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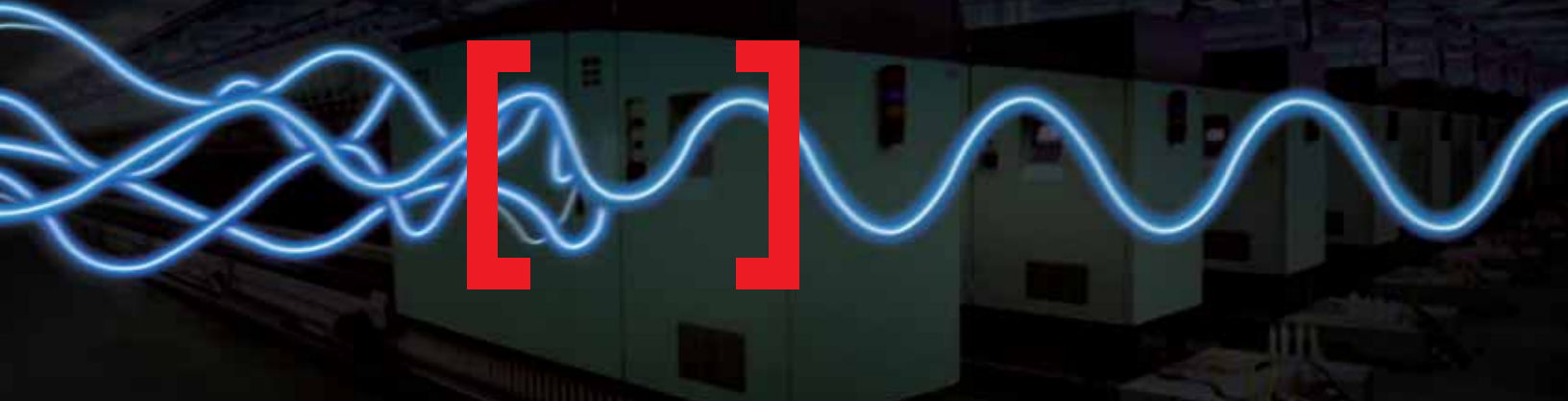
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# Publisher's Letter

## A High Growth Potential Ahead



“Golden days are coming for the Indian pumps and valve manufacturers...”

Pumps and valves are two commonplace components in today's industrial as well as civic world. With the rising need for landfill management, fast growing trend of erecting high-rise buildings, mushrooming construction of water and waste water treatment plants and many other on-going industrial and civic activities, the demand for pumps and valves is increasing by leaps and bounds. In this modern world, beside electric pump sets, the use of motorized valves is also steadily increasing. Growing side by side is the application of valve actuators. As far as automated fluid transfer operations are concerned, these three literally integral components are gaining more and more attention.

According to one of the Technavio's recent research reports, the global pumps market is to grow steadily at a CAGR of 5% between 2016 and 2020. Through their analysis, Transparency Market Research (TMR) is informing that the global valve market will exhibit a CAGR of 5.6% from 2016 to 2020 in terms of revenue. If the prediction goes true, the market, which was valued at US\$71.21 bn in 2015, is expected to rise to US\$92.65 bn by 2020. In terms of volume, the market is expected to grow at a CAGR of 4.6% during the forecast period.

If we see industry wise, the global pump and valve markets will be mainly driven by Oil & Gas, Chemical, Water & Wastewater, Building, Residential Construction, Semiconductor & Electronics and Food & Beverage sectors.

Looking specifically at the APAC region, we find, as far as the pump market is concerned, APAC accounted for the largest market share during 2015, and it is expected to grow at a CAGR of about 6% till 2020. Specific product category wise, use of positive displacement pumps is increasing in the APAC region, which is also a major contributor to the huge growth potential. Rapid industrialization in the APAC region may boost the demand further in the near future.

So, the golden days are coming for the Indian pumps and valve manufacturers. However, they will have to raise their product quality and manufacturing capacity (mass scale production) to the global standard to stay competitive.

Do send in your comments at [miyer@charypublications.in](mailto:miyer@charypublications.in)

*Mahadevan*

Editor-In-Chief

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

- Helen Jacobs

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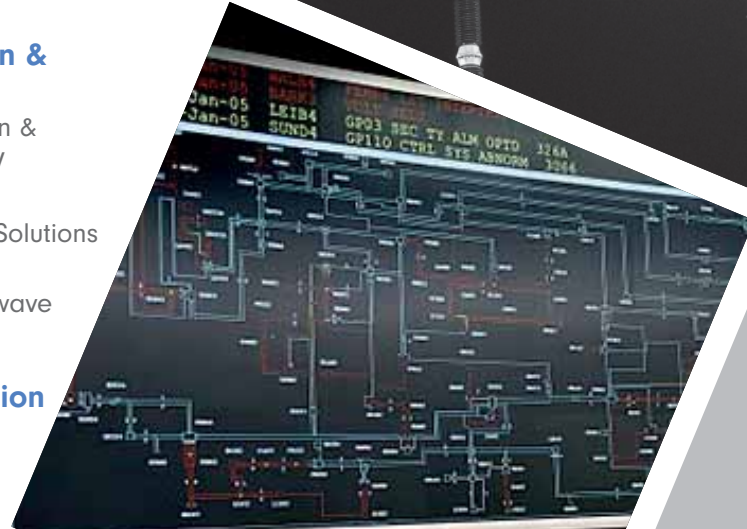
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## Managing Misalignment Is Important



P K Chatterjee (PK)

Overall pump motors are responsible for using around one-fifth of the total energy consumed by the motors in the world. We all know that the energy consumption of an electric pump set depends on the quality of power supply, loading of the pump etc. Yes, that is very true. Putting in the simplest way, a slow rotating motor with a full load consumes more energy than a fast revolving one with no load. Although application of Variable Frequency Drives (VFDs); the most common type of Adjustable Speed Drives (AFDs); often helps in controlling the energy consumption in a pump set, it is not always feasible. Thus, other methods like use of by-pass valve etc., are prevalent. But how many of us do realize that mechanical causes also have a great contribution in increasing the energy consumption of a pump set?

It has been experimentally verified that the use of flexible couplings, which are mostly subject to misalignment, often increases the energy consumption by 4 to 8%. The reason is the energy required for the sliding velocities due to misalignment is actually drawn from the original source of energy, i.e., the electric power supply. Not only this waste of energy reduces the efficiency of the pump, but also it produces vibration, heat and sound.

It has been practically seen that better alignment has many other benefits too. From the maintenance and parts replacement costs' angle, better alignments have significant contribution on controlling the hardware costs. Moreover, it reduces downtime, which is also an indirect cost saver.

Heating; out of misalignment; often damages the motor winding, which also adds to the maintenance costs, and obviously it adds to the overall production cost of any factory. Also, continuous sound in the work environment is quite unwholesome for the workers around.

Although it is very difficult to accurately determine the amount of energy savings through right alignment of the pump shaft, as the pump motor becomes free from overcoming the stress and strain caused by friction and sliding forces, the consumption of energy by the motor reduces. Are we very careful about this?

A handwritten signature in black ink that reads "P. K. Chatterjee".

“  
How many of us do realize that mechanical causes also have a great contribution in increasing the energy consumption of a pump set?”

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

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## India to receive Euro 1 billion soft loan from Germany

Union Minister for State (IC) for Power, Coal, New & Renewable Energy and Mines, Piyush Goyal has informed that in order to facilitate integration of large scale renewable generation capacity addition, a comprehensive scheme including Intra-State and Inter-State transmission system has been identified as a part of 'Green Energy Corridors'. Intra-State Transmission System is being implemented by respective State Transmission Utilities (STU) and Inter-State Transmission System is being implemented by Power Grid Corporation of India Ltd. (PGCIL).

The Minister informed that for the funding of green energy corridors in both intra and inter State transmission projects, under the framework of cooperation between Govt. of India and Govt. of Germany, KfW Germany is providing soft loan to the tune of Euro 1 billion. Intra State transmission schemes under Green Energy Corridors (GEC) are to be funded as 20% equity

of the State Govt., 40% grant from National Clean Energy Fund (NCEF) and 40% soft loan, whereas, the inter State transmission schemes are to be funded as 30% equity by PGCIL and 70% as soft loan, he added.

For Inter-state transmission projects pertaining to Part A, B and C of Green Energy Corridor, loan agreement for financial assistance of Euro 500 million from KfW, Germany has been signed by PGCIL and the projects are likely to be completed by 2018. Further, for implementation of transmission schemes under Green Energy Corridor-Part D, PGCIL has taken loan from ADB.

For Intra-state transmission projects under Green Energy Corridor; the States of Tamil Nadu, Rajasthan, Himachal Pradesh, Andhra Pradesh, Gujarat and Madhya Pradesh have signed the loan agreements from KfW, Germany for financial assistance of Euro 76 million, Euro 49 million, Euro 57 million, Euro 68 million, Euro 114 million and Euro 124 Million respectively. 

## NTPC, NALCO sign Memorandum of Understanding


NTPC Limited and National Aluminium Company Limited (NALCO) have signed a Memorandum of Understanding (MoU) recently in New Delhi in the presence of Piyush Goyal, Minister Of State (I/C) Power, Coal, NRE and Mines; Dharmendra Pradhan, Minister Of State (I/C) Petroleum & Natural Gas; Tathagata Satpathy, Lok Sabha MP from Dhenkanal; Prafulla Kumar Malik, Minister of Labour, Employees State Insurance Steel & Mines, Govt. of Odisha; Gurdeep Singh, CMD, NTPC; Dr. T. K. Chand, CMD, NALCO ; K.K. Sharma, Director (O) NTPC and other dignitaries. The MoU was signed by B.K. Thakur, Director (HR), NALCO and K. Biswal Director (Finance), NTPC. The Joint Venture Company shall establish a 2400 MW (3X 800 MW ) coal based power project at Gajmara, Dhenkanal in Odisha and supply captive power for expansion plans of NALCO at Angul and also greenfield project at Kamakhyanager in Dhenkanal, Odisha.



A view of the MoU signing ceremony...

Speaking on the occasion Piyush Goyal said in coming days the demand for aluminium shall increase many folds in the rapidly growing Indian economy the projects led by swadeshi companies shall take forward the Make in India initiative bringing jobs and opportunities for the people of Odisha. He appreciated the turnaround capability of NTPC by running nearly 50 year old

Talcher Thermal Power Station at more than 90% PLF. Shri Goyal said environment friendly power generation is a priority with the government.

Contextually, NTPC capacity crosses 48K Mark- with first 800MW Unit at Kudgi. With commissioning of 800MW unit at Kudgi Super Thermal Power Station in Karnataka , the total installed capacity of the largest Power Utility of the country NTPC has risen to 48028 MW. This is the first 800 MW Unit commissioned by NTPC. The company is playing a major role in meeting the power needs of the country and contributing to its economic and social development contributing nearly 24% of country's generation. 

## Rural electrification projects accelerated


One hundred and two villages have been electrified across the country during 19th to 25th December 2016 under Deen Dayal Upadhyaya Gram Jyoti Yojna (DDUGJY). Out of these electrified villages, 17 villages belong to Assam, 9 to Bihar, 10 to Chhattisgarh, 29 to Jharkhand, 5 to Manipur, 30 to Odisha and 1 each to Madhya Pradesh and Rajasthan.

In view of the Prime Minister, Narendra Modi's address to nation, on Independence Day, Government of India has decided to electrify remaining 18,452 un-electrified villages within 1000 days i.e., by 01st May, 2018. The project has been taken on mission mode, and strategy for electrification



consists of squeezing the implementation schedule to 12 months and also dividing village electrification process in 12 stage milestones with defined timelines for monitoring.

Eleven thousand four hundred and twenty nine villages have been electrified till date. Out of the remaining 7,023 villages, 698 villages are uninhabited. Three

thousand seven hundred and seventy five villages are to be electrified through grid, 2,502 villages to be electrified through off-grid where grid solutions are out of reach due to geographical barriers and 48 villages are to be electrified by State Government. 



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## Finance secured for distributed clean energy projects

Recently, during a signing ceremony in Delhi, the U.S.-India Clean Energy Finance (USICEF) initiative proclaimed its formal launch. The launch of USICEF marks a critical milestone on the commitment made between the United States and Indian governments to mobilise finance for Indian distributed clean energy projects.

The William and Flora Hewlett Foundation, Good Energies Foundation, the John D and Catherine T MacArthur Foundation, and the David and Lucille Packard Foundation have committed funding to USICEF to begin operations, and Climate Policy Initiative (CPI) in Delhi has been selected as secretariat for the initiative. The USICEF program helps promising distributed solar projects develop into viable candidates for financing from The Overseas Private Investment Corporation (OPIC), the U.S. Government's development finance institution, as well other finance institutions.

USICEF will deploy up to \$20 million in project preparation support,



Santosh Vaidya

sourced equally from leading foundations and the Government of India (GoI), to distributed solar power projects under consideration for long-term financing from OPIC. This support will lay the foundation for project developers to access much-needed capital to scale up their businesses. By developing a framework for leveraging funding from development finance institutions, USICEF will also set the scene for a broader catalytic impact.

USICEF will target India's distributed solar markets, where falling technology costs and government initiatives have created opportunities for rapid expansion, provided that renewable energy companies can overcome financing hurdles.

Santosh Vaidya, Joint Secretary at Ministry of New and Renewable Energy, Government of India said, "India plans to deliver 100 GW of solar power by 2022. ICEF can help meet this goal, while also growing India's economy by supporting the renewable energy industry from the ground up."

## CII awards Maithon Power Plant for excellence in management

Tata Power's Maithon Power Limited (MPL), the company's 74:26 joint venture with Damodar Valley Corporation (DVC), has always stood out for its excellence in operations, implementation of innovative technology and managing its people. In recognition to its excellence, MPL has been honoured with two awards by the Confederation of Indian Industries for being Leader in Excellence in Operation Management and Emerging Leader in People Management. Maithon Power plant has maintained an exemplary track-record of project execution excellence, customer care, and world class operation & workforce management.

K Chandrasekhar, ED & CEO, MPL along with his team at MPL comprising Rakesh J Singh, Sriballav Singh, and Boban Chacko, received the award from R Mukundan, Co-Chairman, CII Institute of Quality.

Commenting on the achievement, K Chandrasekhar, CEO & ED - Maithon Power Ltd, Tata Power, said, "It's an honor for us at Maithon Power



Ltd, to have been conferred with the awards recognizing our efforts in Operation Management and People Management. Our team has worked hard in maintaining global standards in every sphere of our operations. We bag this honour with great value entrusted to safety in our premises and workings, and I heartily congratulate everyone for their valuable contributions. We would strive further to ensure more such laurels keep coming to MPL."

Tata Power's Maithon Power Limited is in a continuous process of conducting various training programmers on a regular basis to ensure that the employees are thoroughly trained and well equipped with latest technological & operating mechanism on the stipulated parameters set by the company. The company regularly reinstates the importance of manpower and maintains world-class HR and IR standards at their project sites ensuring the most cordial and safe environment at the workplace.

## NPCIL, PSUs may set up nuclear power projects

At present, Nuclear Power Corporation of India Limited (NPCIL) is the sole agency producing electricity from nuclear power in the country. However, another company, Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI) is also authorised to generate electricity from nuclear power.

Union Government has brought about amendments in the provisions of the Atomic Energy Act, 1962 to enable Joint Ventures (JVs) of NPCIL & Public Sector companies to set up nuclear power projects. The main objective of enabling the JVs is to achieve expansion of nuclear power capacity in the country. So far, three joint venture companies – Anushakti Vidyut Nigam

Limited (NPCIL-NTPC Ltd.), NPCIL-Indian Oil Nuclear Energy Corporation Limited (NPCIL-IOCL) and NPCIL-Nalco Power Company Limited (NPCIL-NALCO) have been incorporated. Exploratory discussions have also been held with other Public Sector companies and Indian Railways in this regard.

The quantity of electricity produced in the year 2015-16 was 37456 Million Units (MUs) and has been 25803 MUs during the current financial year (2016-17) up to November 2016, including 425 MUs of infirm (non-commercial) power from Kudankulam Nuclear Power Plant (KKNPP – Unit 2). In the last ten years, share of NPCIL's generation was around 3% of the total electricity generation in the country.



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## ABB India collaborates with NITTTR Chandigarh


ABB India signed a Memorandum of Understanding (MoU) with National Institute of Technical Teachers Training & Research (NITTTR) to establish a first of its kind Simulation Centre of Excellence (SCoE) for teachers, students and industry engineers to develop a deeper understanding of the underlying multi-physics and design principles for the manufacturing of various best in class electro-mechanical equipment in India. The electro-mechanical equipment industry is a critical element in the success of the proposed exponential growth in the Indian power sector and needs to reach a quality level among the best in class to become a manufacturing hub of global repute.

Giandomenico Testi, CTO, ABB India, said, "In a bid to partner India's vision of becoming a manufacturing hub, the SCoE is our endeavour to build a robust eco-system of next level training and support technologies to



further the design, development and manufacturing of critical electro-mechanical equipment in the country. Such a centre will provide an exposure, currently scarce, in the areas of modelling, simulations and design with expert guidance to engineers, scientists, researchers and faculties across industry oriented topics. The centre will be a key

step in providing a differentiating technology platform and focus on quality in the midst of increasing price pressure and competition in the sector."

Scope of the centre includes establishing a high performance computing platform with necessary advanced computational tools. The centre is expected to be operational by 2017. It will be funded by ABB's Corporate Social Responsibility (CSR) to promote education and skill improvement for graduating engineers, research students, industry professionals as well as faculty. 


## BHEL bags a major order from Indian Railways

Bharat Heavy Electricals Limited (BHEL) has bagged a major order for the supply of 118 sets of IGBT-based Traction Converters for 3 Phase 6,000 HP Electric Locomotives.

Valued at Rs.200 Crore, the order has been placed on BHEL by Chittaranjan Locomotive Works (CLW). The Traction Converters shall be manufactured and supplied by BHEL's Electronics Division, Bengaluru. Significantly, BHEL has already supplied 225 such IGBT-based Traction Converters, which are under operation with Indian Railways.

BHEL has been working very closely with Indian Railways for the past more than four decades to meet their requirements of electric propulsion

equipment for rolling stock and mainline electric locomotives. The company has emerged as a reliable partner of Indian Railways, through its long term association, providing quality products and prompt after sales services.

With a view to cope with technological advancements and continuous improvement of equipment and transportation systems, BHEL has set up a Centre for Electric Transportation at its Bhopal plant and a Centre of Excellence for Transportation at its Bengaluru plant. The centres are envisaged to act as the focal point for systems-oriented research in the area of Railway Transportation. These centres have facilities for vehicle testing and computer simulation of service operation. 

## NTPC partners with Inox Wind to foray into wind energy


Inox Wind Limited, India's well known wind energy solutions provider, has bagged an order for a 50 MW wind power project to be deployed in the state of Gujarat from NTPC Limited, a Government of India undertaking and a Maharatna company. With ~47GW of capacity under operations, NTPC is India's largest energy conglomerate and this 50MW maiden order marks its foray into Wind energy generation. The move is a part of the company's target of sourcing about 11% of its planned capacity of 128 GW by 2032 from renewable energy. The Project is scheduled to be commissioned by Q1 FY 17-18 and will be executed on a turnkey basis.

As part of the order, Inox Wind will supply and install 25 units of its advanced 2MW DFIG 100 rotor dia Wind Turbine Generators (WTGs) for NTPC Limited. The 100 rotor dia WTG has one of the highest swept areas that make



Kailash Tarachandani

it ideally suited to maximise returns, especially in low wind areas. Inox Wind's 450 MW Rojmal site is one of the largest wind farms in the state of Gujarat. The common power evacuation infrastructure facilities at the site have already been commissioned.

Kailash Tarachandani, Chief Executive Officer (CEO) of Inox Wind Limited, said, "It is a proud moment for Inox Wind to partner with NTPC Limited, India's largest energy conglomerate and a 'Forbes Global 2000' company to provide clean, sustainable and renewable power to our nation. With this new order, we will further reinforce our dominant market position in Gujarat as the leading wind energy solutions provider. We look forward to strengthening this relationship in the future by augmenting renewable power capacity for NTPC and reducing the nation's carbon footprint." 

# Power Transformer Loss Measurement System

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- State of the Art Technology
- Exceptional Reliability
- Operator Friendly Software
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The measurement of electric power and energy at high voltages and currents at low power factors is becoming increasingly important economically as a way to reduce costs in an ever-growing industrial economy. Today the transformer purchaser subjects the transformer manufacturer to an economic penalty for losses that occur in load and no-load conditions. To keep these penalties as low as possible, it is important that the manufacturer accurately measure these losses.

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## S&W turns into a one-stop power solution provider

Developing colossal capability of engineering, manufacturing, project execution and servicing, a completely Diesel Generator (DG) based power generation plant; Sterling Generators has been a one stop power solution provider. Its availability, competence and a knack to customise in the industries of metal, steel, mining, power plants, chemicals, automobiles, pharmaceuticals and more make Sterling Generators the most preferred while making the choice.

The Stone Crushing Industry is an important industrial sector in the country.

Stone Crushers need loads of electricity supply and large number of man power for their operation, and Sterling generators provides the ultimate and customised solution – that makes it ideal for this industry.

In the avenue of Stone Crusher Applications, Sterling Generators is the most flexible and solution oriented power provider to look out.



These generators, being ideal for small and medium size of stone crushers, are customised DG sets which appertain to the load requirements, comprising of a brilliant combination high fuel efficiency along with long periodical maintenance cycles with a low running costing in comparison to others in the industry.

A rugged design DG powered by a high block load handling capacity Engine is always an ideal choice for any crusher application where the DG has to withstand adverse climatic and atmospheric conditions.

Sanjay Jadhav, President of Sterling and Wilson Powergen, said, "Today at Sterling and Wilson Powergen, we have the confidence, technical capabilities, human resource talent, and superior infrastructure in place to achieve our ambitious goal of establishing ourselves as the market leader heavy duty, commercial segment but

also in the small and medium user segment as well. We now provide flexibility and best customised DG sets thus making us one stop power solution provider in the industry."

## Suzlon Group, AMP Solar join hands

According to the contract signed between Suzlon Group and the AMP Solar recently, AMP Solar shall acquire a 49% stake in Rudra Solarfarms, a Special Purpose Vehicle (SPV) set-up by Suzlon for executing this project. AMP Solar has the option to acquire the balance of the 51% stake in the SPV in the future in accordance with the relevant rules and regulations. The off-taker of the SPV project will be the Telangana State Southern Power Distribution Company Limited (TSSPDCL). Suzlon will be responsible for project commissioning and to provide comprehensive operation and maintenance services for a period of 25 years. The project is expected to be commissioned in the financial year 2017 (FY17).



J P Chalasani

Suzlon won solar projects of 210 MW in Telangana through a competitive bidding process and the PPAs for the same were signed in February, 2016. These include one project of 100 MW, one of 50 MW and four projects of 15 MW each.

J P Chalasani, Group CEO, Suzlon, said, "The global renewable energy sector is witnessing a huge momentum. We are glad to partner with AMP Solar. For Suzlon, this project is a contribution towards our commitment for reducing the carbon footprint and transitioning of renewables from alternate to mainstream source of energy. We look forward to work collaboratively with AMP Solar and contribute towards promoting green energy."

## VIPL signs agreement with InfraCo Asia

Virtuaal Infra Power Limited (VIPL), a green energy developer producing energy through hydroelectric power plants has revealed its association with Singapore based Infra Co Asia Development.

The association will help Virtuaal Infra power in producing renewable energy in north-eastern state of Arunachal Pradesh.

VIPL have been doing its bit to counterstrike issues of carbon foot prints with its 'Run of the River scheme (ROR)', with two projects in Arunachal Pradesh.

The company will be producing 23 MW and 14.5 MW energy through Keyi and Pareng respectively in the state. The association will not only be



Allard M Nooy

beneficial to both companies involved but will also lead to the benefit of the society at large, particularly the local population in Arunachal Pradesh.

Allard Nooy, CEO, Infra Co Asia, said, "While our association with Virtuaal Infra Power is touted to unravel a new era in the renewable energy sector and aid our partner with its pioneering Run-of-River small hydro projects, this association also marks our entry into the India market. It will enable us to sustainably develop projects within India's renewable energy sector. We look forward to working with Virtuaal on the execution and implementation of these projects."



## Electrical Test & Measuring Solutions



Turns Ratio Meter



Winding Resistance Meter



Automatic Transformer Observing System



Digital Microhm Meter



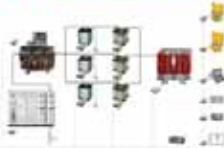
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Static Frequency Converter (EPS)



Automatic Transformer Test System



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STATOR TESTER



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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 Converter (EPS)  
Mobile EPS  
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## Brazil opens its largest solar module manufacturing facility

Canadian Solar, a well known solar power company, has commenced solar module manufacturing in Sorocaba, Brazil. The new state-of-the-art manufacturing facility will be Brazil's largest, with 380 MW annual capacity of made in Brazil solar modules.

