that creates big time savings.

Save time!
with quick results in every test.

Measure resistance
on short-circuited winding CT.

About Megger

For over 100 years, Megger has been the premier provider of electrical test equipment and measuring instruments for electrical power applications. Megger is best known for being the pioneers of the world famous range of insulation testers. Megger's product offerings spans 30 distinct product groups with over 1000 products. With such a diverse product offering, Megger is the single source for electrical test and measuring instruments.

Visit en.megger.com to know more.

Megger

211 Crystal Paradise Mall
Off Veera Desai Road
Andheri (w) Mumbai 400053
T +91 22 26740468
F +91 22 26740465
E indiasales@megger.com

WWW.MEGGER.COM

24/7

DESMA

Silicone Injection Moulding

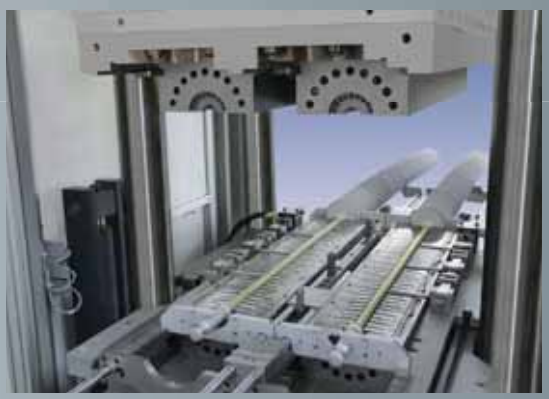
DESMA offers SE Series for Economical Production of High Voltage Composite Insulators, Arrestors & Cable Accessories. Complete Solution with Machines, Moulds & Cold Runner Blocks

1965 - 2015 - SHAPING IDEAS FOR YOUR FUTURE
50 - YEARS -

SIGMA 250 SE
- Optimised for Multiple Cavity 11 kV & 33 kV insulator Production
- 25 kV RDSO insulators
- Process Optimised for less than 5% wastage

SIGMA 400 SE
- Optimised for 66 kV to 400 kV insulators by Step moulding
- High flexibility, fast cycles, easy ejection, easy access to parts

SIGMA 630 SE
- Optimised for 400 kV or Longer insulators
- Perfect solution for post insulators, hollow core insulators and surge arrestors



Strategies for Success in Rubber and Silicone Injection Moulding

ISO 9001: 2008
ISO 14001: 2004
OHSAS 18001: 2007

Kloeckner DESMA Machinery Pvt Ltd
Plot No.10, Road No.1, G.I.D.C., Kathwada,
AHMEDABAD 382430, India

Phone +91 79 6619 0000
Fax +91 79 6619 0076
Mail sales@desmaindia.com

Sales & Service : DELHI • HYDERABAD • PUNE • NASIK • CHENNAI

www.desma.biz

11/2015 marg

RNI Registration No.: 6226/1961 • Published and Posted on 5th of every month at Patrika Channel STG. Office, Mumbai 400 001.
Licence to post without prepayment WPP Licence No. MR/TECH/WPP-228/NE/2016 • Postal Registration No. MNE/95/2015-17