The official inauguration of this state-of-the-art new solar module facility was attended by Geraldo Alckmin, Governor for the State of Sao Paulo; Eduardo Azevedo, Secretary from the Ministry of Mines and Energy; Antonio Carlos Pannunzio, Mayor of Sorocaba and Rick Savone, Canadian Ambassador to Brazil.


Dr. Shawn Qu, Chairman and Chief Executive Officer of Canadian Solar, said, "This is a great day for Canadian Solar, the supportive local



Dr. Shawn Qu

government, and the people of Brazil. Our new state-of-the-art facility is already having a positive impact on Brazil's economy through the jobs created, investment made in the local economy, and our help in the promotion and further development of the country's renewable energy industry."

"Our current solar project portfolio in Brazil has reached 390 MWp, of which EDF EN do Brazil, the local subsidiary of EDF Energies Nouvelles, bought 80% of the equity interest of our 191 MW Pirapora I project (expected to come online in 3Q17).

We now gain a powerful competitive advantage with our new local content facility, which we will leverage in Brazil, one of the world's most attractive and fastest growing solar markets," he added. 

## Gamesa gets debut order for its new 3.3 MW platform in Mexico


Gamesa, a well known company in wind energy sector, has achieved an important milestone in its sales and product strategy, having secured the first order for its new G132-3.465 MW turbine, which guarantees the lowest cost of energy across a broad spectrum of sites.

The company has secured an order from a power utility for the supply of 198 MW at one of its wind developments in Mexico. Specifically, Gamesa has been contracted to install 57 of its G132-3.465 MW turbines.

The new platform, unveiled one year ago, builds from the technology proven in the company's 2.0 MW and 2.5 MW platforms, by leveraging the same mechanical and electrical systems but boosting nominal capacity.

Offering the most compelling cost of energy in its segment, the G132-3.465 MW, part of the company's 3.3-MW platform, guarantees maximum output at medium and medium-low wind speed sites. This turbine comes in four different tower heights, ranging from 84 to 134 metres, so that it can be tailored for each region's specific requirements and wind ranges.

Moreover, this new turbine's blade, which is made from fiberglass and spans 64.5 metres, features a new family of aerodynamic edges which increase annual output while minimising noise emissions.

As a result of this combination of technologies, this model delivers 50% and 30% more energy than the G114-2.0 MW and G114-2.5 MW (similarly both turbines for class II winds), respectively. 

## ENGIE depends on PV solutions from IBC SOLAR in Switzerland

IBC Solar AG will be cooperating with ENGIE, one of the largest providers of energy solutions and building technology in the Alps. The solar specialist from Bad Staffelstein will support its new Swiss partner in the future in the provision of energy solutions in combination with photovoltaics, and will supply among other things high-quality solar components of its own brand.

A central component of ENGIE's offer to its private and commercial customers is the complete takeover of all steps from planning to commissioning of an individual solution to optimise energy efficiency in buildings. Depending on the application, different technologies are used:

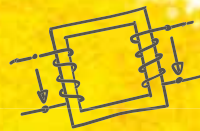


heat pumps, heating systems or photovoltaics, also in combination with other technologies. All photovoltaic components and corresponding services will be provided by IBC SOLAR in the future.

Wolfgang Schwarzenbacher, CEO of ENGIE Services AG, said, "Photovoltaics optimally complements our range of products with environmentally friendly and energy-efficient solutions. For example, a photovoltaic system can generate electricity for the heat pump or the hot water preparation. We are therefore pleased to be able to offer environmentally friendly and economical PV solutions to our private and commercial customers with the support of IBC SOLAR." 

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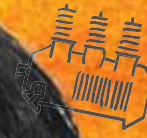
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**POWER  
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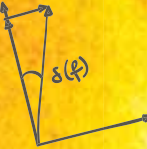


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[www.omicronenergy.com/newTESTRANO600](http://www.omicronenergy.com/newTESTRANO600)




## NMC provides solutions for water industry

Innovator Nidec Motor Corporation (NMC) offers water industry customers two certified NEMA Premium efficient vertical hollow shaft product lines: new SINEWAVE OPTIMISED motors for constant speed pumping, and inverter duty products for variable speed pumping.

Not all pumping applications require a variable speed motor to maintain constant water pressure and/or flow. For these circumstances, NMC offers new U.S. MOTORS brand SINEWAVE OPTIMISED premium efficiency vertical high thrust motors. These motors, from 7-1/2HP to 600HP, meet the new DOE efficiency requirements, provide a lower cost alternative to inverter duty

motors, and provide the construction and reliability that customers have come to expect from the U.S. MOTORS brand.

For variable speed applications, NMC builds U.S. MOTORS brand inverter duty motors, from 15HP to 600HP, with features designed to protect against the punishing effects of Pulse-Width Modulation (PWM) waveforms generated by inverters.

To support these motors and provide even more peace of mind about system reliability, NMC developed the ACCU-SERIES line of drives and panels to deliver high wire-to-water efficiency, backed by a Motor Match Warranty. 


## SSVEC, SunPower dedicate 20-Megawatt Solar Power Plant

Sulphur Springs Valley Electric Cooperative (SSVEC) and SunPower are dedicating a 20-megawatt (AC) solar photovoltaic power plant that is now generating clean, renewable solar power for customers in SSVEC's service territory.

SSVEC will purchase the power generated by the solar plant under a 20-year power purchase agreement with SunPower.

SSVEC is retaining the renewable energy credits associated with the solar plant. The plant is anticipated to generate enough electricity to serve the needs of approximately 2,800 average Arizona homes over the next 20 years, based on estimates provided by the Solar Energy

Industries Association. SunPower designed and built a SunPower Oasis Power Plant system at the site. The Oasis platform is SunPower's fully integrated, modular solar power block solution for utility-scale solar projects that is designed to optimise land use and is engineered for rapid, cost-effective installation.

The plant includes half a megawatt of the newest generation of the SunPower Oasis platform, just launched in September. Improvements in the Oasis platform design to optimise every system component for seamless operation generate 34 % more energy density than conventional solar technology over 25 years. 

## Wärtsilä to supply two 57 MW power plants to Indonesia

A consortium between Wärtsilä and an Indonesian construction company, PT PP (Persero) Tbk, has signed a contract to supply two 57 MW modular power plants, totalling 114 MW to PT PLN, the Indonesian state utility. The consortium will be responsible for the complete Engineering, Procurement & Construction (EPC) project, and will also operate and maintain the power plants for a 5-year period.

The power from the two plants, placed in the cities Jayapura and Kendari, will be generated by 12 Wärtsilä 34DF engines (six per power plant) capable of operating on multiple fuels, including liquid fuels and natural gas. The equipment will be delivered during the first quarter of 2017 and the plants are scheduled to be operational during the first half of 2017, making this a fast-track delivery. The order is booked in the fourth quarter of 2016.


The plants will be based on Wärtsilä's Gas Cube technology. Gas Cube is a ready-to-use pre-engineered modular power plant package



Frederic Carron

designed to achieve fast delivery with minimal site work. In addition to the short installation time needed, they can also be easily dismantled and re-installed individually somewhere else if necessary. The power plants are part of a public tender from PT PLN and the plants will provide flexible baseload power to the Indonesian grid.

Wärtsilä and PT PLN have a long and healthy business relationship. The two parties recently signed an MoU to build additional power generation in Indonesia. Wärtsilä's installed capacity in Indonesia will exceed 3.2 GW during 2017.

Frederic Carron, Regional Director at Wärtsilä, said, "These power plants will increase the electrification ratio of eastern Indonesia, and will add reliability to the existing system. Our Gas Cube concept enables us to deliver the power plants quickly, and have them operational with a minimum of delay." 

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The World's Sixth Sense\*

## Tata Power appoints an Additional Director




S. Padmanabhan

*He has a distinguished academic record in the technical and management domain...*

Tata Power, India's well known integrated power company, has appointed S. Padmanabhan as Additional Director. The appointment of the Additional Director has been intimated to Stock Exchanges, in accordance with Regulation 30 of the SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015.

Padmanabhan is currently the Executive Chairman, Tata Business Excellence Group (TBExG) and was recently given the additional responsibility as Head of Group HR for Tata Sons Limited. His career with the Tata Group companies began with Tata Consultancy Services Limited (TCS) in 1982 and spans over 34 years. During his 26 year stint with TCS, he has served as Executive

Director of Human Resources, Head of Application Development and Maintenance, Head of Airlines Practice and Country Manager, TCS Switzerland. He was also the Executive Director-Operations of Tata Power from February 2008 to June 2014, and was responsible for the profitable and sustainable operations of all thermal and hydro generation plants across India and the transmission and distribution systems in Mumbai.

Padmanabhan has a distinguished academic record in the technical and management domain from reputable institutions. He is a Glaxo Marketing Scholar Medalist, a distinguished alumnus of IIM Bangalore, and a Gold Medalist from PSG College of Technology, Coimbatore. 

## Vertiv appoints new Chief Executive Officer (CEO)



Rob Johnson

*He was President and CEO of APC when the company was sold to Schneider Electric in 2007. ..*

Emerson Network Power is now rebranding as Vertiv. The company has recently appointed Rob Johnson as CEO and officially commenced a campaign to rebrand the standalone company as Vertiv. Johnson, most recently an operating partner at Kleiner Perkins Caufield & Byers, spent 10 years at American Power Conversion (APC). He was President and CEO of APC when the company was sold to Schneider Electric in 2007. While at APC, he also served as General Manager of the company's Availability Enhancement Group.

In addition to his career at APC, Johnson also

worked in executive positions at Consolidated Container Corporation, a provider of rigid plastic packaging solutions. In 1989, he founded Systems Enhancement Corporation (SEC), a company that created innovative software and hardware solutions for the Uninterruptible Power Supply (UPS) industry. He sold the company to APC in 1997.

Johnson said, "It's a fresh start for a business that already has so much going for it. I look forward to working with my new colleagues at Vertiv as we begin this transformational chapter in the company's history." 

## Vikram Solar appoints new Head for Global Module Sales



Nimish Jain

*He is an MBA in sales and marketing from the Indian Institute of Management (IIM), Lucknow...*

Vikram Solar, a well known solar energy solutions provider, has appointed a new Head of Global Module Sales – Nimish Jain. In the given role, he will be responsible for driving sales in both domestic and international markets. Also, he will supervise the accomplishments of targets and Profit and Loss (P&L) of the year, along with recruiting and managing the sales team.

With around nine years of experience in the Solar PV segment, Nimish, in his most recent stint was associated with Jinko Solar as its Deputy Director – APAC, where he was responsible for the complete business operations in SE Asia.

Additionally, he has held leadership positions in renowned companies like, SMA Solar and Reliance Industries Limited. He is an MBA in sales and marketing from the Indian Institute of Management (IIM), Lucknow, and has been conferred with awards like "The Outstanding Achievement Award" at World HRD Congress and "Global Solar Energy Leadership Award" at Solar Energy Global Conference and Award.

Ivan Saha, President and CTO, Vikram Solar, said, "As we enter into the next phase of our growth, Nimish's appointment is anticipated to bring in a fresh perspective to our sales operations and our overall growth strategy." 



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## BHEL bags the EEPC Export Excellence Award

**B**harat Heavy Electricals Limited (BHEL) has won the EEPC INDIA National Award for Export Excellence for the year 2014-15 as 'Star Performer - Project Exports (Large Enterprise)'. The award was received by Atul Sobti, CMD, BHEL from Suresh Prabhu, Union Minister of Railways, on 13<sup>th</sup> December 2016.

Instituted by EEPC, the award is given annually to Top Exporters for excellence in physical exports. Significantly, BHEL has been winning the prestigious EEPC award for export excellence consecutively for the last 26 years. With footprints in over 80 countries across six continents, the company has been India's leading exporter for more than 45 years. **EI**



Atul Sobti is receiving the EEPC Award 2016...

## JinkoSolar gets recognised for its corporate culture

**J**inkoSolar Holding Company, which is well known in the Photovoltaic (PV) industry, has been awarded the 2016 Chinese Excellent Corporate Citizen Award at the 12th Annual Chinese Excellent Corporate Citizen Conference. The conference was held by the Corporate Citizenship Committee of the China Association of Social Workers, China Central Television (CCTV). The Tencent Charity Foundation, Xiande Li, Chairman of JinkoSolar was also recognised as an Outstanding CSR Entrepreneur. The company received the award in recognition of its excellent performance in terms of business ethics, corporate sustainable development and environmental protection.

Xiande Li, Chairman of JinkoSolar, said, "Receiving the 2016 Chinese Excellent Corporate Citizen Award acknowledges the



A view of the recognition ceremony...

contribution JinkoSolar has made to the international community with the development of renewable energy. We are committed to providing the best environmental and financial returns possible as we continue developing new green power technology to optimise the global energy structure and promote the sustainable development of economy and environment." **EI**

## Synecore wins M&E Contractor of the Year title

**T**he team at Synecore were pleased after winning the award for 'M&E Contractor of the Year' at the Electrical Industry Awards. Synecore, based in Detling and Kent provides professional electrical design and installation, commercial refrigeration, air conditioning and ventilation for the hospitality, leisure and retail industry.

With the ability to support national development schedules, the company has become a preferred mechanical and electrical contractor for major restaurateurs and hoteliers across the UK.

Its vast project portfolio includes design and installations services for the likes of Leon Restaurants, Frankie and Benny's, Comptoir Libanais, Cote Brasserie, Wasabi, Five Guys, Giraffe,



Synecore team receives the award...

Chiquito, Coast to Coast, Hilton hotels and many more.

The award for M&E Contractor of the Year recognised Synecore's dedication to staff training, ability to overcome intricate technical issues and superior customer service. It was among four finalists that were selected from a host of contractors across the UK and the only contractor

within Kent.

Synecore's Finance Manager, Maria Harris said, "We are over the moon with this achievement; it acknowledges all our hard work and commitment to building such a solid company. We really must thank our loyal clients and suppliers for their support over the years and congratulate the other finalists." **EI**



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*Motor Test Facility*



*Pump Test Facility*



*Testing for IC Engines*



# Management Of The Equipment



**S Kundu**  
Sr. Vice President  
(Transformers)  
IMP Powers Limited  
Silvassa

This article explains how 'condition monitoring' of transformers ultimately increases the life expectancy and renders trouble free service to the customer – and helps economic development of the country...



Recently there was heavy cyclone in Rajasthan and due to that a 400kV Transmission line got intercepted (Fig. 1). Also, many transformers failed due to line to earth, line to line faults of higher magnitude travels to the connected loads, which were beyond anybody's control. But probably with good quality maintenance this accident could have been avoided.

We have come across the failure of transformers due to not monitoring their proper storage – particularly nitrogen filled. The transformer was kept idle for a long period without monitoring the presence of  $N_2$  in the Job. Due to poor quality of gaskets, sometimes minor leakages are observed, and that become the

source of  $N_2$  escape – and that is slowly replaced by atmospheric air, which ultimately deteriorates the insulation of the job – and tends to fail when electric supply is given.

Winding and electrical circuit failure observed due to improper clearance, insulation of winding aged due to continuous over loading, insulation got damaged but not noticed/overlooked, during winding of coil transposition (Fig. 2) are not made proper and got sharp edges due to improper bending tool used, joints of conductors are not made proper resulted overheating, inter-strand (Fig. 3) insulation is inadequate to carry voltage safely and ultimately resulting circulating current to flow and to overheat the point of fault. Inter turn failure is



Figure 1

more severe and can lead to fire the Job and sometimes due to enormous force caused due to fault gases Tank can be busted. Static end rings are provided at the ends of winding for capacitance distribution but sometime the gap between starting & finishing is not provided / insufficient resulted heavy current flow and ultimately burnt. If the process of the Job is not carried out under control atmosphere / dust free chamber, there is every possibility of foreign particles / metallic dust entering in the coil and create conductive path to make inter-turn/ inter tapping leads short and fail the Job. Therefore, Partial Discharge test is essential to detect presence of such particle well before the failure occurs.

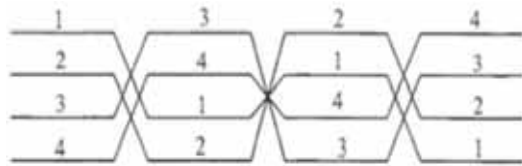


Figure 2

### Optimum transposition of parallel conductors

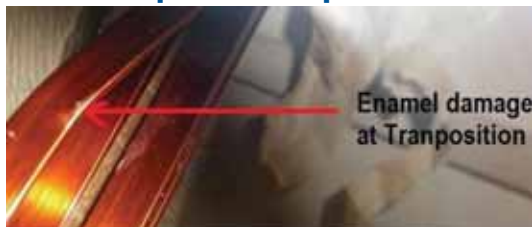


Figure 3A

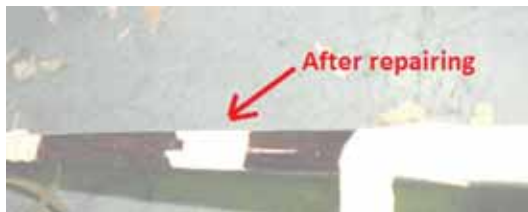


Figure 3B

Core and clamping structure failure observed due to poor clearance and moisture effects. Some time core belts found shorted each other and resulting inter turn failure. Pressboard liner if not properly dried and used of lesser width / thickness used under the core belt it can fail due to low creep age. Recently, we have come across one failure of Fiber glass stud with tank wall due to poor clearance, so long so due to continuous pitting with Tank wall tank surface was having a hole and oil started coming out through the hole in the form of a jet.

Bushing failure due to ingress of moisture, poor Tan delta and Capacitance value, loose / bad joints of lead, low level of oil in the oil conservator, leakage in the conservator and Test cap short with body.

Electrical failure : Transient over-voltage, load current, short circuit fault current due to line to ground, line to line, line to line and to ground, lightning and switching surges.

Operating environment (Physical): Temperature (operating at full load with high ambient temperature humidity index) wind, rain, seismic and pollution.

Frequent number of operation of Tap Changer may cause poor contact or worn contact and result to failure due to unbalance current flow. Sometimes due to Earth Quake, vibration exceeds its resonance limit and

result to failure. So, foundation should be shock proof to withstand / dump the vibration effect.

Moisture contents in oil is a very detrimental effect in the Transformer and resulted failure of active part / high voltage withstanding capacity. So time to time, value should be noted and should be improved to the required value – as per the voltage class of Transformer by on line Filtration method / off line as found suitable.

There is an increasing need for power utilities to use assets to their fullest while maintaining system reliability. Transformers which have exceeded their design life or are approaching the end of their operating life, require all the more attention as compared to new transformers. Due to increasing failure of large power transformers the maintenance engineers are seriously reviewing their O&M procedures in order to prevent forced outages, incur less maintenance cost, and to have longer life of equipment. To assess the extent of deterioration within the transformer, it is necessary to employ the appropriate diagnostic tool.

A few decades ago, Tan delta / Insulation Resistance measurement of winding / bushing, monitoring of oil / winding temperature, checking of BDV of oil and fault gas analysis were framed as the major part of condition monitoring strategy. Latter on DGA & Furan analysis of oil are added and proved to be the effective tools in the condition monitoring of transformer. However, due to the advanced and improvement of technology following additional diagnostic tests have been included for condition assessment of transformer, which have saved power transformers from undergoing major damages.

- Partial Discharge Measurement.
- Sweep Frequency Response Analysis.
- Recovery Voltage Measurement.
- Thermo Vision Measurements.
- Dissolved Gas Analysis.

### Partial discharge measurement

Partial discharge occurs in oil filled transformers due to the following reasons. Partial Discharge (PD) occurs when a local electric field exceeds a threshold value resulting in a partial breakdown of the surrounding medium. Its cumulative effect leads to the degradation of insulation. PDs are initiated by the presence of defects during its manufacture or the choice of higher stress dictated by design consideration. Measurement can be collected to detect these PDs and monitor the soundness of insulation. PDs manifest as sharp current pulses at transformer terminals whose nature depends on the types of insulation defects measuring circuits and detectors used.

Generally acoustic method (Fig. 4) is being used at sites since it is cheaper, simple and online measurement on the Tank, PD activity region can be identified. Acoustic PD method employs a sensor that converts sound signals into electrical pulses. Sound being emitted by partial discharge inside the transformer is picked up by the sensor, and is converted into electrical sensor which is further amplified by the main equipment neglecting false signals due to core vibration, noise produced by cooling system. The number of peaks in the signal available for one second is stored as counts per second. PD may not cause an immediate failure but definitely gives sound information of healthiness of transformer.

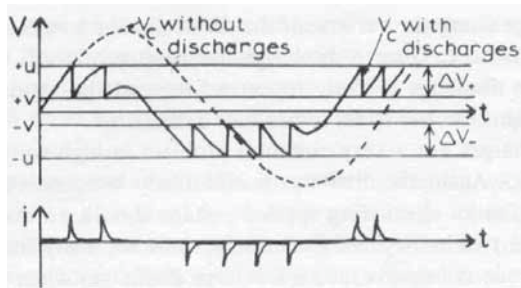


Figure 4A

### PD PATTERN WHEN THE VOLTAGE APPLIED IS TWICE THE INCEPTION VOLTAGE

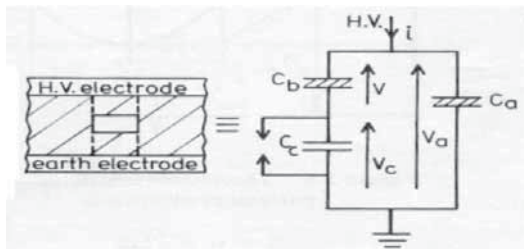


Figure 4B

### MODEL OF A VOID-ABC DIAGRAM

- Voids in the solid insulation.
- Conducting particles in paper or in oil.
- Wet fibers in oil.
- Gas bubbles in the oil.
- Sharp edges of conductor.

### Sweep frequency response analysis

When a transformer is subjected to several short circuits with high fault currents, the mechanical structure and winding are subjected to severe mechanical stresses consequently may cause deformation / displacements of windings as well as changes to winding (Fig. 5) inductance or capacitances in transformers. It may also result in insulation damage and turn to turn faults. Such small movements may not be detected through the conventional condition monitoring techniques, such as DGA, Winding resistance measurements, capacitance and tan delta measurements etc., however frequency Response measurement has proved to be an effective off-line tool to detect these changes and is widely being used world wise. The test is repeatable and immune to electromagnetic interference and is not influenced by weather.

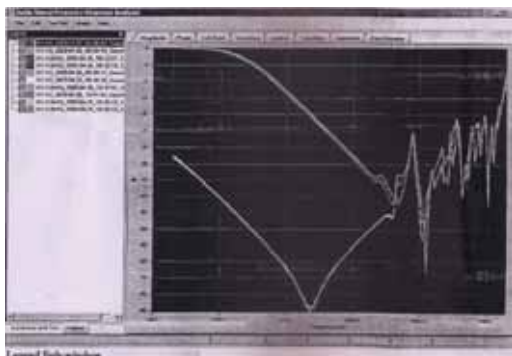


Figure 5A

By checking or un-checking the tick box at the left of the legend name it is possible to make the trace visible on the chart or invisible. This particularly useful when comparing a number of traces simultaneously.

### SFRA testing basics

- Off-line test
- The transformer is seen as a complex impedance circuit
- [Open] ("magnetization impedance") and [Short] ("short-circuit impedance") responses are measured over a wide frequency range and the results are presented as magnitude response (transfer function) in dB
- Changes in the impedance/transfer function can be detected and compared over time, between test objects or within test objects
- The method is unique in its ability to detect a variety of winding faults, core issues and other electromechanical faults in one test!

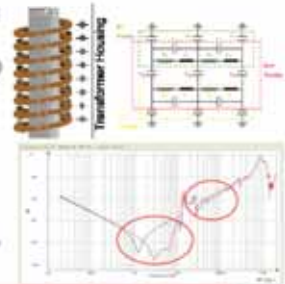


Figure 5B

### Detecting Faults with SFRA

- **Winding faults**
  - Deformation
  - Displacement
  - Shorts
- **Core related faults**
  - Movements
  - Grounding
  - Screens
- **Mechanical faults/changes**
  - Clamping structures
  - Connections
- And more...



Figure 5C

### Typical response from a healthy transformer

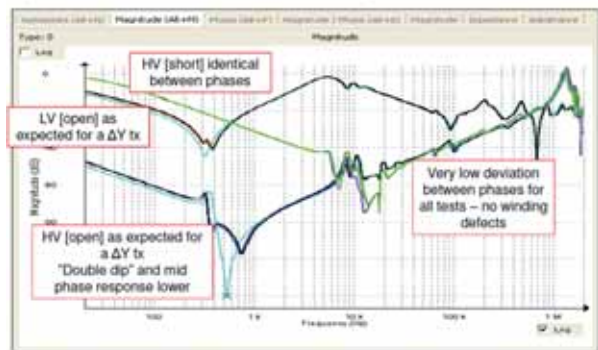


Figure 5D

### Transformer with serious issues...

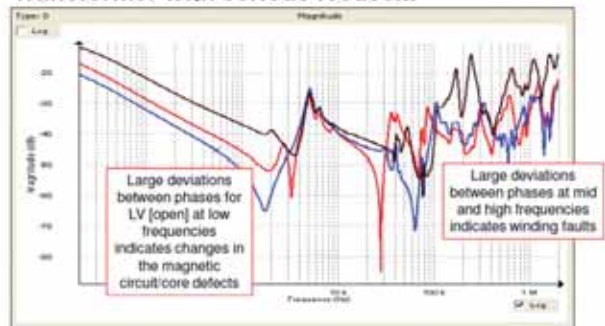


Figure 5E



# Innovative Cable Solutions



ELECTRON BEAM IRRADIATED SOLAR CABLES

ELECTRON BEAM IRRADIATED WIND MILL CABLES

1.8 KVDC, 120° C OPERATING TEMPERATURE EB-XLPE CABLE

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Following inference can be drawn from the test results and demonstrated through photographs.

- Transformer is healthy and there is no moment of windings.
- Transformer is damaged and requires immediate repairs.
- Minor winding movement is occurred but the transformer can be run under close monitoring.
- Internal inspection of transformer can be avoided after it had met heavy short/circuit inter turn faults.

### Recovery Voltage Measurement (RVM)

Moisture in transformer has an adverse effect on the dielectric strength of oil and paper. It reduces mechanical strength of paper and accelerates the aging process which ultimately reduces the electrical strength and lead to failure. In addition to conventional tests viz. capacitance, tan delta and insulation resistance measurement for assessing the moisture in transformer. DC recovery voltage measurement (Fig. 6) is another off-line diagnostic tool for the condition monitoring of the oil, paper insulation of transformer. It detects the content of water (in percentage) present in insulation system.

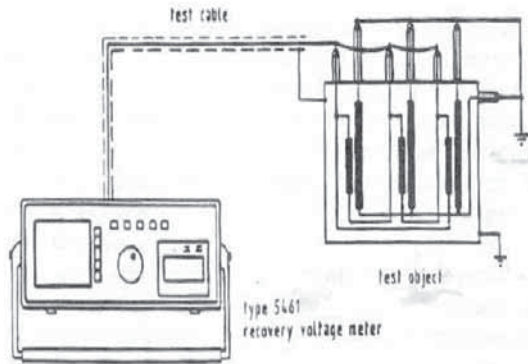


Figure 6

### Thermo vision measurement

Thermal imaging is one of the most valuable diagnostic tools used for condition monitoring of equipment. Infra red pictures (Fig.7) are produced by which temperature measurements can be made. By detecting anomalies often invisible to the naked eye, thermal imaging allows corrective action before costly system failure occurs. A thermal vision camera has proven to be an effective on-line condition monitoring tool of a transformer for determining hot spots on tanks, bushing terminal joints etc., this information is useful in predicting the temperature profiles within the inner surface of transformer tank and would provide approximate details of heating mechanism and deciding the remedial action to be taken well in advance.

### Infra Red Thermal Scan Of Transformer

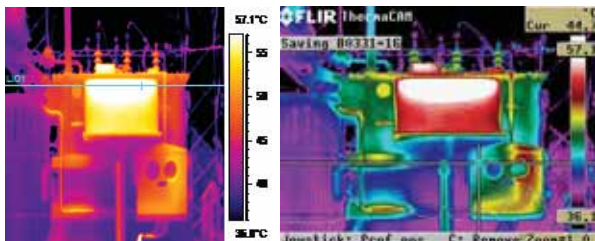


Figure 7

### Life extension programme of transformer in service

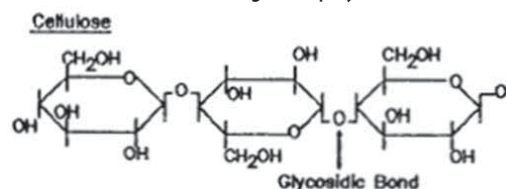
Some of this tips used to improve the life expectancy of transformer in service are highlighted below:

- Strictly adhere to the routine maintenance schedule, which include hourly, daily, quarterly, half yearly, yearly inspections as prescribed by the OEM.
- Transformer oil being hygroscopic absorbs moisture from the surrounding air. Oxidation and contamination of oil can be avoided by adopting proper oil preservation system. The most effective way is by using air-cell in conservator. By this technique, transformer oil does not come in contact with air directly but through oil resistant nitrile rubber membrane. Air-cell (Fig.8) can be retrofitted on old transformers also.
- Thermosyphon is an online oil filtration system (Fig. 9) having adsorbents viz activated alumina, silica gel etc., for continuously removing moisture and acid from transformer oil. This system is installed at the manufacturing stage and has proven to be very effective.
- Employing condition monitoring tools viz. DGA, Furan analysis and other online / offline tests as explained above for assessing health of transformer and accordingly deciding the maintenance strategy.
- Over the years, utility system has grown resulting in an increase in the available short circuit MVA. Transformers, which have aged and also having lower percentage impedance than required by the system, are likely to get damaged if installed in such high fault current areas. Hence, while shifting old transformers to new areas, this precaution may be kept in mind.
- Reducing the fault currents for the more frequent line to ground faults by installing neutral reactors can protect many old transformers. Also, it will be worthwhile to use metal oxide gap less surge arrestors for better protection and having higher safety margins.
- As Stray losses of transformer are generated at many places and it become extremely difficult to determine with sufficient reliability the total loss level by calculating every element individually if this losses are control by proper designing such as use of continuously transposed conductors (CTC FIG. 10) in the chase of high current winding. Life expectancy of the transformer can be largely improved.

### Residual Life Assessment

#### Why Residual life assessment??

- Methodology
  - Analysis of history of transformer
  - Furan Analysis
  - DP Evaluation
1. **Degree of polymerization:** Interpreting the remnant life in the transformer based on the degree of polymerisation:





# Surge Protection for PV Systems



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Figure 8

| Specimen condition | Expected DP value |
|--------------------|-------------------|
| New                | 1000 to 2000      |
| Good               | 650 to 1000       |
| Average            | 350 to 650        |
| Aged               | < 350             |

### Cellulose degradation takes place by 3 mechanisms

1. Thermal degradation
  2. Oxidative degradation
  3. Hydrolytic degradation
2. **Furan Analysis:** Furanic compounds are produced during the breakdown of the cellulose insulation in Transformers due to ageing and other reasons. The furanic compounds are:
- 2-Furaldehyde (2 FAL)
  - 5-Methyl-2-Furaldehyde (5M2F)
  - 5-Hydroxymethyl- 2-Furaldehyde (5H2F)
  - 2-Acetyl furan (2ACF)
  - 2-Furfuryl alcohol ( 2FOL)

Studies have indicated that there is a relationship between the 2 FAL and the DP.

Generally from a practical point, it is difficult to obtain proper sample of the paper for evaluation of the DP. As for this the oil must be drained and a



Figure 9

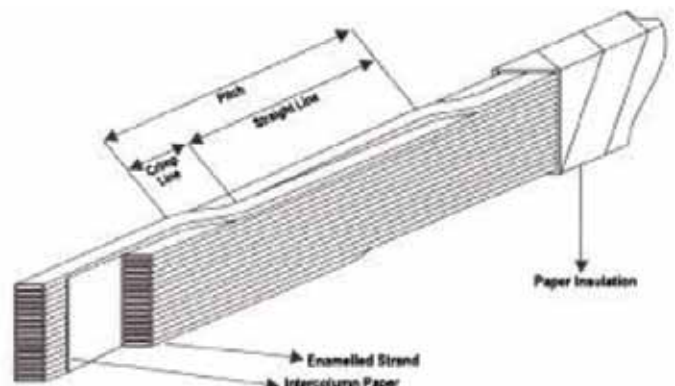


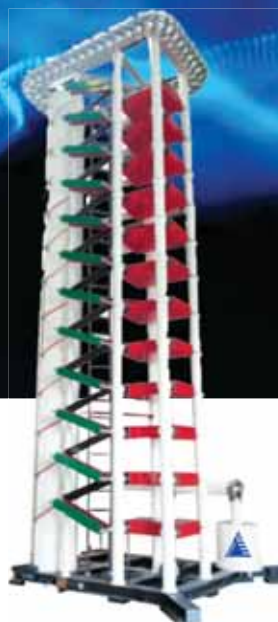
Figure 10



# KVTEK The most recognised name in India for High Voltage Test Systems



Static Frequency Converter



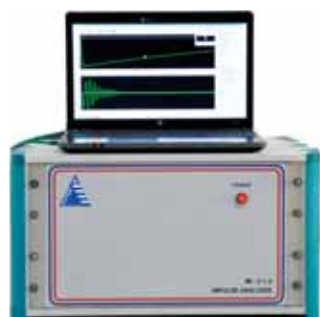
Impulse Voltage Test System



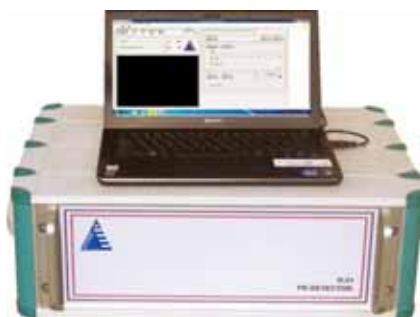
HV AC Series Resonant Test System

## PRODUCT RANGE :

- ❖ Impulse Voltage Generator
- ❖ Recurrent Impulse Calibrator
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- ❖ Partial Discharge Detection Test Set
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- ❖ Static Frequency Converter
- ❖ AC/ DC Hipot Tester
- ❖ Online Moisture Absorption System
- ❖ Online Dissolved Gas Analyzer
- ❖ Digital Impulse Analyzer
- ❖ Recurrent Impulse Generator
- ❖ HV AC Dielectric Test Set
- ❖ RF Shielded Room
- ❖ Transformer Loss Measuring System
- ❖ AC/ DC Kilo Voltmeter
- ❖ CT/ PT/ CVT Test Set
- ❖ Bushing Monitor



Impulse Analyzer



Partial Discharge Test Set



Transformer Loss Measuring System

## APPLICATIONS :

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Stray losses in transformer can be drastically reduced by using yoke shunt (Fig. 11) & Tank wall shield (Fig. 12) As shown below.



PLACEMENT OF YOKE SHUNT & EARTHING ARRANGEMENT

Figure 11



PLACEMENT OF WALL SHIELD & EARTHING ARRANGEMENT

Figure 12

**High concentration of FAL is an indication of aged insulation**

| 55°C Rise transformer 2FAL (ppb) | Estimated degree of Polymerisation (DP) | Estimated percentage of life remaining | Suggested interpretation     |
|----------------------------------|---|--|------------------------------|
| 58                               | 800                                     | 100                                    | Normal ageing                |
| 130                              | 700                                     | 90                                     |                              |
| 292                              | 600                                     | 79                                     |                              |
| 654                              | 500                                     | 66                                     | Accelerated ageing           |
| 1,464                            | 400                                     | 50                                     |                              |
| 1,720                            | 380                                     | 46                                     |                              |
| 2,021                            | 360                                     | 42                                     | Excessive ageing Danger Zone |
| 2,374                            | 340                                     | 38                                     |                              |
| 2,789                            | 320                                     | 33                                     |                              |
| 3,277                            | 300                                     | 29                                     |                              |
| 3,851                            | 280                                     | 24                                     | High risk of failure         |
| 4,524                            | 260                                     | 19                                     |                              |
| 5,315                            | 240                                     | 13                                     | End of life of paper         |
| 6,245                            | 220                                     | 7                                      |                              |
| 7,337                            | 200                                     | 0                                      |                              |

Ref : An introduction the half century Transformer by The Transformer Maintenance institute, S D Myers, 2002

proper sample obtained and the area is to be reinsulated.

More often than not this is difficult. Hence, the method of estimation of the DP and the remnant life of the transformer by measuring the furan content of oil is very convenient.

**How to enhance the life of transformer?**

- Vapour Phase Drying
- Low Frequency Heating
- Overhauling by conventional method
- Overhauling by modified method
- Online dry out



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# Using Pumps With Caution



Dr S S Verma  
Department of  
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S.L.I.E.T.  
Longowal, Punjab



Different fluids have varying characteristics and are usually pumped under different conditions. It is therefore very important to know all relevant product and performance data before selecting a pump...

Moving fluids plays a major role in many processes for daily life utilities. Liquids can only move on their own power only from top to bottom or from a high pressure to a lower pressure system. This means that energy to the liquid must be added, to moving the liquid from a low to a higher level. To add the required energy to liquids, pumps are used. There are many different definitions of the name PUMP but the best described one is as: "a machine used for the purpose of transferring quantities of fluids and or gases from one place to another". A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps are used throughout the society for a variety of purposes. Early applications include the use of the windmill or watermill to pump water. Today, the pump is used for irrigation, water supply, gasoline supply, air conditioning systems, refrigeration (usually called a compressor), chemical movement,

sewage movement, flood control, marine services, etc. In biology, many different types of chemical and bio-mechanical pumps have evolved, and bio-mimicry is sometimes used in developing new types of mechanical pumps.

## Types of pumps

Because of the wide variety of applications, pumps have a plethora of shapes and sizes: from very large to very small, from handling gas to handling liquid, from high pressure to low pressure, and from high volume to low volume. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or solar/wind power, come in many

sizes, from microscopic for use in medical applications to large industrial pumps. Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis. There are generally two types of pumps:

- Single stage pump - When in a casing only one impeller is revolving then it is called single stage pump.
- Double/ Multi stage pump - When in a casing two or more than two impellers are revolving then it is called double/ multi stage pump.

Pump types generally fall into two main categories –Rotodynamic and Positive Displacement, of which there are many forms. The Rotodynamic pump transfers rotating mechanical energy into kinetic energy in the form of fluid velocity and pressure. The Centrifugal and Liquid Ring pumps are types of rotodynamic pump, which utilize centrifugal force to transfer the fluid being pumped. The Rotary Lobe pump is a type of positive displacement pump, which directly displaces the pumped fluid from pump inlet to outlet in discrete volumes. In order to select a pump two types of data are required:

- Product/Fluid data which includes viscosity, density/specific gravity, temperature, flow characteristics, vapor pressure and solids content.
- Performance data which includes capacity or flow rate and inlet/ discharge pressure/head.
- Different fluids have varying characteristics and are usually pumped under different conditions. It is therefore very important to know all relevant product and performance data before selecting a pump.

## Pump efficiency

Pump efficiency is defined as the ratio of the power imparted on the fluid by the pump in relation to the power supplied to drive the pump. Its value is not fixed for a given pump; efficiency is a function of the discharge and therefore also operating head. For centrifugal pumps, the efficiency tends to increase with flow rate up to a point midway through the operating range (peak efficiency or Best Efficiency Point (BEP) and then declines as flow rates rise further. Pump performance data such as this is usually supplied by the manufacturer before pump selection. Pump efficiencies tend to decline over time due to wear (e.g. increasing clearances as impellers reduce in size). When a system includes a centrifugal pump, an important design issue is matching the head loss-flow characteristic with the pump so that it operates at or close to the point of its maximum efficiency. Pump efficiency is an important aspect and pumps should be regularly tested for the same.

## Centrifugal pumps

Many people employ the centrifugal pumps to move liquid or water through a piping system from one place to other. They work on centrifugal force generated by impellers and help to move the fluid. When centrifugal pumps are in operation, they increase the liquid pressure from the inlet points to their outlet points. They increase the pressure by transferring mechanical energy that is generated through the rotating impeller to the

fluid, which they have to move out. Generally, these types of pumps are used to pump buildings water supply, hot water circulation and sump pits etc. At domestic level they are applied for maintaining wells water supply and to boost pressure from intake line. They can be applied to move hot water which needs low head in a closed system. Centrifugal water pumps are used worldwide for moving different types of fluid from one location to another. Perhaps they are the most common type of water pumps especially for commercial use but they have drawbacks also.

For most household or light industrial uses, a centrifugal pump is fine. As long as the liquids aren't too viscous, like mud or waste, and the pump can be totally submerged, it will provide consistent, effective, and reliable operation. Centrifugal pumps provide a lot of flexibility, are easy to move, and don't take up a lot of space. Centrifugal pumps are fairly simple in nature. They use the kinetic energy of a motor to move liquids. An engine is attached to the axis, which then rotates the pump impeller, which is reminiscent of an old ship's 'water wheel'. The rotation moves the water from its entry point through the casing, and finally to the exit. While most pumps are used for water, centrifugal pumps are also used for sewage, petroleum, and chemicals. Incidentally, the reverse of this process is called a water turbine. The impeller is placed in moving water; it can be used as a water turbine which converts the water's energy into rotational energy. In other words, instead of the motor moving the pump to move the water, the water moves the pump to move the motor. Because of the direct conversion of the motor to rotational energy, the centrifugal pump is a very simple pump. The most common centrifugal pump control methods are

- Stop-Start/Float Level control Operation
- Control Valve Operation
- By-Pass Valve Operation
- Variable Speed Operation
- Hybrid Control (VFD + By-Pass)
- Parallel Operation of Multiple Pumps
- Multiple Speed Motors (2, 3 or 4 Speed)

As with all pumps, there are advantages and disadvantages. The biggest advantage of centrifugal pumps is their aforementioned simplicity. They don't require any valves, or many moving parts. This makes them easy to produce with many different materials. It also allows them to move at high speeds with minimal maintenance. Their output is very steady and consistent. Most of all, they are very small compared to other types of pumps that create the same output. The main disadvantage is that they use rotation instead of suction to move water, and therefore have almost no suction power. This means that a centrifugal pump must be put under water, or primed, before it will move water. Centrifugal pumps can also develop a phenomenon called "cavitations". This happens when the speed of the water causes it to vaporize, which causes bubbles in the liquid. A combination of the speed of the vapor bubbles and the implosion of vapor bubbles can be corrosive to the impeller surfaces and pump casing. Advantages and disadvantages of centrifugal pump in general can be summarized as:

### Advantages of centrifugal pump

- As there is no drive seal so there is no leakage in pump
- It can pump hazardous liquids

- There are very less frictional losses
- There is almost no noise
- Pump has almost have 100 efficiency
- Centrifugal pump have minimum wear with respect to others
- There is a gap between pump chamber and motor, so there is no heat transfer between them
- Because of the gap between pump chamber and motor, water cannot enter into motor
- Centrifugal pump use magnetic coupling which breakup on high load eliminating the risk of damaging the motor

### Disadvantages of centrifugal pump

- Because of the magnetic resistance there is some energy losses
- Unexpected heavy load may cause the coupling to slip ferrous particles in liquid are problematic when you are using magnetic drive. This is because particles collect at impeller and cause the stoppage of pump after some time

### Health of pumps for efficiency

It is important to understand the role pumps and valves play in ensuring product safety, and how to clean and maintain them properly. In today's uncertain economy, keeping pumping systems and stations operating at their optimum capability is vital. However, many organizations responsible for this crucial task do not perform regular health checks on their pump systems. Most people would not run their car or home heating units until they break down or stop working. Similarly, most people maintain their health with visits to the doctor or dentist. The same principles apply to pump systems. They require the same level of preventive care and maintenance so that operators and end users benefit the most from their investments. Preventive maintenance and monitoring provide a clear picture of the pump system's performance, save end users money and reduce environmental impact by improving energy usage.

### Regular monitoring

The maintenance of a pumping station should not be a one-time event. A robust monitoring system along with regular health checks will deliver an accurate understanding of how a pump system is performing. When end users consider the different options for monitoring performance, they should look for a system that monitors energy use, the whole life-cycle cost of the equipment and how the pump performs against its most efficient duty point.

Also, maintenance records can reveal any fault trends that will help predict or diagnose pump failure, regular breakdowns or loss of performance. This information can assist the operator in planning maintenance and controlling the budget.

Continuously-improving technology has resulted in the increased accuracy of system variable measurements. Monitoring equipment can measure pressure, flow, depth, energy consumption, vibration and temperature, without the need to drastically modify the pump station layout. A modern monitoring system can accurately obtain and record precise data, including trends of all the hydraulic and power inputs, which display in real time as the pump operates. A visual display such as this is more informative than basic numerical data logging and can be invaluable in providing information for system troubleshooting.

### Specific requirements

Having access to the data obtained from a monitoring system is particularly important because each system or station has a different set of requirements. In general, pumps are selected based on the most efficient duty point designated by the manufacturer.

Selections are most often made from desktop designs and drawings. However, even in the best circumstances, installation of a pump system/station rarely occurs exactly according to plan. This means that the pump will probably operate outside its best efficiency point. Once installed, its performance can be monitored and adjustments can be made, such as an impeller trim or speed change on the variable frequency drive. For pump upgrades and replacements, knowing the precise pumping station system data makes accurate and efficient pump selection easier.

### Adjusting the system over time

As time passes, conditions change. Components wear. Parts may be added or removed, and these changes can completely alter the system's operation. More often than not, particularly if there is no health check in place, these changes are not taken into account. However, they have altered the footprint of the originally installed system. Over time, pipes can become partially obstructed because of silt and debris build up, or local damage may occur in which pressure from the surface has damaged or misshaped a buried pipe.

Unlike our bodies, which provide signals such as pain when they are damaged, the only signals a faulty pipe will give are problems, such as flooding or a reduction in output. In most instances, pump station operators can only see the external picture. They know that the system is not working as it should, but they have no data to support their concerns. Many common pump station issues do not show up immediately. For example, the poor design of wet well benching or in-flow paths can lead to cavitation, pump wear and reduced performance. Analysis of the pump system throughout operation will indicate the telltale signs of performance deterioration. In an ideal world, and particularly when it comes to large pump systems or stations that use a lot of energy, the operator should perform regular health checks through a robust and reliable monitoring system that considers all aspects of the process. This includes a software system that runs seamlessly with the pumping equipment and records data, which can be viewed remotely at any given time for a performance analysis.

### Key elements of analysis

Products are available that can show end users how the key elements of their pumping system are operating. These elements include pressure, flow, vibration and temperature. These parameters, combined with audio monitoring, provide operators with the big picture and many small problems before they become big issues. The purpose of a health check and monitoring system is to ensure that pump systems operate at optimum performance as designed. If end users decide to employ a specialist engineering organization to perform this service, it can use the data that it gathers to advise them on their system performance, energy use and efficiencies.

If performance is poor, the service provider should recommend possible causes and remedial actions. Many of us live by the mantra, "If it isn't broken, don't fix it." However, because of this mentality, some pump system operators are pouring money down the sewer. Even if the pump well empties or the station does not flood, does not mean that problems do not exist and

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improvements cannot be made. If problems are left unresolved, one day the system will fail, which can result in expensive outages and repair or replacement costs. Failure can also cause environmental issues. All of this can be prevented through a regular health and maintenance program.


### Small repairs result in large savings

When it comes to poor performance, the issue may not be with the pump but with an associated part—an impeller, for example. A big bill can easily be avoided by having the right system, working in the right way and delivering the desired result. Small repairs and changes can make a big difference to performance.

### Analysis before replacement

Replacing a pump with the exact same pump is no longer a practical or viable option. If a pump replacement is essential, then the whole pumping system should be analyzed before investing in a new pump. This is because, over time, the surroundings in which the pump operates is likely to have changed, possibly because of the environment, local construction, changes in weather conditions or a host of other potential causes. Again, a regular health check of the system will

have identified these changes on an ongoing basis, supplying the operator with the knowledge required to make an educated pump purchase. Addressing problems in pumping systems is a constant challenge for operators. They should think of their pump system as a finely tuned engine that needs the same level of care and attention as a car's engine.

With state-of-the-art monitoring technology at their fingertips, improving the performance of pump systems is easier than ever, without the expense of costly replacements or excessive energy use. A significant factor in the design of a pumping system is the flow variation required by the process. Several pumps in parallel, variable speed pumps, pumps with on-off control and pumps with a control valve are some of the methods available for flow variation. A widely used method in the industry is to use control valves, generally located on the pump discharge in the pipe supplying process fluid. The flow could be used for different purposes—such as maintaining the level in a process vessel or in a boiler drum, or maintaining the flow in a pipeline or in the tubes of a fired heater. To understand how flow can be varied by a control valve, the system designer and operator need to understand the basic principles of how control valves behave. 

<< Guidelines

## Developing Onshore Wind Power Projects

The specific points in the new guideline for wind power projects will serve the purpose of streamlining the new projects...

The Ministry of New & Renewable Energy (MNRE) has issued draft guidelines for development of onshore wind power projects. These guidelines will facilitate development of wind projects in an efficient, cost-effective and environmentally benign manner.

Following are the features of these guidelines:

- i. Free availability of time series data from all the wind masts installed through government funding.
- ii. Provision to discourage land squatting.
- iii. Installation of international quality wind turbines.
- iv. Micrositing criteria relaxed. Safe distance prescribed for public roads, railway tracks, highways, buildings, public institutions and extra high voltage lines from wind turbine.
- v. Wind turbine to comply grid regulations.
- vi. Mandatory to install Availability Based Tariff (ABT) compliant meter with telecommunication facility to enable implementation of Forecasting & Scheduling (F&S) Regulation.
- vii. Creation of an online registry of wind turbines installed in the country and submission of monthly performance report.
- viii. Prescribing criteria for noise and shadow flicker to ensure health and safety of people working/residing near the wind farm.
- ix. Provisions for Hybridisation and repowering.
- x. Submission of Decommissioning Plan at the proposal stage itself.







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# Using Numerical Relay

## Micom P632



**Shrotriya Keyal**  
JE  
SSHEP  
Gujarat State Electricity  
Corporation Ltd.



The major operating challenge to transformer differential protection is maintaining security during CT saturation for external faults while maintaining sensitivity to detect low magnitude internal faults. CT saturation reduces the secondary output from the CT, and cause a false differential current to appear to relay...

**T**RANSFORMER is one of the most vital equipment in electrical transmission system. Power transformer is a static electric machine which transforms electric energy from one voltage level to another voltage level at a constant frequency. There is no moving part in transformer & hence it is called static machine. Grid operation and Power transmission can be reliable only if power transformers and transmission lines perform well. The transformers are very costly device. They are such an important part of a generation, transmission and distribution of an electrical system. So, one can say that transformer is a heart of an electrical system and hence they are required to be protected against any kind of faults occurring. If a fault is allowed to be persisted the equipment will get damaged causing a loss of crores of rupees. Even a micro volt discharge can disrupt mega units of system and hence causing losses, hence it is necessary to take the transformer out of service as soon as possible so that the damage is minimized and hence loss is minimized.

Traditionally the protection of transformers has been relegated to the application of transformer differential and back up over current relays to provide short circuit protection. But nowadays due to advent of multifunction digital and numerical relays, the term protection of transformer has gained a whole new level.

### A transformer is a device that

- i Transfer electric power from one circuit to another.
- ii It does so without a change of frequency.
- iii It accomplishes this by electromagnetic induction.
- iv Where the two electric circuits are in mutual inductive influence of each other.

Main part of Transformer:-

- 1) Main Tank
- 2) O.L.T.C.
- 3) Conservator Tank
- 4) Breather
- 5) Radiator
- 6) Explosion vent
- 7) Cooling device

### Basic information about Power Transformer Protection:

Large power transformers belong to a class of very expensive and vital components in electric power systems. If a power transformer experiences a fault, it is necessary to take the transformer out of service as soon as possible so that the damage is minimized. Traditionally, the protection of transformers has been relegated to the application of transformer differential and back up over current relays to provide short circuit protection. With advent of modern multifunction transformer packages, differential

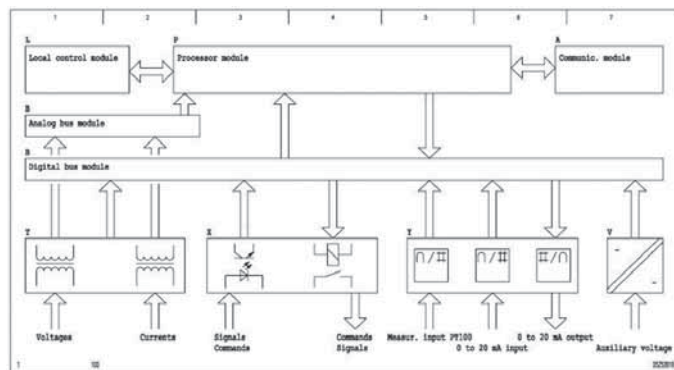


Figure 1: Modular and interfacing structure of Relay Micom P632...

and over current protection are only two of many protective and logic functions that can be incorporated into transformer packages. Transformer protection requirements also vary depending on location of transformer in power system. Since Transformer protection requirements vary depending on application, users typically want only those functions that are needed for specific applications. In addition, the use of programmable logic functions extends the benefit of digital multifunction transformer protection.

The costs associated with repairing a damaged transformer may be very high. The unplanned outage of a power transformer can also cost electric utilities millions of rupees. Consequently, it is of a great importance to minimize the frequency and duration of unwanted outages. Accordingly, high demands are imposed on power transformer protective relays.

The operating conditions of power transformers do not make, however, the relaying task easy. Protection of large power transformers is perhaps the most challenging problem in the power system relaying area.

### Faults in transformers

Faults can be divided into three main classes:

#### a) Faults in auxiliary equipment:

The incipient faults can develop major faults. Some of them are as follows:

- 1) Transformer oil:
- 2) Gas cushion:
- 3) Oil pumps and Forced Air fans:
- 4) Failure of insulation between Laminations of core and core bolt insulation failure:
- 5) Badly made joints and connections:
- 6) Inter turn faults:

#### b) Winding Faults:

When the insulation between windings and between the winding and core fails, electrical faults are said to have taken place.

#### c) Through Faults:

The through faults can occur due to overloads or external short circuits.

### Types of protection

- Differential protection
- Definite Time Over Current protection
- Inverse Definite Minimum Time(IDMT) protection
- Under Voltage
- Over Voltage

- Over Fluxing
- Restricted Earth Fault

### Specification of transformer used

I implement a single phase transformer protection scheme by numerical relay MiCom P632 manufactured by ALSTOM; in laboratory so that student can understand its real aspects and how protection scheme is developed in real field so that I took 1KVA core type transformer.

- 1 kVA TRANSFORMER
- 220/110 VOLTAGE
- Core type transformer
- Single phase transformer
- Frequency=50Hz
- Turns ratio 1:1
- Cooling – Natural air cool
- INS CLASS-B

### Specification of CTs:

- Burden 15kVA Class 5P
- Ratio 10/5 Frequency=50Hz Voltage =0.66kV
- H.V WINDING 10/5 AMPERE
- L.V WINDING 5/10 AMPERE

|        |   | P631 | P632 | P633 | P634 |
|--------|---|------|------|------|------|
| COMM1: | Communication link  | ✓    | ✓    | ✓    | ✓    |
| DIFF:  | Differential protection   | ✓    | ✓    | ✓    | ✓    |
| DTOC1: | Definite-time overcurrent protection 1  | ✓    | ✓    | ✓    | ✓    |
| DTOC2: | Definite-time overcurrent protection 2  | ✓    | ✓    | ✓    | ✓    |
| DTOC3: | Definite-time overcurrent protection 3  | -    | -    | ✓    | ✓    |
| DVICE: | Device  | ✓    | ✓    | ✓    | ✓    |
| f<>:   | Over-/underfrequency protection   | -    | ✓    | ✓    | ✓    |
| FT_DA: | Fault data acquisition  | ✓    | ✓    | ✓    | ✓    |
| FT_RC: | Fault recording   | ✓    | ✓    | ✓    | ✓    |
| IDMT1: | Inverse-time overcurrent protection 1   | ✓    | ✓    | ✓    | ✓    |
| IDMT2: | Inverse-time overcurrent protection 2   | ✓    | ✓    | ✓    | ✓    |
| IDMT3: | Inverse-time overcurrent protection 3   | -    | -    | ✓    | ✓    |
| INP:   | Binary inputs   | ✓    | ✓    | ✓    | ✓    |
| IRIGB: | IRIG-B interface  | ✓    | ✓    | ✓    | ✓    |
| LED:   | LED indicators  | ✓    | ✓    | ✓    | ✓    |
| LIM_1: | Limit value monitoring 1  | ✓    | ✓    | ✓    | ✓    |
| LIM_2: | Limit value monitoring 2  | ✓    | ✓    | ✓    | ✓    |
| LIM_3: | Limit value monitoring 3  | -    | -    | ✓    | ✓    |
| LIMIT: | Limit value monitoring  | ✓    | ✓    | ✓    | ✓    |
| LOC:   | Local control panel   | ✓    | ✓    | ✓    | ✓    |
| LOGIC: | Logic   | ✓    | ✓    | ✓    | ✓    |
| MAIN:  | Main functions  | ✓    | ✓    | ✓    | ✓    |
| MEAS1: | Measured data input   | ✓    | ✓    | ✓    | ✓    |
| MEASO: | Measured data output  | ✓    | ✓    | ✓    | ✓    |
| MT_RC: | Monitoring signal recording   | ✓    | ✓    | ✓    | ✓    |
| OL_DA: | Overload data acquisition   | ✓    | ✓    | ✓    | ✓    |
| OL_RC: | Overload recording  | ✓    | ✓    | ✓    | ✓    |
| OP_RC: | Operating data recording  | ✓    | ✓    | ✓    | ✓    |
| OUTP:  | Binary outputs  | ✓    | ✓    | ✓    | ✓    |
| PC:    | PC link   | ✓    | ✓    | ✓    | ✓    |
| PSS:   | Parameter subset selection  | ✓    | ✓    | ✓    | ✓    |
| REF_1: | Ground differential protection 1 (Am) ; (Br: Restricted earth fault protection 1) | -    | ✓    | ✓    | ✓    |
| REF_2: | Ground differential protection 2  | -    | ✓    | ✓    | ✓    |
| REF_3: | Ground differential protection 3  | -    | -    | ✓    | ✓    |
| SFMON: | Self-monitoring   | ✓    | ✓    | ✓    | ✓    |
| THRM1: | Thermal overload protection 1   | ✓    | ✓    | ✓    | ✓    |
| THRM2: | Thermal overload protection 2   | -    | -    | ✓    | ✓    |
| V<>:   | Time-voltage protection   | -    | ✓    | ✓    | ✓    |

Table 1: Function group of Micom P63\* Relay group...

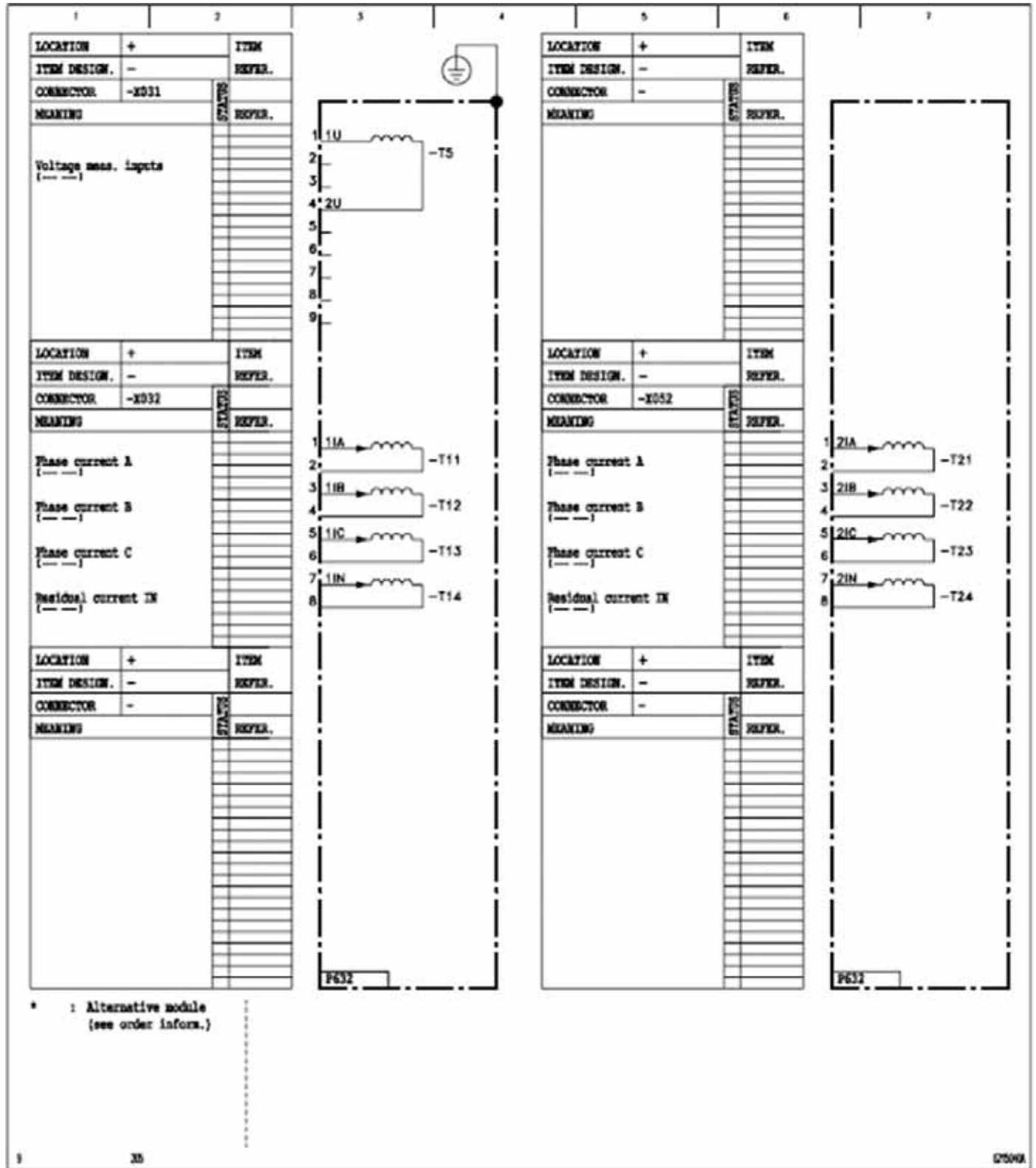


Fig. 2: Terminal diagram of Relay Micom P632...

### Introduction of Micom P632 Relay

The P63x differential protection devices are designed for the fast and selective short-circuit protection of transformers, motors and generators and of other two-, three- or four winding arrangements. Four models are available.

The P631 and P632 are designed for the protection of two-winding arrangements, the P633 and P634 for the protection of three- or four-winding arrangements, respectively.

### Main functions of Relay MiCom P632:

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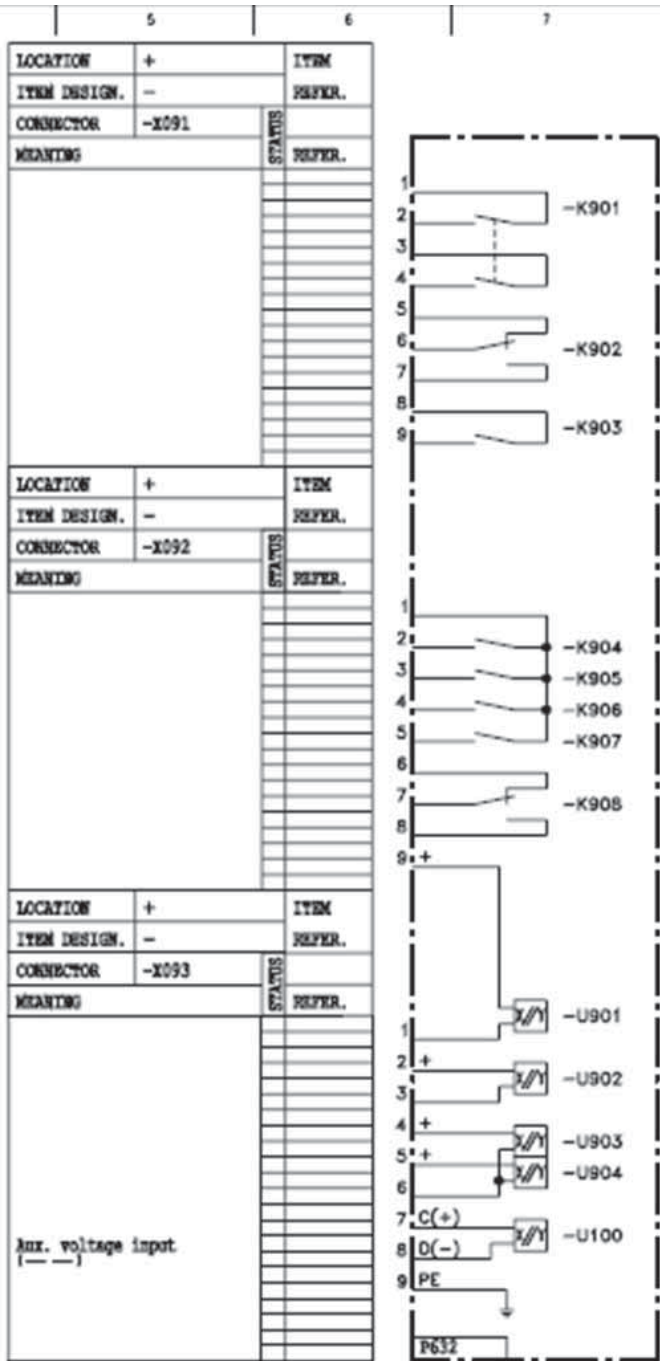


Fig. 3: Tripping contact diagram of Relay Micom P632...

- Three-system differential protection for protected objects with up to four windings.
- Amplitude and vector group matching.
- Zero-sequence current filtering for each winding may be deactivated.
- Triple-slope tripping characteristic.
- Inrush restraint with second harmonic, optionally with or without global effects may be deactivated.
- Over fluxing restraint with fifth harmonic component may be deactivated.
- Through-stabilization with saturation discriminator.

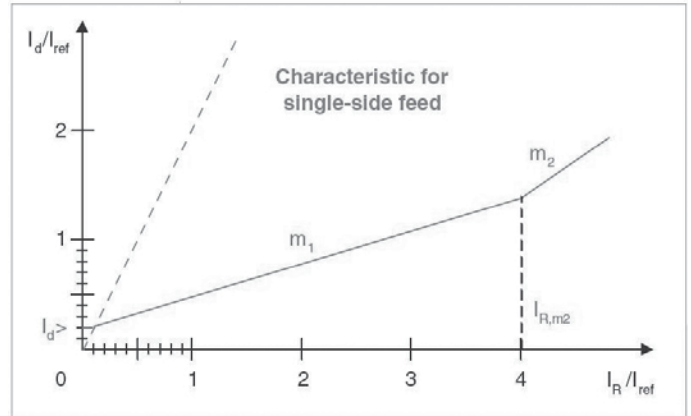


Fig. 4: Tripping characteristic of the differential protection...

- Ground differential protection.
- Definite-time over current protection.
- Inverse-time over current protection.
- Thermal overload protection.
- Over-/ under frequency protection.
- Over-/ under voltage protection (time-voltage protection).
- Limit value monitoring.
- Programmable logic.

### Global functions

In addition to the features listed above, the P63x models provide comprehensive self monitoring as well as the following global functions:

- Parameter subset selection.
- Operating data recording (time-tagged signal logging).
- Overload data acquisition.
- Overload recording (time-tagged signal logging).
- Fault data acquisition.
- Fault signal recording (time-tagged signal logging with fault value recording of the phase currents for each winding).
- Extended fault recording (fault recording of the neutral-point current for each winding as well as the voltage).

### Introduction of transformer differential

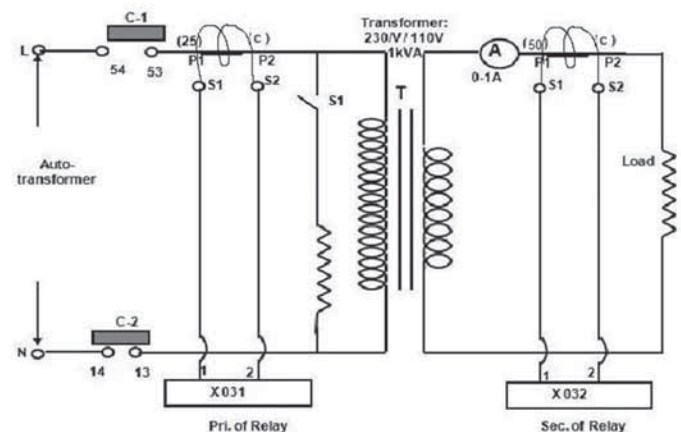


Fig. 5: Power circuit...

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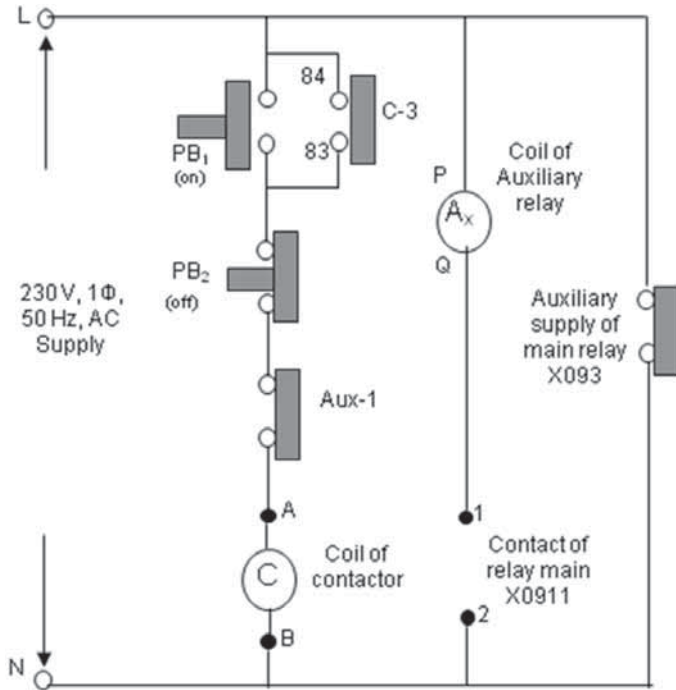


Fig. 6: Control circuit...

**protection**

On the basis of the primary transformer currents, the differential protection devices can be flexibly adapted to the reference currents of the protected object. Amplitude matching is by means of a straight-forward input of the reference power common to all windings plus the nominal voltages and the nominal transformer currents for each winding. Zero-sequence filtering may be deactivated separately for each winding in case of an operational grounding within the protected zone. The tripping characteristic of the differential protection device has two knees. The first knee is dependent on the setting of the basic threshold value  $I_{d>}$  and is on the load line for single-side feed. The second knee of the tripping characteristic is defined by a setting. Above the user-selected differential current level  $I_{d>>>}$ , the restraining current is no longer taken into account. Up to a certain limit, stability in the event of external faults is

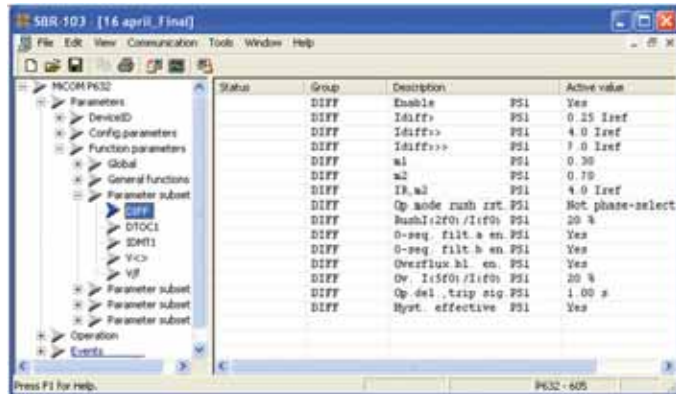


Fig. 7: settings of function parameter <parameter subset1 <diff (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM)...

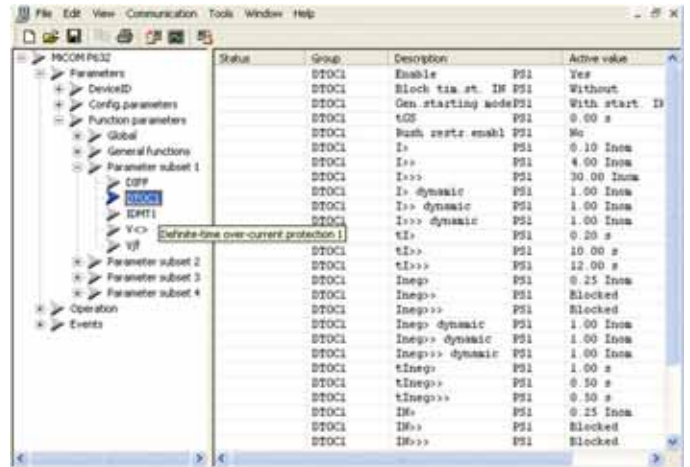


Fig. 8: settings of function parameters <parameter subset1 <DTC1 (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM)...

ensured by means of the bias. Due to the triple-slope tripping characteristic, the stabilization is particularly pronounced for high currents.

However, as an additional safeguard for through currents with transformer saturation, the MICOM P63x series differential protection devices are provided with a saturation discriminator. Particularly the start-up of directly switched asynchronous motors represents a problem in differential protection due to transient transformer saturation caused by a displacement of the start-up current for relatively high primary time constants. Even under such unfavorable measurement conditions, the MICOM P63x series differential protection devices perform with excellent stability. Stabilization under inrush conditions is based on the presence of second harmonic components in the differential currents. The ratio of the second harmonic component to the fundamental wave for the differential current of the measuring systems serves as the criterion. Optionally, tripping is blocked either across all three measuring systems or selectively for one measuring system. However, from a user-selected differential current level

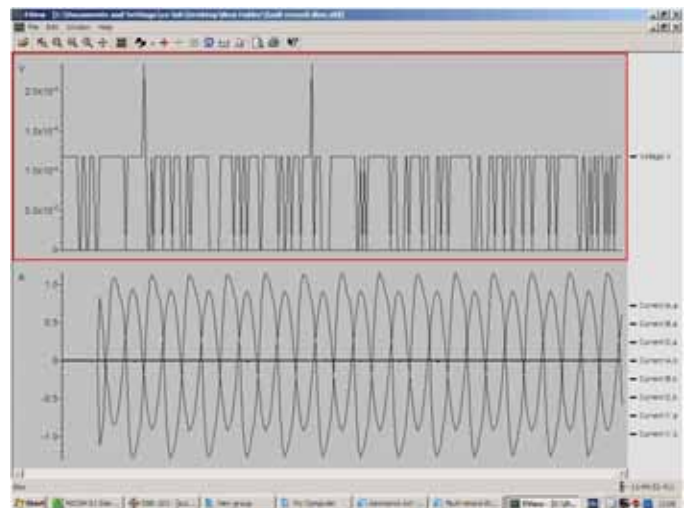


Fig. 9: fault recording graph of transformer DTC over current protection scheme...

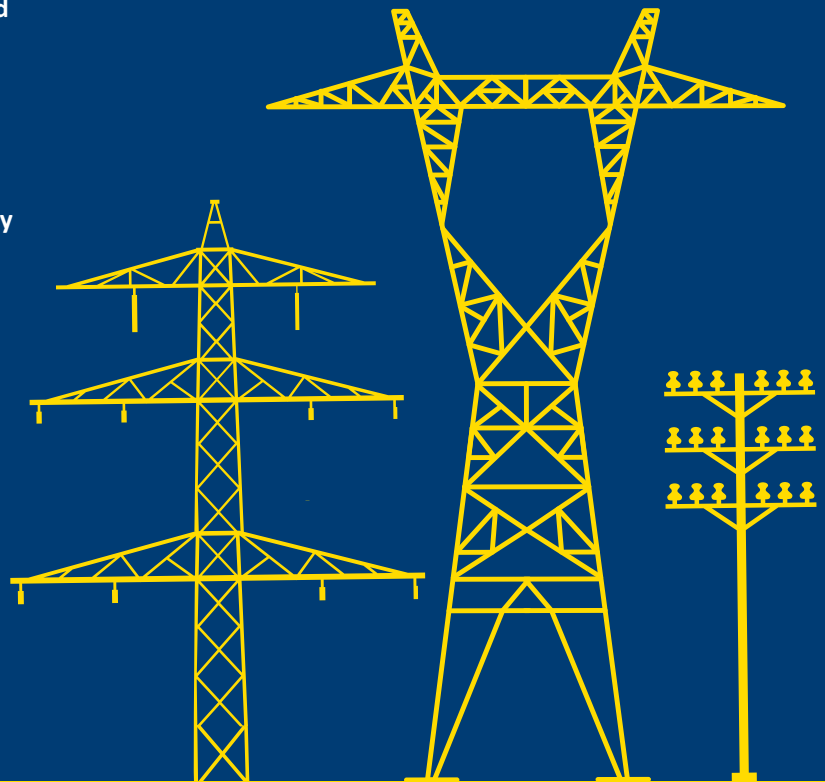


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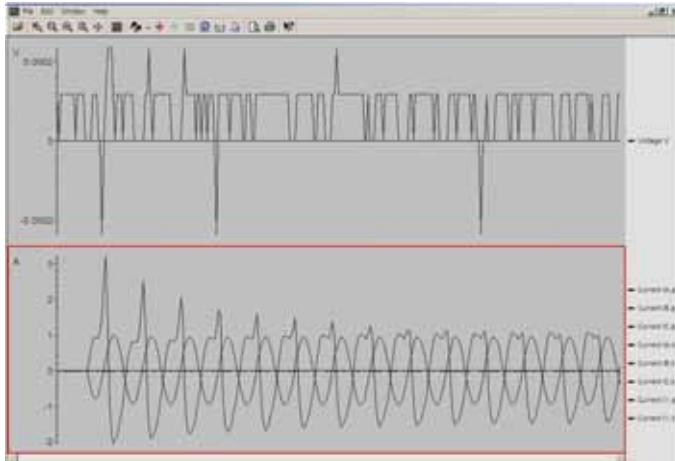


Fig. 10: fault recording graph of transformer IDMT over current protection scheme...

Id>>, the blocking criterion is no longer taken into account. For application as differential protection device for motors or generators, the harmonic restraint can be deactivated.

**Power circuit diagram:**

As shown in circuit diagram we have used 1 transformer of 1 kVA, 239/110V, two CTs having ratio of 10/10 Amp (primary side) and 10/5Amp (secondary side). Two rheostat (1 for load and another for internal fault purpose) having a ratio of 185ohm,1.5Amp.

**Control circuit diagram**

For energizing transformer we push ON button and it will close the contact C1, C2 of the contactor coil. As internal fault occurs contact of relay closes thus energizing auxiliary relay. The Ax1 thus opens up from its normally closed position to normally open. This de-energizes the contactor coil and hence circuit gets de-energized.

**Terminal Diagram**

- X091-RELAY CONTACT
- X032-PRIMARY SIDE CT INPUT X052-SECONDARY SIDE CT X031-VOLTAGE INPUT FROM PT X093-AUX- POWER SUPPLY (7,8)

Software settings done in Relay MiCom P632 for differential protection scheme:

(This flow chart is shown for easy understanding when you are working on Relay and is given for only one protection scheme.)

- >CONFIGURATION PARAMETER
  - >DIFF-WITH
- >CONFIGURATION PARAMETER
  - >OUTP
    - >>GENERATION TRIP SIGNAL1
- >GLOBAL
  - >>MAIN
    - >>>DIFFERENTIAL TRIP SIGNAL1
- >CONFIGURATION PARAMETER
  - >LED X7

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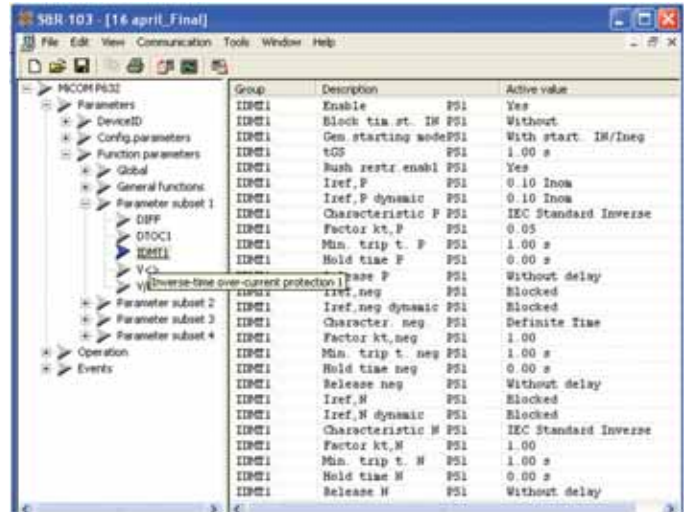


Fig. 11: settings of function parameters<parameter subset 1 (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM)...

- >FUNCTION PARAMETER
- >GENERAL FUNCTION

->>DIFF-Yes

**Calculations of set values in the reference of 1 KVA transformer:**

We have value of Sref=0.1 MVA, Vnom=54.4kV  
Current Iref=(Sref)/(√3 \* Vnom)= 1 Amp

Fault resistance is placed at 45ohm.

So that current I=2.55 Amp

Differential current Idiff=1.55 Amp

**Procedure for checking transformer differential protection scheme:**

For a creation of fault there is a rheostat with a switch connected in a series with it and in open position. This is connected on a primary side as shown in a power diagram. Now as the switch is closed, thus the primary is short through the rheostat. So now Idiff passes through the relay as there is no current in the secondary side. The value of this diff current is above the

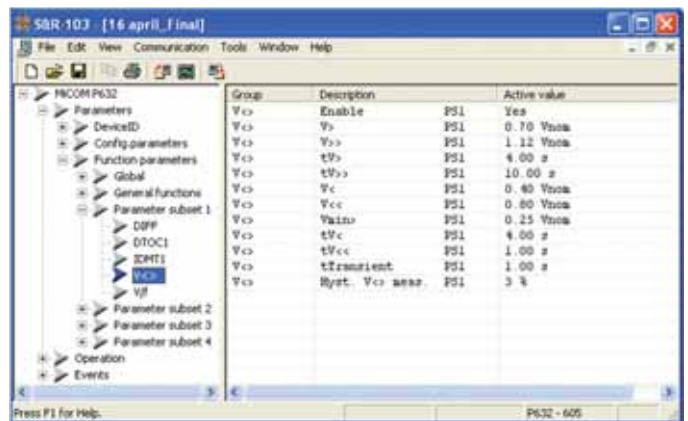


Fig. 12: settings for over voltage (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM)...

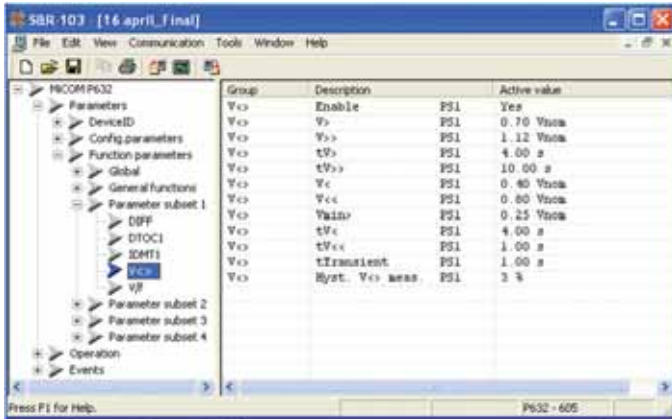


Fig. 13: settings for under voltage (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM...

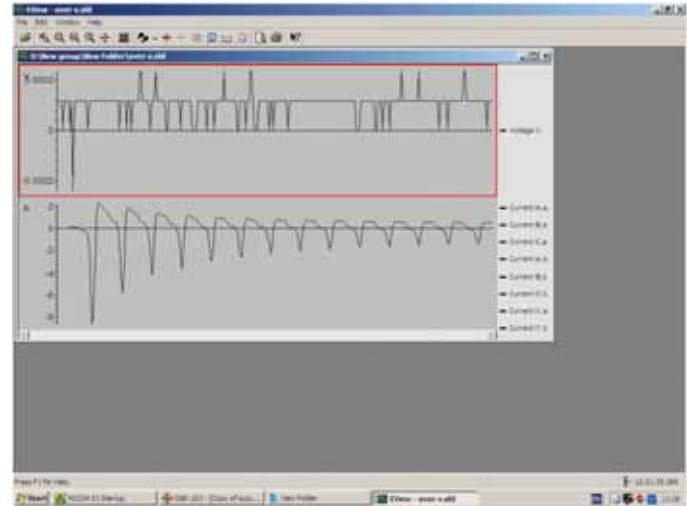


Fig. 14: fault recording graph of transformer over voltage protection scheme...

pickup and hence the diff protection will be operated. So the relay will operate when Idiff is more than a set value and generate the trip signal and giving trip command.

**Introduction and scheme of Definite time and inverse time over current protection of Transformer**

Both the definite-time and the inverse-time over current protection operate with separate measuring systems for the evaluation of the three phase currents, the negative-sequence current and the residual current. Three stages each are provided for the three protections. The inverse-time over current protection offers a multitude of ripping characteristics for the individual measuring systems

Software settings done in Relay MiCom P632 for definite time over current protection scheme(This flow chart is shown for easy understanding when you are working on Relay and is given for only one protection scheme.)

```
>CONFIGURATION PARAMETER
->DTC-1-WITH
>CONFIGURATION PARAMETER
->OUTP
->GENERAL TRIP SIGNAL1
>FUNCTION PARAMETER1
->>MAIN
->>>DTC-1 TRIP SIGNAL1
>CONFIGURATION PARAMETER
->LED X8
>FUNCTION PARAMETER
->GENERAL FUNCTION
->>DTC-1-Yes
```

**Procedure for checking transformer over current protection scheme:**

Push the green push button and energize the circuit. Now select the IDMT1 function in parameter subset1 and select "NO" value in enable feature so that this function is temporarily bypassed. This is done to show the individual test function of DTOC. Now, increase the load current by decreasing the rheostat load. As the current goes above specified amp the relay will send trip signal after the set time 5sec as the stated above and

circuit gets de-energized.

In the P632, two three stage Inverse-time over current protection. Functions (IDMT1 and IDMT2) are implemented and can be assigned to the two transformer ends. It works on the principle that, if the current measured by the CT goes above the threshold then according to selection of operation characteristic the relay will send the trip signal. For each IDMT function, a setting parameter is provided for this assignment by the user.

That means as the value of current goes above 0.10A then the protection feature gets enable and the relay send the trip signal according the characteristics that has been selected.

**Introduction and scheme of under and over voltage protection of Transformer:**

The two stage voltage-time protection function of the p63x evaluates the fundamental wave of the pulse voltage. V<> protection is ready when it is enabled and measuring circuit monitoring has not detected a fault in the voltage measuring circuit. The p63x checks the voltage to determine whether it exceed or falls below set threshold. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs. If the decisions of under voltage monitoring are to be included in the trip Commands, then it are recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and thus it would not be possible to close the circuit breaker again.

Here we do not have a three transformer or a PT connected to transformer. Hence we have used auto-transformer for simulation purpose.

Here the setting is multiple of Vnom voltage.

This voltage is set by software, means we can set this value according to the PT secondary available. Thought here we do not have a PT so we have set this standard value to 110 volt. Here there is setting of Vnom PT sec. this setting has to be changed to 110 volt. We can change it according to the option available in that menu and hence make our further setting accordingly for trip command. So this means, if we set the threshold of 0.7 Vnom for V>setting then the relay will send the trip signal as soon as the voltage goes above 77V.

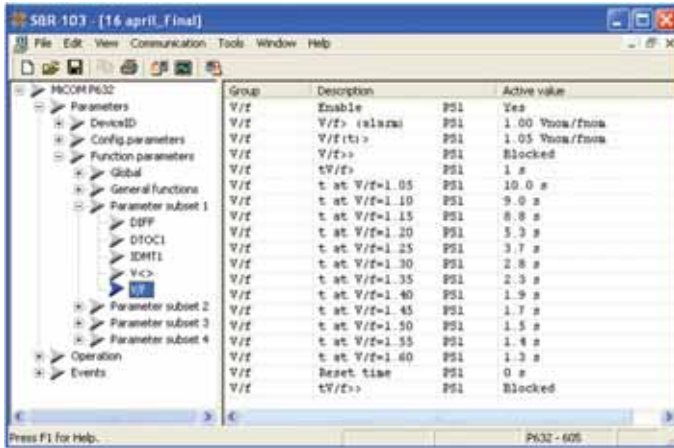


Fig. 15: settings of function parameters<parameter subset1<v/f (this is a screen shots of micom software based setting program for which user have to install micom software given by ALSTOM...

Similarly for under voltage feature, we have set the threshold of 0.4 Vnom in V<menu available in the same menu. This means if anyhow the voltage dips beyond 44 volt then the relay will give out the trip signal after the set time or even instantaneously.

The operating time can be set in the same menu under tV>for overvoltage and tv<for under voltage. For both the features we have kept the time as 5 seconds.

### Procedure for checking transformer over and under voltage protection scheme

Connect the auto-transformer output between pin 1 and pin 4 of X032. Now before energizing the circuit, energize the auto-transformer and set the voltage anywhere between 44V to 77V. now push the green push button and energize the circuit. You will notice the relay and circuit in healthy state. Now for testing over voltage feature, slowly increase the voltage knob such that it crosses 77V.

As soon the threshold is crossed after 5 second, the relay will send the trip signal and visual indication will also be seen.

Similarly follow procedure from first step after clearing the fault and test for under voltage.

### Introduction and scheme of over fluxing protection of transformer:

The P63X checks the voltage to detect whether it exceeds or falls below set threshold. The frequency is determines from the difference in a time between the zero crossing of the voltage. The voltage is the one that is measured by PT and send to relay at its terminal. As for simulation purpose we are using a single phase transformer, the frequency is constant. An introduction of frequency changer is not feasible so far over fluxing we have kept the frequency constant and we will change the voltage and thus the ratio of V/f will change. The input for this is also the same terminal where we have given supply for under voltage protection. The PT secondary voltages are tested for the given protection and will acts accordingly.

### Procedure for checking transformer over fluxing protection scheme:

First of all to avoid any conflict in simulation of protection, we disable

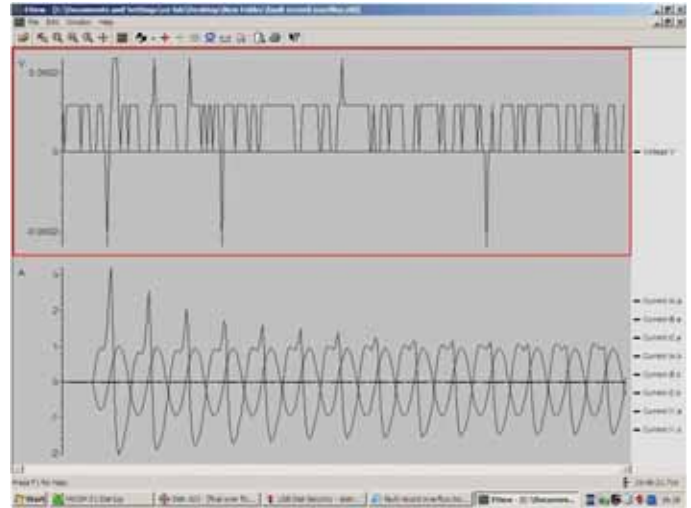


Fig. 16: fault recording graph of over fluxing protection scheme of transformer...

the over- under voltage feature. This is done as here also it is required to change the voltage level by auto- transformer to change the ratio of V/f after disabling the over under voltage feature, set the voltage level at 110V. Now push the green button and the circuit energize. If the voltage level is increased by 1 volt, immediately we can see the visual indication of protection of function and the alarm LED flashing. Now further if we increase the voltage then the value of ratio of V/f increases. When this crosses the threshold for trip signal then the relay sends the trip command exactly after the pre set delay time.

We have set Vnom as 110V and fnom as 50 Hz. Normally the ratio of V/f for this simulation should be equal to 110/50=2.2 so we have set the alarm value for this protection as 1.00\*(Vnom/fnom).

Meaning above 2.2 thresholds, the relay will not trip but will give alarm and visual indication.

Now if the value of the ratio goes above 2.8 times, then the relay will give trip command after a delay of 5 sec.

## Conclusion

In relay MICOM P632, many protections are provided for the transformer such as differential protection, under-voltage protection, definite time over current protection, and inverse time over current protection, thermal overload protection, over/under frequency protection and many more.

The major operating challenge to transformer differential protection is maintaining security during CT saturation for external faults while maintaining sensitivity to detect low magnitude internal faults. CT saturation reduces the secondary output from the CT, and cause a false differential current to appear to relay. We have also faced a problem i.e. the transformer is of 1KVA and the lowest range in MICOM P632 is 0.1 MVA.

Relay calculates differential current in multiples of Ire which is based on MVA rating. So we have to set Ire equal to 1 and we have to set Vmin to 57.73 KVA.

As a result we always get better results for protecting the transformer by using numerical relay MICOM P632 rather than using an electromechanical relays.

Reference: Manual of Micom P632 Relay provided by ALSTOM



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## Uniquely >>> Different

Introducing NEW electrical Measuring Instruments with unique features to complete your HVAC/R kit.

After intensive research and development work, Testo SE & Co KGaA has now reached its target to provide an all round solution to the HVAC/R sector by introducing first of its own set of electrical measuring instruments, backed by latest German technology. With them, the company tries to provide uniquely different solutions with advanced features to their customers. These intelligent electrical measuring instruments from Testo makes it possible for the users to carry out their daily measurement tasks more easily, safely and efficiently than ever before. In contrast to many products in the market, the measuring instruments from Testo show many differentiating benefits and an excellent price-performance ratio. Added to this is the advantage, that with 12 products, Testo India completes its basket of necessary tools for measuring needs of HVAC/R.

### The objective is to make HVAC/R measurements easier

The market for electrical measuring instruments today already offers a multitude of solutions for many different measurement parameters. This is the reason why Testo did not want to simply launch yet another measuring instrument on to the market, but to provide a real added value for the target group. In particular, Testo wants to provide innovative technology to enable

efficient working of HVAC/R sector than with existing measurement solutions. The new instruments are extremely user-friendly: they are easy and intuitive to use, save many work steps, offer the highest level of safety, and are suitable for various applications.

### Five product families for all important measurement tasks

Testo is launching a total of five product families for all important measurements on electrical appliances and systems. These include a digital multimeter in three versions, which automatically recognizes the measurement parameters by socket use, and which can be more safely operated using function buttons than with the usual rotary dial. Three clamp meter models with a unique clamp mechanism for measuring tight-fitting cables. This allows current cables to be grabbed precisely. It is available with two current-voltage testers which fulfil the newest voltage tester standard, and allows selection of measurement parameters automatically and without the danger of confusion. Completing the range are three voltage testers – all equipped with an all-round LED display which can be read from any position – and a non-contact voltage tester with a filter for high-frequency interference.





### testo 760 – the first automatic multimeter

The testo 760 digital multimeter family comprises of three models for all important electrical measuring tasks. Function keys replace the traditional dial on all three instruments, which means easier operation and greater reliability. Incorrect settings are now impossible, because the measurement parameters are detected automatically via the assignment of the measuring sockets and also shown by the illumination of the appropriate function keys. The testo 760-1 model is the standard version for almost all daily measuring tasks. The testo 760-2 is differentiated by a larger current measurement range, the true root mean square measurement - TRMS - and a low-pass filter – for VFD output voltage measurements accurately. The testo 760-3 is the model with the highest specification and, in addition to the features of the other two models; it has a voltage range of up to 1,000 V, along with higher measuring ranges for frequency and capacitance. In addition,  $\mu\text{A}$  current measuring range is also available.

### testo 770 – grab cables without touching

The three instruments in the testo 770 clamp meter family are ideally suited for non-contact current measurement in switching cabinets with a unique feature of inrush current measurement as well. One of the two pincer arms can be fully retracted into the instrument. This unique grab mechanism means that cables in tight switching cabinets can be easily grabbed. The



automatic measurement parameter detection also ensures reliable work: in the current and voltage area, all three instruments detect direct and alternating current and select other parameters such as resistance, continuity, diode and capacitance automatically. The testo 770-1 model is the standard version for daily measuring tasks, including starting current measurement. The testo 770-2 also has a  $\mu\text{A}$  range as well as an integrated temperature adapter for all type K thermocouples. In addition, the testo 770-3 offers a power measurement function, along with Bluetooth.

### testo 755 – the first voltage tester measuring current

Both instruments in the testo 755 current/voltage tester family are the first of their kind: voltage testers which meet the latest standard and which can also measure current. This means they are suitable for virtually all daily electrical measuring tasks. Each time they are used they automatically select the right settings and therefore prevent dangerous incorrect settings. Both instruments have all the important functions for determining voltage/de-energization, for measuring current and resistance, as well as for continuity tests. In addition, the integrated flashlight enables dark spots to be illuminated. The measuring tips can be changed easily, so that the whole instrument does not need to be replaced in the event of damage. The testo 755-2 model is differentiated by the larger current range of up to 1,000 V and special functions, such as the single pole phase testing and rotating magnetic field measurement. In addition, it is also certified according to voltage tester standard DIN EN 61243-3:2010.

### testo 750 – the voltage tester with all-round LED display

The three models in the testo 750 voltage tester family are the first instruments with an all-round LED display. The display can be seen from any position and guarantees an ideal voltage indication thanks to its unique fibre optics. All three models meet the latest voltage tester standard EN 61243-3:2010 and have a safety specification according to CAT4. They have the most important functions for voltage testing, continuity testing and rotating magnetic field measurement. The testo 750-2 is also suitable for single pole voltage testing and has a flashlight along with an RC trigger function. Vibrating load buttons ensure that trigger tests cannot be carried out accidentally. In addition, the testo 750-3 is fitted with an LC display to show the current reading.

### testo 745 – the non-contact voltage tester

The testo 745 non-contact voltage tester with a voltage range of up to 1,000 V is particularly well-suited to fast initial checking of any suspected fault sources. When the presence of voltage is determined, the testo 745 gives a warning via a clear visual and acoustic signal. In order to increase reliability, the voltage tester has a filter for high-frequency interference signals and is also waterproof and dustproof according to IP 67.

With the introduction of the electrical measuring instruments, Testo now offers portable and stationary measurement solutions for almost all areas of application from one provider for HVAC/R.

For further information: [www.testo.in](http://www.testo.in)

# 5 Tips To Avoid Electrical Accidents

Copper Development Association (CDA) offers a few important tips to keep you and your property safe...

Electrical wiring is everywhere, tucked behind the walls of your home and within your HD television, DVD player, laptop computer, printer, smartphone, security systems and other equipment. It only takes one electrical accident to deliver a lethal jolt to a human body, or burn a home to the ground. Copper Development Association (CDA) offers 5 tips to keep you and your property safe.

## Reduce excessive attic temperatures

When you're up in an attic on a sunny summer day, you know the meaning of hot. If the wires are buried in attic insulation, pass over light fixtures or, worst of all, are arranged in tight bundles, they become even hotter than if they're out in the open. The heat doesn't affect the copper conductors in the wiring; it's the plastic insulation and jacketing that surrounds the wires that are the problem. These are usually rated to withstand up to 194 degrees. The cumulative effect of ambient heat and current on attic wiring can result in temperatures that come close to or exceed the limit. To help reduce excessive temperatures that could possibly lead to fires, use larger diameter wires than minimum requirements because they offer less resistance to electrical current, and they permit more current flow while staying cooler.

## Replace old wiring

Along with spring cleaning, it's a great time to update your electrical wiring. If your home is more than 25 years old, and you've never upgraded your electrical service, you may be living with an inadequate and possibly hazardous wiring system. Homes more than 40 years old are especially susceptible to bare or frayed wires, crumbling insulation or faulty switches. Passing too much current through a wire, or overloading, can melt or burn the wire's insulation and start a fire. If your home is wired with aluminium branch circuit wiring – largely used 50 or more years ago – consider replacing the wiring with modern copper branch circuits. Have a qualified electrician inspect your wiring for dangerous conditions.

## Avoid overloaded or damaged extension cords

Outdoors, electrical extension cords power everything from hedge trimmers to power saws to drink mixers. Indoors, they're used for temporary power needs from the basement to attic. Because electrical tools and appliances have different power ratings, these rugged, weather-resistant portable cords are designed to accommodate a variety of temporary power requirements, but not all extension cords are created equal, varying in gauge (wire diameter) and thus capacity.

An improperly sized extension cord can cause a tool or appliance motor to burn out if allowed to run for too long. It can also cause a dangerous situation if it overheats. It is important to know how much electrical current (typically rated in amperes, or amps) each electric tool requires.

High-powered tools like saws and mowers use considerably more amperage, so extension cords rated to handle greater electrical loads should be used with them. Tool and appliance manuals usually specify extension cord requirements for proper operation of the equipment.


Amperage ratings are also marked on the equipment itself. Given the relatively low cost of extension cords, compared to the expense of replacing a damaged tool or appliance, consumers are urged to check the numbers and buy up. You may have one application in mind when shopping for a cord, but end up using it for more demanding applications. The wire can never be too big, but it can be too small.

## Stay away from wet locations

It's not safe to go near the water with electrical equipment. Wet locations such as kitchens, baths and utility rooms – as well as grounded areas like your basement or garage – require outlets protected by Ground Fault Circuit Interrupters, or GFCIs. If GFCIs have already been installed near sinks and dishwashers, test their reset buttons to be sure they are working properly. Have an electrician inspect your outlets to make sure you have GFCI outlets where required.

## Install a lightning protection system

Severe thunder and lightning may occur only during the spring and summer months, but when a storm does pass through, the number of strikes it produces can be alarming. Lightning protection systems do not attract lightning to structures, nor do they repel it. Rather, these systems intercept the lightning and channel the energy onto a low-resistance path, thus safely discharging, or 'grounding,' the electrical current to the earth. Copper and its alloys are the most common materials used in lightning protection because of superior corrosion resistance and tight connections, although manufacturers offer the same products made of either copper or aluminium.

The best way to safeguard against electrical hazards is to have a professional electrician install, inspect and – if necessary – upgrade your wiring. It's not worth the risk to rely on non-copper wiring materials that can corrode, loosen or fail under pressure. If you have any doubts about the wiring in your home, call a licensed electrician, who knows the code and will make sure your wiring is done right. 





## Revitalising The Nuclear Power Generating Station

The Palo Verde Nuclear Generating Station's three pressurized water reactors are capable of generating more than 4,000 megawatts per year...


**T**welve low-pressure feedwater heaters at the Palo Verde Nuclear Generating Station in Tonopah, Ariz, will be replaced by AREVA NP. These components help in increasing the performance of a nuclear energy facility by pre-heating water used in the steam generator.

As per a contract signed between the companies, AREVA NP will lead a team that includes SPX and Barnhart to design, manufacture, prepare and install the feedwater heaters. Pre-outage work for the replacements will begin in spring 2018, with the maintenance outages occurring between 2019 and 2025.

"Our reliable team has decades of experience in successfully manufacturing, delivering and replacing major components, like these feedwater heaters. Installing these modern components supports the U.S. nuclear industry's drive for operational excellence and helps the existing

reactor fleet generate electricity efficiently and reliably," said Craig Ranson, Senior Vice President of Installed Base Services at AREVA Inc.

Earlier this year, AREVA NP delivered 54 in-core detector assemblies to Palo Verde as part of another initiative to increase the facility's efficiency. In-core detector assemblies provide operators with the ability to enhance reactor operation through continuous, real-time monitoring of core conditions. Two additional deliveries, each of 53 in-core detector assemblies, are scheduled for 2017 and 2018.

The Palo Verde Nuclear Generating Station's three pressurized water reactors are capable of generating more than 4,000 megawatts per year and 32.5 million megawatt-hours of low-carbon electricity for approximately 4 million people in Arizona, California, New Mexico and Texas. 



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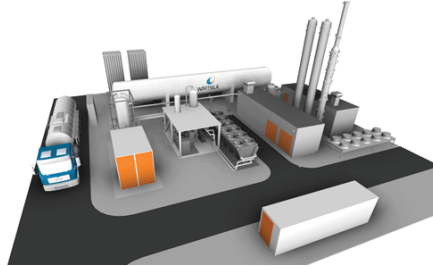
## A Groundbreaking Biohybrid Plant

The technology for this plant represents a new and unique response to market needs to liquefy and store methane-based streams...

German energy company, Erdgas Südwest GmbH is all set to buy one biohybrid production plant from Wärtsilä. The contract between the companies has been signed recently in December, and delivery will be made on a fast-track basis.

Wärtsilä will deliver its unique liquefaction system. Moreover, the system is specially designed to clean and liquefy both biogas and pipeline gas streams. In the process, the liquid is cooled to a temperature of minus 160° C – before being stored in a fully insulated tank. The ability to clean both biogas and pipeline gas is new to the market and groundbreaking in terms of flexibility and energy storage.

Timo Koponen, Vice President, Flow & Gas Solutions, Wärtsilä Marine Solutions, informs, “The contract award is based upon Wärtsilä’s compact and proven technology, and on our capabilities in adapting the system to the customer’s specific needs. Biogas and pipeline gas compositions can vary substantially, and Wärtsilä Gas Solutions’ advanced technology can




handle both.”

The technology for this plant represents a new and unique response to market needs to liquefy and store methane-based streams. Both gas cleaning and liquefaction are cost- and energy efficient, thereby making profitable projects possible even for smaller gas streams. This is especially important within the European Union where the target is to have 10% of the fuel

produced from renewable sources by 2020.

The new biohybrid solution will be integrated into the customer’s existing biowaste-to-biogas production, whilst LNG production will be part of the customer’s existing pipeline gas infrastructure. Everything will be located at a single site in southern Germany.

“This is a very important milestone for us at Erdgas Südwest. It is a completely new concept adapted to the future needs of the German energy market, and we see a great future for this storage solution,” says Oliver Auras, Project Director, Erdgas Südwest GmbH. 

## Supporting Inclusive Growth in Egypt

The DPF will support the country’s inclusive economic reform program through supporting energy security, efficiency and investment...

World Bank finances programs and projects to reduce poverty and boost shared prosperity for the people of Egypt through investments in key sectors including social safety nets, energy, transport, water and sanitation, agriculture and irrigation, social housing, primary health care, as well as supporting employment-intensive projects and financing for micro- and small enterprises.

The current portfolio of the World Bank in Egypt includes 25 projects for a total commitment of about \$8.5 billion. As per a latest development, the World Bank and Ministry of International Cooperation have signed a new loan agreement for USD 1 billion for the Second Fiscal Consolidation, Sustainable Energy, and Competitiveness Programmatic Development Policy Financing (DPF) for Egypt. This operation will support the country’s inclusive growth program across key economic areas. The DPF loan was approved by the Executive Board of the World Bank on December 20, 2016.

“We welcome the World Bank’s support of the transformational economic reform agenda of the government. This second operation supports our home grown program to help Egypt realize its full potential and raise




the living standards of all its people,” said H.E. Dr. Sahar Nasr, Egypt’s Minister of International Cooperation who also represents Egypt on the World Bank’s Board of Governors.

The DPF supports the country’s inclusive economic reform program. Key to this are efforts to create jobs, spur growth, and attract new investment. This is to be achieved through an enabling economic environment

that puts public finances on a more sustainable footing, supports energy security, efficiency, and investment, and helps improve the business environment for small and medium enterprises through cutting red tape, reducing barriers to entry, and promoting better competition policies.

“We are pleased to continue supporting the country’s ambitious program of reforms with a strong focus on private sector led job creation and creating a platform for inclusive growth of Egypt,” said Asad Alam, World Bank Country Director for Egypt, Yemen and Djibouti.

The DPF is a loan over 35 year maturity with a grace period of 5 years, so as to spread the repayment period over a longer tenure. The loan carries a variable interest rate of around 1% above LIBOR. 


## SAP ACE Award 2016 Goes To Tata Power

Tata Power, India's well known integrated power company, has been a frontrunner in technology adoption and innovation while also setting benchmarks excellence in business. In recognition of these efforts, the company has been winner of SAP ACE Award from last three years. This year too, it was awarded with two SAP ACE Award 2016, in the "Mobile Technology in Business Processes" category for Tata Power Mobile App, and "Technology Adoption in Utilities" category for SAP implementation in Tata Power Trading. Winning these prestigious awards, Tata Power, showcased its investment in Mobility to align with one of key theme of organisation Customer



Affection to connect customer and provide information on their mobile devices and allow users in a new way to interact and on the other side technology upgrade to build integrated platform for trading businesses.

SAP ACE awards are an industry benchmark to recognise the best of best-run businesses in the Indian subcontinent.

This year being the 10<sup>th</sup> year of SAP ACE awards, SAP continues to honour business excellence achieved through the implementation of SAP solutions. This year, more than 200 projects were nominated in various categories, of which 74 were shortlisted for jury discussion and 34 projects won under the various categories. 



### TRUE RMS DIGITAL INSULATION MULTIMETER MODEL KM 885



### 15KV HIGH VOLTAGE INSULATION TESTER MODEL KM 7015



#### FEATURES :

##### DIGITAL MULTIMETER :

- Sensing : AC, True RMS
- Display : 3-5/6 digits 6000 Counts Backlight LCD Display.
- Auto or Manual-ranging mode.
- VFD AC Voltage : 600V
- AC / DC Voltage : 60.00mV ~ 1000V
- AC/DC  $\mu$ A, mA & A Ranges : 600.0 $\mu$ A ~ 10A
- Resistance : 60.0 $\Omega$  ~ 60M $\Omega$

##### INSULATION RESISTANCE TESTER :

- LOCK-Test Mode for Insulation resistance & Earth Continuity Test.

- Test Voltage Ranges : 50V / 100V / 250V / 500V / 1000V
- Insulation Resistance : 3M $\Omega$  ~ 25G $\Omega$
- Short circuit current upto 1mA.

#### FEATURES :

- Microprocessor controlled Menu driven.
- Measuring 30 Insulation Test Voltage Ranges.  
500V, 1kV, 1.5kV, 2kV, 2.5kV, 3kV, 3.5kV, 4kV, 4.5kV, 5kV, 5.5kV, 6kV, 6.5kV, 7kV, 7.5kV, 8kV, 8.5kV, 9kV, 9.5kV, 10kV, 10.5kV, 11kV, 11.5kV, 12kV, 12.5kV, 13kV, 13.5kV, 14kV, 14.5kV, 15kV.
- Insulation Resistance 70G $\Omega$  / 0.5KV.
- AC Voltage : 0 ~ 700V.
- DC Voltage : 0 ~ 1000V.
- Short circuit current upto 5mA.
- PI, DAR & Auto Hold Function.
- 2 Lines X 16 Characters large LCD Backlight display.
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## Preventing Failure



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Former Executive  
Director

Karnataka Vidyuth Karkhane  
Limited

Selection of the Circuit Breaker has to be done carefully, so that it does not allow the transformer to exceed the permissible winding temperature. The built-in Bi-metallic strips mounted in the Circuit Breaker, located below the top oil, achieve the temperature sensing function. The circuit breaker thus provides Thermal matching with the transformer & protects it against over loads...



Power transformers are used in transmission network of higher voltages for step-up and step down applications (400 kV, 220 kV, 110 kV, 66 kV, 33kV), whereas Distribution transformers are used in the Power Distribution net works, to provide the final lower voltage requirements of the end user. (11kV, 6.6 kV, 3.3 kV, 440V, 230V). Distribution transformers are one of the most important purchases any power distribution utility makes & constitute a large percentage of the Utility's investment each

year. The focus has been on improving efficiencies (Lower Losses) & reliability while maintaining an affordable purchase price. In USA & other western countries, the failure rate of Distribution transformers due to all causes have been stated to be around 1% per year whereas in India, the failure rate which was around 22% in 1999-2000 have been brought down to around 17% today, still our country has a long way to go to reach the levels of Western countries. This high rate of failure of Distribution transformers in Power systems



perhaps be described as one of the tragedies of the present Power Distribution system management.

Following are some of the causes of failure of transformers in service.

1. **PROLONGED OVERLOADING**
2. **UNBALANCED LOADING**
3. **FAULTY TERMINATIONS**
4. **POWER THEFT AND HOOKING OF MAINS**
5. **PROLONGED SHORT-CIRCUIT**
6. **VOLTAGE SURGES DUE TO LIGHTNING**
7. **LACK OF PROPER MAINTENANCE**

## 1. Prolonged Overloading

Overloading of distribution transformers cannot be avoided for short durations, however, continuous overloading will heat up the windings resulting in failure. Hence, utilities have to maintain a history card for each transformer & record the pattern of loading (Using periodical Current measurements during peak hours) which will facilitate taking a decision on changing of the transformer at the proper time with a bigger capacity. These history cards will also facilitate determining the capacity of the new transformer. In India, It has been a general practice by the line men using higher current rated re-wirable fuses to avoid frequent breakdowns of Power supply caused due to overload, thus resulting in ultimate failure of the transformers.

## 2. Unbalanced Loading

In Distribution transformers feeding domestic power to suburban & Metro cities, it is very difficult to exactly balance all the three phases uniformly. An unbalance of about 10% may not create a serious operational problem. Continuous un-balance exceeding the limit, will result in an additional circulating current on the 'Delta' primary winding of the transformer resulting in over current, increase in winding temperature & ultimate damages to winding. A regular measurement & recording of currents in each phase as well as neutral current, can help in proper balancing of the loads on three phases, by proper re-distribution of the residential single phase loads on the three phases.

## 3. Faulty Terminations

On many occasions, one can observe heavy arcing / sparking on the terminations done at the outdoor transformer centers, near transformer HT / LT bushings, group operating switches, lightning arrestors, HT fuse holders etc., which indicate loose connections. When once an arc is observed it can only increase creating more arc eventually resulting in melting of the conductors / terminals. Normally the line men who attend to such sparking & melting of conductors, carry a piece of aluminum wire & they place the two conductors to be joined, side by side & use the aluminum wire to bind the two conductors manually. This kind of joint does not last long. Use of crimped cable shoes & bolted connections are seldom adopted, resulting in ultimate failure of the transformers.

## 4. Power Theft And Hooking Of Mains

Stealing of power by hooking on to the Over head power system is a serious national problem, which causes over loading / unbalanced loading resulting in transformer failures. Utilities are not only loosing revenue for the stolen power, but also loose their valuable transformers. Power utilities should seriously look into this area. Facilities of power measurement at substations can throw more light on the magnitude of power theft by calculating the power sold to genuine users & estimating the actual power loss in the transmission system. Presently SEB's wrongly account all the stolen power as Transmission loss which is not correct. Regular energy audit & surprise raids can solve this problem to some extent.



Figure 1: Single Phase & Three Phase CSP Transformers...

## 5. Prolonged Short-Circuit

Distribution transformers can withstand occasionally external short circuits of approximately 20/25 times the rated LV current for a period of 2/3 seconds. Prolonged short circuits will result in transformer failures, if proper protections are not foreseen on the HV & LV sides & the line men use over sized fuse wires.

## 6. Voltage Surges Due To Lightning

Lack of surge arrestors, or if Surge Arrestors are located at a distance from H.V. side of the transformer, then the H.V. Side of the transformer is exposed to voltage surges arising out of Lightning causing failure of the transformer.

## 7. Lack Of Proper Maintenance

Proper routine maintenance will prolong the life of the transformers. Checking of Transformer oil levels, its Breakdown values, general cleaning of the transformer, prevention of oil leakage, checking of Silicagel in the breather, checking of loose connections etc. will enhance the life of the transformers.

Most of the distribution Transformers are located in remote Rural areas, with long distribution lines etc., where special attention can not be given by the maintenance team as in the case of Metro or cities. Power theft is more in rural areas leading to overloading of Transformers resulting in failures. Power theft can be prevented to some extent using armored cables instead of over head lines. Since the distances are long, cost of cabling is prohibitive.

## Completely Self Protected Transformers (Csp Transformers)

The only solution to the above problems, is to look out for transformers equipped with all the protective devices, built-in, to prevent failures against over loading on HT & LT sides, surge protection, as well as a transformer needing the least maintenance. This kind of transformers is ideally suited not only for Rural areas, but also for sub-urban & cities (Fig.1). The design of Completely Self Protected Transformers (CSP Transformers) meet this requirement. These transformers are widely used in USA & other advanced countries in their distribution net work & hence their transformer failure rates have come down

drastically to around 1% or even less as against ours which is around 17%. CSP Transformers come also with sealed tanks, totally stopping oil pilferage as well as its contamination. Unfortunately, our Electricity boards are unable to appreciate the positive features of CSP technology & still sticking on to older conventional design, which answers the high rate of failures.

M/s. KAVIKA (Karnataka Vidyuth Karkhane Ltd), Bangalore, were the first one to bring out CSP transformers, in India, under the Technical Collaboration with M/s. Westinghouse Electric Corporation USA, in the year 1983 (Fig.1).

## Special Features Of Csp Transformers Over Conventional Transformers

CSP transformer, is primarily a Conventional transformer built as an integrated package incorporating the following additional built-in protective elements.

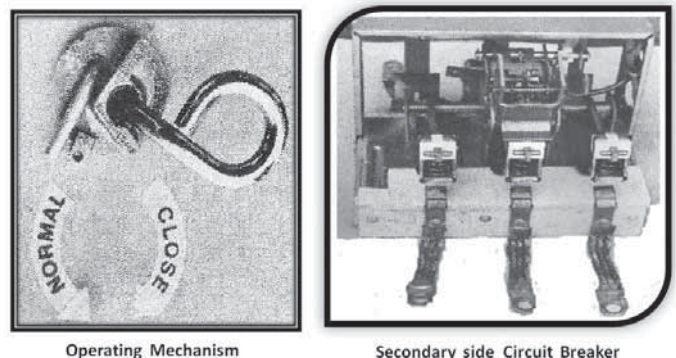
- Load / Temperature sensing built-in Circuit breaker on the LV side of the transformer,
- Protective expulsion type fuse on the HV side,
- Tank mounted Lightning Arrestors,
- An indication lamp providing visual warning against over temperature.
- Sealed tank construction (Without conservator) with Nitrogen filling is also available to prevent pilferage / contamination of Transformer oil.

Reasons for the failure of the distribution transformer listed under points 1 to 7 above, are fully taken care of by the combination of the above protective devices, built into the conventional transformer, thus the design of the CSP Transformers, ensure reliability, continuity of service & prolonged life of the transformer.

## L V Circuit Breaker

The specially designed built-in Circuit breaker in a CSP unit, is connected between the L.V. Windings & the L.V. Bushings, & mounted in the oil inside the transformer tank. This forms the heart of the protection against over current. The average temperature of the transformer winding at any moment is given by the Load vs Time curve up to the moment under consideration PLUS the thermal effect of the instantaneous load current flowing at that moment (Fig.2).

For an oil immersed transformer, the average temperature of the winding is given by the average oil temperature PLUS the average



Operating Mechanism

Secondary side Circuit Breaker

Figure 2



Figure 3

winding temperature rise due to the instantaneous load current at the moment under consideration. Permissible average winding temperature is determined by the transformer design based on the thermal qualities of the insulating material used. Hence, selection of the Circuit breaker has to be done carefully so that it does not allow the transformer to exceed the permissible winding temperature. The built-in Bi-metallic strips mounted in the Circuit breaker, located below the top oil, achieve the temperature sensing function. The circuit breaker thus provide Thermal matching with the transformer & protects it against over loads.

### HV Protective Fuse Links

The expulsion fuses (Fig.3) are mounted inside the transformer, between the incoming HV leads from the bushings & the HV leads of the transformer primary winding. The function of these fuses are: in the event of an internal winding fault in the transformer, blowing out of the fuse will isolate the defective transformer, thus ensuring isolation of the defective transformer, without affecting the rest of the Electrical distribution network. Proper co-ordination between HV Fuse link & LV Circuit breaker ensures that even in the event of dead short on the LV bushing, the LV circuit breaker will clear the fault without blowing the HV expulsion fuse.

### Surge Arrester For Lightning Protection

In a CSP Transformer Surge Arrestors (Fig.3) are mounted directly on the transformer tank thus protecting the transformer from insulation damage caused by Lightning induced surges. Basically the surge arrester appear as an open circuit to power frequency voltages & as a short circuit to surge disturbances diverting the surge to earth thus protecting the transformer. In the case of conventional distribution transformer, the lightning arrestors are separately mounted on the tower inter connected by a conductor wire. In such a case, the voltage appearing across the transformer winding when the arrester is operating is the SUM of the arrester discharge voltage & the voltage drop in the lead connecting the arrester & the transformer. As a thumb rule, the voltage drop in the connecting lead is around 1.6KV/foot of the lead length. If the lead length is say, 10 feet, this extra voltage will be  $1.6 \times 10 = 16kV$ ,

which will not be there in the case of CSP transformers, since the arresters are directly mounted on the transformer tank.

### Signal Lamp

The purpose of the CSP circuit breaker is to safely permit the safe functioning of the transformer upto the point where the load begin to affect the life of the transformer. At this stage, the signal light provided on the side of the CSP transformer tank, will light up giving the first indication to the operating personnel that the load on the transformer has gone up to a stage where significant insulation deterioration can occur. The operating personnel have to manually reset the signal lamp. If this lamp repeatedly lights up, it is a warning sign to the utility supplier, leaving the following option.

- Change the existing transformer with a larger capacity.
- Think of re-distributing part of the existing load of this transformer to other transformers.

If no action is taken by the utility supplier & the signal lamp glows continuously, resulting in excessive winding temperature, the CSP Circuit breaker will trip. Re-closure of this breaker is only possible after the temperature comes down.

### Emergency Reclosure Of CSP Breaker (Fig.2)

During emergency if the power has to be restored urgently, an emergency control handle has been provided on the side of the CSP transformer tank which facilitate increasing the load carrying capacity of the breaker. By operating this, one should understand that we are restoring the power supply due to emergency, however the Circuit breaker is no longer thermally protecting the transformer which can result in significant deterioration of the insulation if continuous over loading should occur on this transformer.

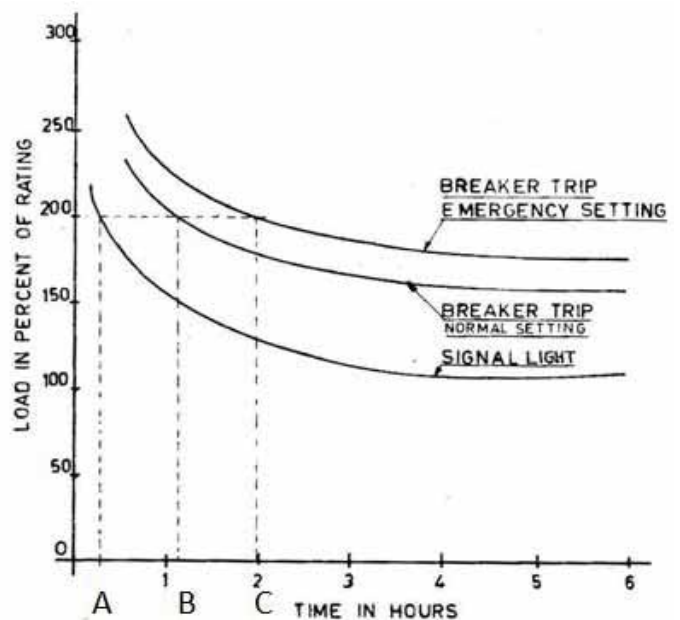


Figure 4: CSP Load Time Curves Following 75% Load at 28C ambient 63 kVA, 11/0.433 kV Transformer...

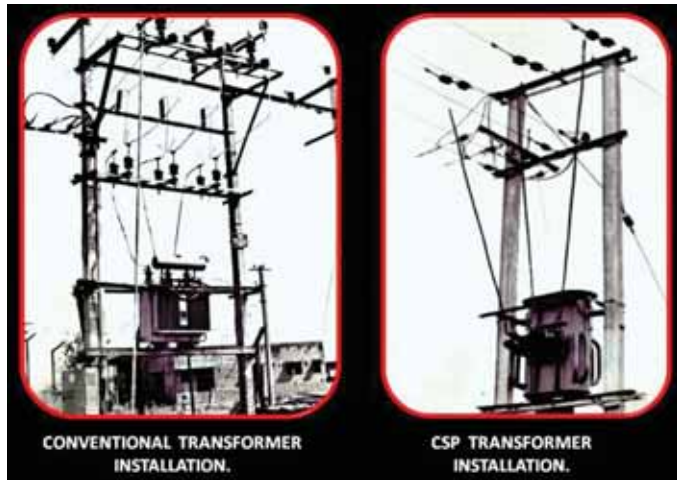


Figure 5

### CSP Transformer Performance

CSP transformer performance is defined by a set of Load vs Time curves - one curve for signal light, one for CSP Breaker trip, & one for Emergency operation of the Transformer. (Fig.4) From the curve it can be seen that for a 200% load, the signal light will light up in 18 minutes & the transformer will carry the load for a total duration of 69 minutes before the circuit breaker trips. If under this condition, if Emergency control is activated, the transformer can carry the same percentage of load for further 51 minutes before the CSP breaker trips again.

### Advantages Of CSP Transformer Installation

a) Lower Installation cost. If one observe the conventional transformer installation mounted on Two pole Steel / RCC structure, you will observe provision of separate mounting fixtures for mounting of triple pole HT horn gap fuse system, separate mounting fixtures for surge arrestors, Separate Steel enclosure box for L.V. Load break switch / MCB. Cost of all these components & associated hard ware items, associated labour costs etc. have to be added to the cost of the conventional transformer. On the contrary, a CSP transformer unit with all the built-in protective devices, makes the installation simpler, cheaper & presents a better look. If one compare purely the basic cost of the Conventional Transformer & the CSP transformer of the same capacity, outwardly the cost of CSP transformer will be

marginally high, however if you add the cost of the protective elements which are already built-in into the CSP unit, the cost difference becomes negligible.

- b) CSP transformer installation presents a much cleaner and uncluttered appearance. (Fig. 5) Unlike the non-CSP transformer installation with individual mounting arrangements for externally fixed protective equipment like primary fuse, surge arrester and secondary circuit breaker and electrical connections between them.
- c) CSP Transformers are the ultimate solution to prevent expensive transformer burnouts, maintenance free, making it ideally suitable for installations in all locations Rural, Sub-urban, Cities.etc. It is also ideally suitable for use in multi storied Apartment complexes, industries etc. looking for continuous, maintenance free & trouble free services.

### Utility's Concern About CSP Transformers

Though the protective elements provided on CSP transformers, have technical merits, Utilities feel that continuity of service is more important than overload protection & tripping of the breaker is considered as a nuisance. The greatest draw back, perhaps, is the nuisance of internal fuse blow outs, which is a time consuming replacement causing prolonged interruption. This has impacted the use of CSP transformers in favor of Conventional transformers.

### Surges Entering Transformer Secondary Windings

The impact of "Secondary side Surges" entering the un protected secondary windings of pole mounted transformers, had gone undiagnosed till recently, because failures due to secondary surge would show up as Primary winding failures resulting in fuse blowouts. Recent investigations have shown that use of High Energy Low Voltage arresters on the Transformer's secondary terminals, will eliminate failures caused by Secondary induced surges. With the additional provision of High Energy Low Voltage Secondary side Surge protection, the problem of internal fuse blowouts due to the secondary surges is taken care of in the CSP transformers thus making it ideally suitable for power distribution networks, drastically bringing down the transformer failure rates to the minimum. With this modification, CSP would be a solution to transformer failures.

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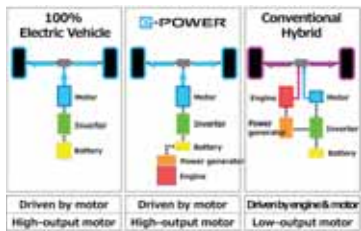
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## e-POWER Technology

Nissan Motor Co., considers its e-POWER technology, which is now available for consumers, as a significant milestone in the electrification strategy under Nissan Intelligent Mobility...

In the race of designing and delivering environment-friendly, safe and reliable electric vehicles, Nissan Motor Co., has once again put a bold step ahead. The company has rolled out its new drive system called e-POWER to customers.



Detailing on its new technology, Nissan Motor has informed that the e-POWER system features full electric-motor drive, meaning that the wheels are completely driven by the electric motor. The power from a high-output battery is delivered to the e-POWER's compact powertrain comprising a

gasoline engine, power generator, inverter, and a motor.

In conventional hybrid systems, a low-output electric motor is mated to a gasoline engine to drive the wheels when the battery is low (or when traveling at high speeds). However, in the e-POWER system, the gasoline engine is not connected to the wheels; it simply charges the battery. And unlike a full EV, the power source originates from the engine and not just the battery.

This system structure generally requires a bigger motor and battery because the motor is the only direct source to drive wheels. This has made it hard for the automotive industry to mount the system in compact cars. However, Nissan has cracked the code and learned how to minimize and reduce weight, develop more responsive motor control methods and optimize energy management. As a result, e-POWER uses a smaller battery than the LEAF (a compact five-door hatchback electric car), but delivers the same driving experience as a full EV.

According to the company sources, Nissan is actively pursuing a zero-emission, zero-fatality world for driving through its EV program and autonomous drive technology. To make this vision a reality, Nissan is developing 'Nissan Intelligent Mobility,' which anchors critical company decisions around how cars are powered, how cars are driven, and how cars integrate into society, all while staying focused on creating more enjoyable driving experiences. e-POWER is another step towards achieving our zero-emission vision through a new and more efficient electric powertrain.

The e-POWER system features full electric-motor drive, meaning that the wheels are completely driven by the electric motor. The power from a high-output battery is delivered to the e-POWER's compact powertrain comprises a gasoline engine, power generator, inverter, and a motor. In conventional hybrid systems, a low-output electric motor is mated to a gasoline engine to drive the wheels when the battery is low (or when traveling at high speeds). However, in the e-POWER system, the gasoline engine is not connected to the wheels; it simply charges the battery. And unlike a full EV, the power source originates from the engine and not just the battery.

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# ULTRAMAX

## *The Ultimate Resolution*

FLIR's new UltraMax technology is a unique image processing technique that allows you to generate reports with images that have four times as many pixels, and 50% less noise, so you'll be able to zoom in on smaller targets and measure them more accurately than ever...

UltraMax is an image enhancement technology on FLIR's T-Series cameras (except on the T600) that captures a series of thermal images and combines the data into one new image. The result is an impressive quadrupling of thermal pixels, including full radiometric measurement data. A 320 x 240 resolution T-Series camera using FLIR UltraMax can now produce true 640 x 480 images. Likewise, native 640 x 480 T-Series camera images can be converted to up to a 1.2 megapixel image with UltraMax.

As a result, UltraMax thermal images will be clearer and larger, allowing for a better analysis of small details. Because of an increased number of pixels covering the same target area, UltraMax also decreases measurement spot size. This gives greater measurement accuracy to particularly small details. The cameras from the T-Series have been the most popular advanced FLIR thermal imagers for years. With the new UltraMax feature, users can obtain even better results, allowing them to be even more productive.

### UltraMax explained

UltraMax is a type of superresolution, a technique for combining the information from multiple original images into an image with higher resolution and less noise. This might seem similar to two other scaling techniques – interpolation and pixel averaging. However, they are totally different.

UltraMax uses the natural movement of the human body to capture an image set in which each image is slightly offset from the others. This results in a wealth of data that is much greater than any one image could provide. The data is combined to form an image that includes many more pixels of the target, resulting in a resolution greater than that of the original camera detector. The data is also used to create a clearer image, since pixel noise can be reduced through comparing similar points in multiple images.


FLIR UltraMax captures 16 thermal images in less than one second. These are stored on the camera as a single jpg file, and will appear as one image when viewed on the camera or in software. In the FLIR Tools environment, you can choose to enhance the image resolution. This is the UltraMax functionality. The enhanced image will have twice the original resolution and four times as many pixels. All pixels still include radiometric data, like normal thermal images.

As a result, UltraMax thermal images will be clearer and larger, allowing better analysis of small details. Because of an increased number of pixels covering the same target area, UltraMax also decreases measurement spot



size. This gives greater measurement accuracy to particularly small details. For instance, a FLIR T420 has a resolution of 320 x 240, yielding 76,800 total pixels. An UltraMax image from the T420 will have a resolution of 640 x 480, for a total of 307,200 pixels. The FLIR T620 with UltraMax for example, will result in a 1280 x 960 resolution for a full 1.2 mega pixels. UltraMax can be toggled on or off as desired from within the camera settings menu.

### Limitations

There are some conditions in which UltraMax will not be able to enhance an image. Too much movement from the user or the target while the images are being captured will result in an image set that cannot be aligned. Similarly, if the thermal camera is mounted on a tripod, it will have too little movement, and the images will not have the necessary offset. FLIR Systems recommends simply holding the camera steady with two hands when capturing the images. A scene with uniformly low contrast, or images being out of focus may also impede the enhancement process. 

For further information: [www.flir.com/t-series](http://www.flir.com/t-series)

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# Easing Multi-function Testing



Peter Fagerström  
Business Unit Manager  
Megger

There is only one instrument to unpack, power up and configure; the same cable set is used for a whole range of measurements, so the connections only need to be made once; and, when carrying out a range of tests, users of multifunction instruments move quickly and easily from app to app, rather than having to go from instrument to instrument...



It is still a common practice in substation testing to use separate instruments for each type of test. This situation, however, is about to change. There are, in fact, many compelling reasons to move away from separate instruments in favour of a multifunction test set, including:

1. Users of multifunction instruments always have all of the test facilities they need readily at hand; there is never a need to go back to the van or, worse, back to base to fetch another instrument for the next test. Plus, a single multifunction tester is much easier to transport than several individual instruments.
2. Multifunction test sets cost less than the individual instruments that would be needed to cover the same range of testing requirements. Four single-function test instruments = four displays, four user interface systems, four enclosures, etc = higher total cost than one multifunction

instrument with one display, one user interface system, one enclosure, etc.

3. Multifunction test sets provide on-going savings by reducing testing time. There is only one instrument to unpack, power up and configure; the same cable set is used for a whole range of measurements, so the connections only need to be made once; and, when carrying out a range of tests, users of multifunction instruments move quickly and easily from app to app, rather than having to go from instrument to instrument.
4. Less operator training is required; users of separate instruments need to familiarise themselves with the quirks of each, whereas users of well designed multifunction testers enjoy a consistent user interface across all functions, which means that the learning process is simplified.

This begs the question that if multifunction instruments have so much to offer, why are they

not used more frequently for substation testing? The reasons are interesting:

1. **Inertia.** Separate instruments have always been used in the past and have delivered satisfactory results, so why change? The simple answer is that changing brings the benefits that have already been described.
2. **Cost.** If an additional single-function instrument is all that's needed to complement instruments already owned, why spend extra on a multifunction tester that will duplicate at least some of the functionality of the existing instruments?  
The answer is investment for the future. Buy a multifunction tester and it will probably be unnecessary to replace the single-function instruments as they come to the end of their lives.
3. **Specification.** Until recently, few, if any, adequately specified multifunction instruments were available. This is not particularly surprising, as designing and manufacturing a versatile, convenient, dependable and easy-to-use multifunction tester for use in substations presents many challenges.

A multifunction test instrument design that can lead a migration from single-function instruments must:

Be capable of generating high currents and voltages yet remain easy to transport. For users with interests that cover a wide geographical area, it is highly desirable for the instrument to weigh less than the international maximum shipping weight of 32 kg for check-in luggage on passenger flights.



Alleviate the potential conflict between versatility and ease of use. There's little point in producing a multifunction instrument that can perform a wide range of tests if many of the tests are difficult to access and set up. This only leads to user frustration and ultimately dissatisfaction with the product, however impressive its claimed abilities may be.

Fortunately, recent advances in instrument design and technology have made it possible to produce multifunction testers for substation and other power applications that address both of these issues, making them truly attractive to users. An excellent example is a recently released integrated transformer and substation test system.

This compact unit, the main section of which weighs just 32 kg in its transport case, provides comprehensive facilities for testing power transformers, current transformers, potential transformers, circuit breakers, rotating machines and many other items of substation equipment. The base unit can generate AC current up to 800 A, DC current up to 100 A, AC voltage up to 2.2 kV and DC voltage up to 300 V. With optional accessories, the AC capabilities can readily be extended to 2,000 A and 12 kV.

The voltages and currents generated by the instrument can be controlled and measured with a high degree of precision, allowing it to be used for an exceptionally wide range of applications that includes, for example, turns ratio, winding resistance and excitation current measurements in transformers; contact resistance, impedance and tan delta/power factor testing; main and resistor contact timing in circuit breakers; and primary injection testing in LV, MV and HV equipment of almost any type.

Other key features include exceptional interference suppression to secure accurate readings even in switchyards where high levels of electrical noise are present, a wide operating frequency range of 5 to 500 Hz (1 to 500 Hz for tan delta measurements), and individual temperature correction of tan delta measurements using patented technology.

The challenge of delivering a simple user interface to complement this vast range of capabilities has been met by making use of the latest colour touch-screen technology and by




designing the user interface so that it presents functions in the form of apps ("virtual instruments"). When the user has decided what to measure and has selected the app/instrument to work with from the start screen, the display shows only those elements that are appropriate to the chosen function.

For example, if the winding resistance instrument is selected, the screen simply shows the output current, the output voltage and the measured resistance. The user selects a test current and starts measuring. Users who prefer test guidance from the instrument simply enter the configuration and the unit provides connection diagrams and a table showing the sequence of measurements. Provision is also made for full manual testing with a generic instrument app that allows the user to freely select outputs, measurement inputs and the way in which the measured data should be processed.

This remarkable new multifunction substation test set – the Megger TRAX – conveniently and cost effectively replaces a whole battery of conventional single-function instruments.

### Accessing Transformer Life Management (TLM) Bulletins

Megger invites you to download a new TLM bulletin each month – absolutely free of charge. You can also register to receive an alert as soon as the latest bulletin becomes available. Visit [megger.com/TLMBulletin](http://megger.com/TLMBulletin) to learn more and start reclaiming the potential of your library today! 

# Driving Energy Efficiency Across Industries



**Ashutosh Shukla**  
Director –  
Equipment and  
Solutions Business  
Schneider Electric India



Smart Power Distribution + Energy Management Solutions

Safety, reliability, energy efficiency and lower carbon trails are some of the key benefits of smart power in homes, buildings and industries

As economies look to grow in size and scale, the focus on efficiency is increasing with each passing day. This is most critical in case of power which is the fuel that drives industrial growth. Be it oil and gas, minerals, metals and mining, Automobiles, hotels, hospitals, data-centers or any other industry, optimising energy usage is one of the most critical agenda for a robust growth. Continuity and quality of power, safety against fire hazards, high reliability, minimum downtime, ease of maintenance and cost of energy are some of the major aspects to be kept in mind to achieve operational efficiency. At the same time, there is a need to ensure strict compliance of equipment or processes with predetermined standards and use clean energy sources to ensure reduction in carbon footprints.

## Making power distribution smart

One of the safest and the most reliable option to address all these challenges is through smart power which involves use of smart technologies. For example, power distribution can be made 'smart' through integrated solution offering that is combined with energy monitoring software. These software convert data into meaningful analysis and help customers improve the efficiency of their system

Asset management is another important facet of smart power, solutions like equipment, with local, remote and cloud based software ensure smooth management of the entire network. This includes safe electrical distribution, power monitoring and control system, power quality analysis, motor management and

diagnostics, crisis management and recovery, and source management. Asset monitoring, asset use optimisation, maintenance management and critical asset management, are some other benefits.

Utilities across the world also set to gain through use of smart power solutions as it provides cost and efficiency management for energy saving and sustainability through cost allocation, energy use optimisation, green cost optimisation and green standard compliance. These can be achieved through smart offerings for power monitoring and quality, energy management systems, security and surveillance, critical power, renewable energy and field services, amongst others.

### Range of Smart power offerings

Smart power offerings are used in various areas. In homes, their deployment assures safety, reliability, connected homes, sustainability and style. In buildings and cities, they ensure urban efficiency, smart mobility, smart grids, renewable power and intelligent, green buildings.

Even industries have great scope to use smart power technologies. In industries, the use of these solutions can speed up the pace of industrialisation, advance the Internet of Things, promote productivity and process automation, lead to faster modernisation of technology and augment sustainability as well as energy efficiency.

Similarly, usage of the Cloud offers benefits such as digitisation, content on demand, Big Data aids predictive maintenance and improves asset life, while fostering a partner ecosystem.

### Smart power for homes and buildings

In the case of buildings, major benefits and savings are assured using smart power offerings. Each building is unique in its design and operation, be it an office complex, hospital, hotel, airport or educational complex, since

all have different functional requirements and occupancy patterns. Therefore, a smart energy management company such as Schneider Electric adopts an integrated approach to building management to reduce energy consumption by up to 30%, curb capital expenditures, lower operating expenses and boost overall business performance.

Home solutions are offered through automatic room control as well as HVAC (heating, ventilation and air-conditioning) and lighting solutions. It is imperative that plans are in place to maximise energy efficiency of all systems in the building even before construction, while other smart offerings are embedded during construction to benefit from these technologies. Engaging the energy efficiency experts during the planning stage itself is the right way to go about it to derive maximum benefits of these technologies. Further, automatic room controls, offer efficiencies to optimise room conditions pertaining to time, access, function and occupancy. Such systems could also provide comfort for occupants, while keeping energy costs low.

Similarly, smart meters regulate energy flow throughout a house, minimising energy use and bills. With CCTVs, motion-sensitive/night-vision cameras and intruder alarms installed in homes, the safety and security of residents is fully assured. In the last case, smart homes equipped with voice command systems can be of immense benefit for bed and wheelchair-bound patients.

Smart power solutions have an important role to play to minimise daily-life stress in home and office environment by offering both comfort and convenience. This is also beneficial to the society at large as lower use of resources leads to lower carbon trails, thereby mitigating the impact of climate change and global warming. B



## Power Loss Measurement System

Measurements International was founded in 1987 as a company with expertise in the science and engineering-intensive electrical metrology segment of the Test and Measurement Industry. Over the years MI has become a recognized global leader in the industry through active participation and contribution to the industry through industry organizations like NIST and NCSL.


Through MI's commitment to quality and service, MI has established a reputation for providing industry leading technology and solutions for metrology based applications. Recognized as "Blue Box" Solutions, MI has introduced a complete line of high accuracy metrology based calibration equipment for DC Resistance, Voltage and Temperature applications as well as standards for AC Power applications.

MI has also excelled in the development of products based upon Quantum Metrology to address the Primary Standards, and has successfully installed their commercially available Model 6800 transportable Quantum Hall Resistance System in developing countries and military laboratories worldwide.



Recognizing the needs of the electric utility industry worldwide, MI has become recognized as the industry leader of systems and technology designed to measure transformer losses in medium and large power transformers. The AccuLoss System provides manufacturers of transformers globally the ability to measure transformer losses with a level of accuracy unmatched by other manufacturers in the industry and critical to the electric utility industry and users of medium and large power transformers.

Providing calibration services is another example of MI's commitment and support of the industry, and as such as achieved level 1 ISO GUIDE 17025 certification as an accredited laboratory.

To support the customers in India Measurements International LLP, India was incorporated in India in the year 2012. MILLP, India is providing Sales, After Sales Service Support, Calibration Support to our esteemed customers in India. Major Indian customers are NPL, BHEL, TBEA, Toshiba, NHPTL, BTW, PGCIL, NTPC, Siemens, Bharat Bijli, GAIL, HAL, IOCL, ABB, ALSTOM, T&R, ERDA, IDEMI and various other customers. 

**For Further Information:** email - sales@millp.co.in

<< Motors

## High Thrust Pump Applications

Expanding its extensive range of Simotics low-voltage Nema motors, Siemens has added in-line, Vertical Solid Shaft (VSS) motors to its portfolio – the LP100 series – in the Nema Premium efficiency class. They have been specifically designed to address high thrust pump applications, and now have an extra high thrust capability allowing them to be teamed up with many pump types. The motors comply with the new Nema Premium efficiency class, the highest efficiency class required today for Nema low-voltage induction motors in the US. A range of special options is available for the series, so that these motors comply with or exceed the most stringent industrial standards – and can be used to address a wide range of applications.

The Simotics DP LP100 series from Siemens also fulfills the US Nema standard MG-1. These state-of-the-art vertical solid shaft motors have a full cast iron enclosure that cannot corrode, guaranteeing improved reliability, performance and long service life – and low vibration levels. These features make them predestined for harsh environments that can be found in the oil & gas industry, chemical industry, pulp and paper water and wastewater, for instance.

The motors' innovative design has also allowed the thrust capability to be increased, within the same design, by up to 175% when compared to




conventional motors. These can be offered in compliance with or even surpass API610 and IEEE841 standards, two of the most stringent standard in the industrial landscape, so that they can provide even higher reliability.

Complying with the new NEMA Premium efficiency class, their electrical and mechanical design guarantees that losses are limited to 5% below the maximum stipulated by the US efficiency regulation.

The motors are available in frame sizes 180LP up to 449LP corresponding to a power range extending from 3 HP to 250 HP, and rated speeds of 1200, 1800 and 3600 RPM, at 60 Hz.

A wide range of special options is available for this motor series from thermistors or space heaters to Hybrid ceramic bearings, Non Reverse Ratchet and extra high thrust.

All of these best-in-class features are complemented by an oversize terminal box - to facilitate easy installation and connection – and practical close lifting lugs. These motors are attractive for end users in many demanding sectors who are looking for innovative and rugged vertical solid shaft motors to drive their pumps. With their cast iron enclosure, high thrust capability and low vibration levels users can be assured a long service life – backed by the global Siemens service network. 



# Comprehensive range of surge protection solutions



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# Powering The Poor

Under DDUGJY, out of 597,464 census villages, 590,774 villages (98.8%) have been electrified...

## State-wise Coverage and Achievement of BPL Households under DDUGJY [Including Rural Electrification (RE) Component]

| Sl. No. | Name of the State | Coverage | Achievement (As on 31.10.2016) |
|---------|-------------------|----------|--------------------------------|
| 1       | Andhra Pradesh    | 2457287  | 2414555                        |
| 2       | Arunachal Pradesh | 74679    | 51621                          |
| 3       | Assam             | 1794604  | 1210224                        |
| 4       | Bihar             | 10660852 | 3767019                        |
| 5       | Chhattisgarh      | 1448997  | 1143343                        |
| 6       | Gujarat           | 848005   | 842945                         |
| 7       | Haryana           | 257902   | 198580                         |
| 8       | Himachal Pradesh  | 19578    | 16290                          |
| 9       | Jammu & Kashmir   | 142885   | 69148                          |
| 10      | Jharkhand         | 2367897  | 1275170                        |
| 11      | Karnataka         | 1036966  | 950098                         |
| 12      | Kerala            | 192919   | 150305                         |
| 13      | Madhya Pradesh    | 3209701  | 1668407                        |
| 14      | Maharashtra       | 1621836  | 1221350                        |
| 15      | Manipur           | 137525   | 70307                          |
| 16      | Meghalaya         | 121758   | 104383                         |
| 17      | Mizoram           | 30643    | 29710                          |
| 18      | Nagaland          | 98616    | 54559                          |
| 19      | Odisha            | 4499998  | 2776723                        |
| 20      | Punjab            | 92988    | 92988                          |
| 21      | Rajasthan         | 1791657  | 1166426                        |
| 22      | Sikkim            | 13601    | 13601                          |
| 23      | Tamil Nadu        | 526468   | 502094                         |
| 24      | Telangana         | 1125306  | 708865                         |
| 25      | Tripura           | 208732   | 137962                         |
| 26      | Uttar Pradesh     | 5212392  | 1910948                        |
| 27      | Uttarakhand       | 238404   | 237921                         |
| 28      | West Bengal       | 2480034  | 2204398                        |
|         | Grand Total       | 42712446 | 24989940                       |

Under Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Government of India is providing free electricity connections to Below Poverty Line (BPL) households.

Out of total 4.27 crore connections sanctioned, free electricity connections to 2.5 crore BPL households have been provided as on 31.10.2016 under the scheme.

In order to provide access to electricity to all rural households and also to ensure quality and reliability of power supply in rural areas, the Government of India has launched the 'Deen Dayal Upadhyaya Gram Jyoti Yojana' (DDUGJY) with an outlay of Rs.43,033 crore and Budgetary support of Rs.33,453 crore.

They consist of separation of agriculture and non-agriculture feeders, strengthening and augmentation of sub-transmission and distribution network, metering at all level and rural electrification.

In addition to this, rural electrification component projects with total outlay of Rs.32,860 crore including budgetary support from Government of India of Rs.29,574 crore have been subsumed in DDUGJY.

Under the scheme, adequate infrastructure would be created in all the villages to provide access to electricity to all households.

Release of service connections to households is the responsibility of concerned State DISCOM / Power Department. Projects under the scheme are to be completed in 24 months from the date of award.

Source: Press Information Bureau (India)

# Power Supply Position In India

An extensive network of Transmission lines has been developed over the years for evacuating power produced by different electricity generating stations and distributing the same to the consumers. 16,398 Circuit Kilometers (CKM) of transmission lines have been commissioned during 2016-17 (April-October 2016).

This is 70.1% of the annual target of 23,384 ckm fixed for 2016-17. Similarly, the overall increase in the transformation capacity has been 39,060 MVA during 2016-17 (April- October 2016) constitutes 86.4% of the target of 45,188 fixed for 2016-17. Following sets of provisional figures gives an idea of the scenario...

## Power Supply Position (Provisional)

Figures in MU net

| State / System / Region | October, 2016 |              |                       |       | April,2016 to October,2016 |              |                       |       |
|-------------------------|---------------|--------------|-----------------------|-------|----------------------------|--------------|-----------------------|-------|
|                         | Requirement   | Availability | Surplus / Deficit (-) |       | Requirement                | Availability | Surplus / Deficit (-) |       |
|                         | (MU)          | (MU)         | ( MU )                | (%)   | (MU)                       | (MU)         | ( MU )                | (%)   |
| Chandigarh              | 125           | 125          | 0                     | 0.0   | 1,135                      | 1,135        | 0                     | 0.0   |
| Delhi                   | 2,622         | 2,620        | -2                    | -0.1  | 21,666                     | 21,639       | -27                   | -0.1  |
| Haryana                 | 4,200         | 4,200        | 0                     | 0.0   | 32,179                     | 32,179       | 0                     | 0.0   |
| Himachal Pradesh        | 736           | 734          | -2                    | -0.2  | 5,142                      | 5,113        | -29                   | -0.6  |
| Jammu & Kashmir         | 1,440         | 1,188        | -252                  | -17.5 | 9,737                      | 7,929        | -1,808                | -18.6 |
| Punjab                  | 4,232         | 4,232        | 0                     | 0.0   | 37,557                     | 37,557       | 0                     | 0.0   |
| Rajasthan               | 5,534         | 5,496        | -38                   | -0.7  | 38,538                     | 38,351       | -187                  | -0.5  |
| Uttar Pradesh           | 9,089         | 8,979        | -110                  | -1.2  | 65,677                     | 64,217       | -1,460                | -2.2  |
| Uttarakhand             | 1,079         | 1,079        | 0                     | 0.0   | 7,943                      | 7,899        | -44                   | -0.6  |
| Northern Region         | 29,058        | 28,654       | -404                  | -1.4  | 219,575                    | 216,020      | -3,555                | -1.6  |
| Chhattisgarh            | 2,485         | 2,485        | 0                     | 0.0   | 14,724                     | 14,671       | -53                   | -0.4  |
| Gujarat                 | 8,550         | 8,550        | 0                     | 0.0   | 62,059                     | 62,059       | 0                     | 0.0   |
| Madhya Pradesh          | 4,983         | 4,983        | 0                     | 0.0   | 35,799                     | 35,798       | -1                    | 0.0   |
| Maharashtra             | 11,659        | 11,659       | 0                     | 0.0   | 80,875                     | 80,838       | -37                   | 0.0   |
| Daman & Diu             | 209           | 209          | 0                     | 0.0   | 1,434                      | 1,434        | 0                     | 0.0   |
| Dadra & Nagar Haveli    | 541           | 541          | 0                     | 0.0   | 3,620                      | 3,620        | 0                     | 0.0   |
| Goa                     | 328           | 328          | 0                     | 0.0   | 2,857                      | 2,855        | -2                    | -0.1  |
| Western Region          | 28,754        | 28,754       | 0                     | 0.0   | 201,368                    | 201,278      | -90                   | 0.0   |
| Andhra Pradesh          | 4,821         | 4,820        | -1                    | 0.0   | 31,471                     | 31,435       | -36                   | -0.1  |
| Telangana               | 4,558         | 4,557        | -1                    | 0.0   | 29,538                     | 29,532       | -6                    | 0.0   |
| Karnataka               | 6,028         | 5,984        | -44                   | -0.7  | 37,114                     | 36,828       | -286                  | -0.8  |
| Kerala                  | 1,998         | 1,996        | -2                    | -0.1  | 14,107                     | 14,084       | -23                   | -0.2  |
| Tamil Nadu              | 8,728         | 8,726        | -2                    | 0.0   | 63,324                     | 63,313       | -11                   | 0.0   |
| Puducherry              | 206           | 206          | 0                     | -0.2  | 1,545                      | 1,544        | -1                    | -0.1  |
| Lakshadweep*            | 4             | 4            | 0                     | 0     | 28                         | 28           | 0                     | 0     |
| Southern Region         | 26,339        | 26,288       | -50                   | -0.2  | 177,100                    | 176,734      | -366                  | -0.2  |
| Bihar                   | 2,406         | 2,398        | -8                    | -0.3  | 16,025                     | 15,766       | -259                  | -1.6  |
| DVC                     | 1,600         | 1,598        | -2                    | -0.1  | 10,829                     | 10,775       | -54                   | -0.5  |
| Jharkhand               | 699           | 698          | -1                    | -0.1  | 4,673                      | 4,662        | -11                   | -0.2  |
| Odisha                  | 2,271         | 2,271        | 0                     | 0.0   | 16,243                     | 16,241       | -2                    | 0.0   |
| West Bengal             | 4,345         | 4,345        | 0                     | 0.0   | 30,916                     | 30,813       | -103                  | -0.3  |
| Sikkim                  | 42            | 42           | 0                     | 0.0   | 270                        | 270          | 0                     | 0.0   |
| Andaman- Nicobar*       | 20            | 15           | -5                    | -25   | 140                        | 105          | -35                   | -25.0 |
| Eastern Region          | 11,363        | 11,352       | -11                   | -0.1  | 78,958                     | 78,527       | -431                  | -0.5  |
| Arunachal Pradesh       | 63            | 62           | -1                    | -2.2  | 407                        | 397          | -10                   | -2.5  |
| Assam                   | 835           | 813          | -22                   | -2.7  | 5,730                      | 5,481        | -249                  | -4.3  |
| Manipur                 | 64            | 62           | -3                    | -3.9  | 418                        | 399          | -19                   | -4.5  |
| Meghalaya               | 150           | 150          | 0                     | 0.0   | 970                        | 970          | 0                     | 0.0   |
| Mizoram                 | 40            | 39           | -1                    | -3.2  | 278                        | 270          | -8                    | -2.9  |
| Nagaland                | 68            | 67           | -1                    | -2.1  | 438                        | 429          | -9                    | -2.1  |
| Tripura                 | 132           | 131          | -1                    | -1.0  | 861                        | 845          | -16                   | -1.9  |
| North-Eastern Region    | 1,352         | 1,322        | -30                   | -2.2  | 9,099                      | 8,785        | -314                  | -3.5  |
| All India               | 96,865        | 96,371       | 494                   | 0.5   | 686,099                    | 681,346      | 4,753                 | 0.7   |

# Lakshadweep and Andaman & Nicobar Islands are stand- alone systems, power supply position of these, does not form part of regional requirement and availability.

## Electrically Conductive Coating Market To Rise High By 2021

This growth is expected to be driven by the high demand from the consumer electronics industry...

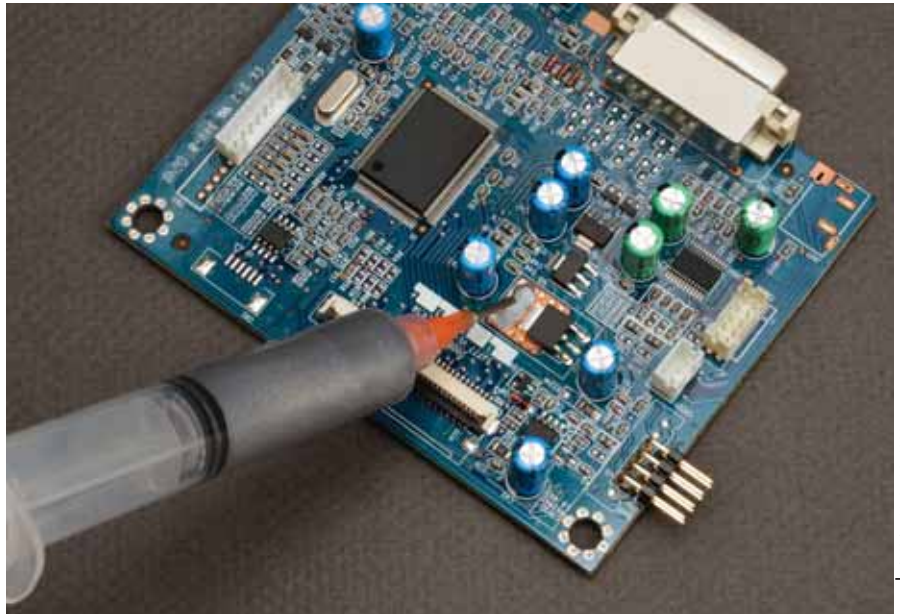
According to MarketsandMarkets "Electrically Conductive Coating Market" is projected to reach USD 18.88 Billion by 2021, at a CAGR of 8.0% from 2016 to 2021. This growth is expected to be driven by the high demand from the consumer electronics industry and increasing demand for electrically conductive coatings in the Asia-Pacific, European, and North American regions.

### EPOXY: The most-widely used material for electrically conductive coatings

Epoxy is widely used for electrically conductive coatings due to their favourable durability, mechanical properties and weather ability. These coatings are light in weight and hence used as replacements for metals such as copper in consumer electronics, solar, automotive, aerospace, bioscience, and others. Epoxy is the largest and fastest-growing type of conductive coating used in the global electrically conductive coating market. The growing demand for coating applications that require electrical conductivity using epoxies in various end-use industries such as consumer electronic displays, solar cells, automotive displays/LCDs, aircraft/space shuttle displays/LCDs, X-ray and MRI equipment, and others is expected to drive the electrically conductive coatings market in the near future.

### Consumer Electronic Displays: The largest application for electrically conductive coatings

Consumer electronic displays are the largest application segment of the global electrically conductive coating market. Electrically conductive coatings are used widely as thin layers of coatings in various end-use industries such as consumer electronic displays, automotive, solar, aerospace, bioscience and others. In the consumer electronics industry, conductive coatings are used in computers/cell phones/radios/calculators/pagers, LCDs/electronic displays/touch panels, and so on, as thin layers over plastic cases and plastic housings in these products to provide EMI shielding and dissipation of static charge.



www.masterbond.com/ids/ep791

### Asia-Pacific: The largest market for electrically conductive coatings

The Asia-Pacific region is the largest market in the global electrically conductive coating market, in terms of value and volume, and this trend is expected to continue till 2021. There is a high growth in demand from countries in this region such as, China, Japan, South Korea, and India, in the use of electrically conductive coatings in the consumer electronic displays industry. This growth is mainly due to the thriving electronics industry, economic growth and increasing population. Globally, India and China are projected to be the fastest-growing markets from 2016 to 2021.

The electrically conductive coating market has few global players competing for their market shares. These companies are actively investing in various strategies such as new product developments, acquisitions, and expansions globally to increase their market shares. Major players such as The PPG Industries Inc. (U.S.), Henkel AG & Company (Germany), Akzo Nobel N.V. (Netherlands), Axalta Coating Systems (Netherlands), Creative Materials Inc. (U.S) and others have adopted various organic and inorganic developmental strategies.



**MEA launches F800 Series VFD**

Mitsubishi Electric Automation (MEA), introduces the F800 Series Variable Frequency Drive (VFD) for precise motor speed control with maximum energy-savings. The low-voltage F800 is specifically designed to improve efficiency of air movement through HVAC systems. While the F800 is especially suitable for HVAC applications, including air handlers, cooling towers, and pumps; this multi-functional F800 is also appropriate for pumps and fans within industrial applications. The F800 controls and supports multiple motor types, including AC induction and permanent magnet motors, eliminating the need to specify multiple VFDs to address various motor control needs. This versatility also makes it ideal for food and beverage, automotive, and water treatment industries.



Using embedded motor control algorithms that optimise AC motor voltage and current based on the desired load, the F800 allows users to maximise motor usage and performance while saving energy. This drive series also includes energy monitoring capabilities to capture and display actual energy usage. The F800 includes on-board preventive maintenance to reduce unexpected downtime. There's also an optional LCD display that provides accurate time stamped logging and real-time clock scheduling functions. The F800 comes in traditional chassis style, large system/component style and is also available as a true turnkey bypass control solution. It is available in 200- and 400-volt classes.

**For further information:** [us.mitsubishielectric.com](http://us.mitsubishielectric.com)

**BorgWarner launches its first Integrated Electric Drive Module**

BorgWarner, well known for its clean and efficient technology solutions for combustion, hybrid and electric vehicles, will launch its electric Drive Module (eDM) with integrated eGearDrive transmission in two pure electric vehicles from a major Chinese automaker. Production is expected to begin in summer 2017.



BorgWarner's eDM provides primary or secondary propulsion for pure electric or P4-type hybrid vehicles. The integrated design of the electric motor and transmission enables weight, cost and space savings. Since both functions are combined into one housing, installation is also easier. Based on the vehicle manufacturer's desired propulsion

characteristics, performance is optimised with various available gear ratios to provide a completely tailored solution. Featuring patented High Voltage Hairpin (HVH) technology and optional power electronics, BorgWarner's HVH 250 electric motor delivers superior performance with over 95% efficiency.

Through its high-efficiency gear train and compact, low-weight design, the eGearDrive transmission contributes to extended battery-powered driving range, which in turn reduces the battery capacity required. An electronically actuated park lock system is also available.

**For further information:** [www.borgwarner.com](http://www.borgwarner.com)

**CBS ArcSafe offers RRS-3 ADVAC (CDL) for ABB Type ADVAC**

CBS ArcSafe, a well known manufacturer of remote racking and switching solutions for low- and medium-voltage switchgears, introduces its single-application Remote Racking System (RRS) for ABB Type ADVAC (CDL) vacuum circuit breakers. The lightweight, portable CBS ArcSafe RRS-3 ADVAC (CDL) allows technicians to remotely install and remove the circuit breaker from a safe distance of up to 300 feet while remaining stationed outside the arc-flash boundary.



Installation and operation do not require any modifications to the existing electrical equipment. The RRS-3 ADVAC (CDL) is compatible with Type ADVAC vacuum circuit breakers with ratings of 1200–3000 A, 5–15 kV with closed-door applications with exterior interlock lever. Typical usage of the ADVAC breaker includes

commercial, industrial, and service entrance applications to protect and switch main, feeder, and incoming lines. The RRS-3 ADVAC (CDL) is a cost-effective solution for keeping operators safe when compared to other arc-flash mitigation alternatives.

Optional features include 25-foot extension cables, 24 V DC LED light, wireless video camera system with LCD monitor, and rugged protective case assembly. All RRS-3 AKD-6 units are portable, fast, and easy to set up; offer mechanical and/or electrical safety protection; adjust to fit unique electrical equipment configurations; reduce the requirements for personal protection equipment, and help customers with NFPA 70E arc-flash safety compliance.

**For further information:** [www.cbsarcsafe.com](http://www.cbsarcsafe.com)

## New Fluke Infrared Cameras deliver 640 x 480 image quality

Fluke Corp. has introduced the Fluke Ti480 and TiX580 Infrared Cameras with 640 x 480 resolution and MultiSharp Focus, delivering high image quality to industrial, process, utilities maintenance and building inspection professionals who need high measurement accuracy to quickly detect problems.

With the Ti480 Infrared Camera, Fluke introduces 640 x 480 resolution into a rugged, pistol-grip form factor.

The camera provides fast, one-handed operation to perform multiple inspections quickly and accurately.

Now there is an 'everyday' camera, with four times the resolution power of many commonly used 320 x 240 pixel cameras, for quick point-and-shoot troubleshooting.



The new TiX580 Infrared Camera features a 240-degree rotating screen that allows thermographers to easily navigate over, under, and around objects to preview and capture images with ease. The 5.7-inch screen provides 150% more viewing area than a standard 3.5-inch screen, enabling thermographers to quickly identify issues in the field and easily edit images directly on the camera, reducing production time back at the office.

Both cameras include MultiSharp Focus, an advanced focus system that takes multiple images with a press of a button. The camera combines them to produce one focused image of both near and far objects, delivering precision image clarity guaranteeing an in-focus image when you get back to your office no matter what the conditions.

**For further information:** [www.fluke.com/Ti640x480](http://www.fluke.com/Ti640x480).

## igus doubles cable test area for extreme temperatures

Continuous movements alone are a challenge for cables, but how do cables behave at extreme temperatures of -40 degrees Celsius or +60 degrees Celsius? There are indeed international standards for moving cables on the market, but they do not provide reliable information about the service life of moving cables at low or high temperatures in use in energy chains.

For this reason, the cable expert igus has been testing its cables in continuous motion for a period of over ten years in these conditions and has now set up another test rig. "As part of our test lab extension to 2,750 square metres, we have now purchased a second 40-foot container and will run only heat tests in one, and cold tests in the other," explains Rainer Rössel, head of the chainflex division at igus. "This separation gives us even more precise test results and can thus guarantee even more reliable statements about our cables." Energy chains with cables can be moved in both containers in different lengths (also gliding) and speeds.

### Guaranteed service life statements for extreme temperatures

Due to the large number of tests under real conditions, igus is the only supplier on the market to be able to make three statements on the appropriate bending radius and the permissible temperature for every cable in its chainflex catalogue. "We not only provide the information on the specific temperatures in which a cable is suitable for fixed installation as well as for the movement according to the standard cold winding test, we can also specify for each chainflex cable a temperature in which the cable can move with guaranteed reliability in an e-chain.

The varying temperatures in applications under these conditions are as different as the problems that can arise: In the case of cold tests, jacket



Source: igus GmbH

In the new igus cooling chamber, tests can be run under real conditions down to -40 degrees Celsius...

ruptures are the biggest challenges. In the case of excessive heat, however, there is the risk that the total core formation will no longer hold due to the thermal alteration of the outer jacket and ultimately fails because of the constant bending in the energy chain.

As a result, for example, single strand breakage or the so-called 'corkscrew' effect can occur.

By doubling the test capacities in the second container, the limits can now be simulated better by igus and, for example, problems with condensation water caused by rapid temperature changes can be prevented in the test rigs.

**For further information:** [www.igus.in](http://www.igus.in)

## "Kusam-Meco" Digital Multifunction And Insulation Continuity-Voltage Tester

**K**USAM-MECO has introduced a new Digital Medium Voltage Insulation Resistance Tester Model 1152MF. Which has range 250/500/1000V, 0-80 Giga Ohms with Polarisation Index & Dielectric Absorption Ratio.

The "KUSAM-MECO" 1152MF packed with features such as Insulation resistance testing, Voltage (AC-DC) measurements (0-700V) with Automatic Hold facility, Continuity Test range 0.01 to 1999W with a short circuit current of minimum 200mA.



Two very unique features in the Multifunction Tester Model 1152MF is MOV and GAS Arrester testing. Most equipments and electrical installations are protected by MOVs and GAS arresters. The 1152MF can test these devices to establish if the devices are still operating correctly or not. EnerSave™ limits the test duration to about 10 seconds to save energy.

It has Digital EE Calibration. Calibration can be done at any calibration facility around the world, without the need for dedicated calibration equipment. All calibration are saved internally in a non volatile memory.

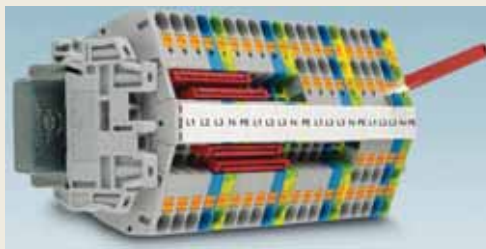
It is supplied complete with Test Leads, Batteries & Manual.

**For further information:** [www.kusam-meco.co.in](http://www.kusam-meco.co.in)

## Push-in terminal blocks in desk design for considerable space savings by Phoenix Contact

**T**he new PTS 4 terminal block range from Phoenix Contact saves a lot of space due to its compact and angled design. Angled conductor entry is required in particular for underfloor wiring systems.

The front connection enables wiring in a confined space. Up to four conductors can be connected quickly and easily using Push-in connection technology. Wiring is carried out easily and tool-free using conductors with ferrules or solid conductors. A high degree of flexibility for potential distribution, e.g., of a three-phase system or for testing, is



provided thanks to up to four function shafts. A test point is also available on all terminal blocks.

The terminal block range consists of two, three, and four-conductor terminal blocks with ground terminals, all of which are the same shape. The terminal block range also features large-surface marking options. Uniform Clipline complete system accessories

are also used, which reduces logistics costs.

**For further information:** E-mail - [adverts@phoenixcontact.co.in](mailto:adverts@phoenixcontact.co.in)

## Bringing the Innovation with Touch Screen Metering Solutions

**I**n today's complex & challenging Power Demand Scenario, it is essential for every Power Company to look at the Demand, Energy, Power Quality, System parameter monitoring and recording for analysis and to take steps in maintenance and control of the system equipments so as to REDUCE system downtime.

The Multi function meter is basically used to Measure, Record(Via Protocol Like MODBUS, Ethernet) and display of AC electrical parameters like RMS Voltage, Current, Active power, Reactive power, Apparent power, Power factor, Phase angle, Frequency, Active energy, Reactive energy, Apparent energy, Demand in 3 phase 4 Wire and 3 phase 3 Wire System. This meter is intended for application areas where accurate & reliable measurement is necessary. Rishabh Instruments has launched various models of Rish Master series



multifunction meters in the past which met all the prominent needs of the market and made Rishabh a common name among the customers & Panel builders. Now to enhance the range further and bring Innovation in the metering solutions market, we are launching the advance series of LCD Touch Display Rish Master 3440i and Rish Master 3430i models which are currently available in only LED display without touch.

### The key highlights of the product are as follows;

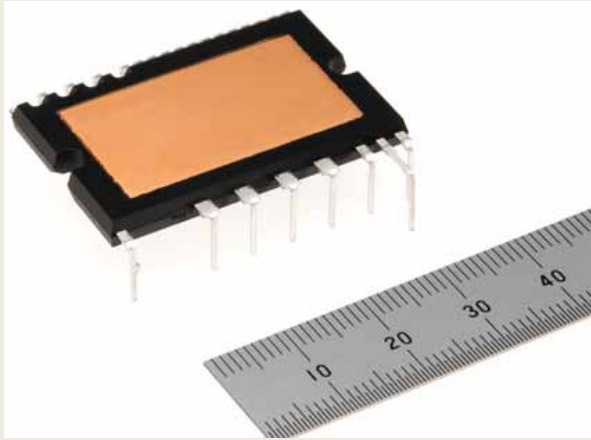
- Touch screen graphics LCD with Custom colour setting.
- Phasor Diagram and Pictorial Representation of Waveform.
- Phase Reversal Indication.
- Measurement of kW, kVA and current Demand.
- Total Harmonic Distortion measurement.
- Indication of Run Hour, ON Hour and No. of Interruptions.
- More than 40 Electrical parameters measurement.
- Optional MODBUS (RS485) Output (With Optical Isolation).

**For further information:** [www.rishabh.co.in](http://www.rishabh.co.in)

## Digital Multifunction

**M**itsubishi Electric Corporation offers a new transfer-mold power semiconductor model in its lineup of Super-mini Dual-In-line Package Intelligent Power Modules (DIPIPMTM), embedded with Silicon Carbide Metal-Oxide-Semiconductor Field-Effect Transistors (SiC-MOSFET).

**For further information:** [www.mitsubishielectric.com/semiconductors](http://www.mitsubishielectric.com/semiconductors)



REDUCTION IN FAILURE RATE OF ELECTRICAL EQUIPMENTS & ENERGY SAVING  
By installing Jindal's Industrial Robot Automatic Voltage Controller

**Voltage Variation is a common phenomenon.**  
The voltage is generally low during day time and high during night hours



### Advantages

- Reduction in breakdown of electrical equipments upto 80%
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- Improvement in power factor and reduction in MDI
- Uniform quality of end product
- Better efficiency of plant due to lesser Breakdown
- Depreciation @80% as per Income Tax Act

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Automatic Voltage Controller (AVC) pay back its cost within 12-24 months depending upon the input voltage variation and working hours of the plant.

### It's a breakthrough in energy conversation

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- Analogue Earth Tester
- Digital Earth Tester
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