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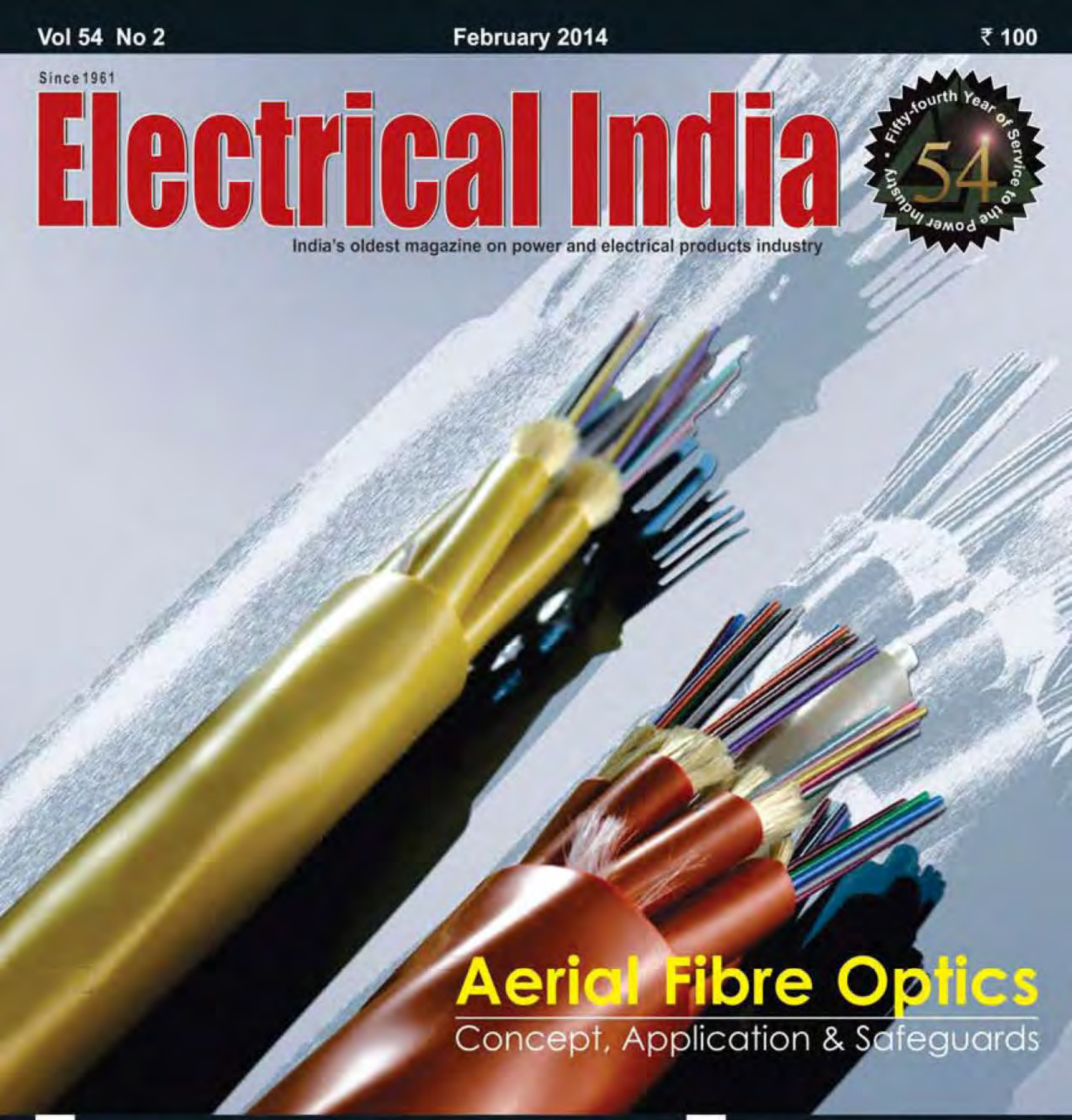

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Publisher's Letter

> "54% of total installed electricity generation capacity is coal based"

A projection in 12th Plan document indicates that total domestic energy production of 669.6 million tons of oil equivalent will be reached by 2016-17. This will meet around 71% of expected energy consumption, with the balance to be met from imports - projected to be about 267.8 MTOE by 2016-17.

The dominance of coal in the country's energy mix is likely to continue in foreseeable future. At present 54% of total installed electricity generation capacity is coal based. Furthermore, over 70% of the electricity generated is from coal based power plants. The demand for coal is projected to reach 980 MT during the Twelfth Plan period, whereas domestic production is expected to touch 795 MT by 2017.

Renewable energy such as wind, geothermal, solar, and hydroelectricity has 2% share in the Indian fuel mix. Nuclear holds 1% share in the power distribution segment. Reliability, in the context of power distribution system, can be defined as the ability of the system components to deliver electricity to all points of consumption, in the quality, quantity and at a reasonable price. An article 'Improvement of Reliability of Power Supply in Distribution System' emphasises, power cuts and interruptions play a vital role in electric power distribution network.

Floating Neutral conditions is very unsafe in the power network. A write-up 'Impact of Floating Neutral in Power Distribution' illustrates various factors depending on the type of Supply, type of installation and load balancing in the distribution is well illustrated by examples.

Do turn pages for post event Elecrama 2014. This issue contains topics relevant to the current trends in power sector. We cherish the feedback from our readers, support of our advertisers & subscribers.

Do send in your comments to us at miyer@charypublications.in

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Power Supply & Distribution, Cables, Safety; UPS, DG Sets, Motors, etc.

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Technical Innovations to Develop Future Power Quality Solutions

> "Power quality determines fitness of electrical power reaching to consumer"

A significant challenge in providing access to adequate and clean sources of energy is power quality. Electric power with high quality is crucial for the present high-tech society moving towards automation. Things are nowadays interconnected in a network and grid and power quality determines the fitness of electrical power reaching to consumer devices. This depicts voltage quality rather than electric current. Synchronization of voltage frequency and multi-phasing allows integrated electrical systems to function properly and qualitatively.

Distribution automation is being adopted by utilities now. Integrated processes imply smooth functioning and also mean that the failure of any component during the flow blocks entire function hence switching to other similar line of function needs be enabled, like if one phase stops, alternate phase takes over and this implies uninterrupted continuous power supply. Maintaining power supply is essential. Power quality is a measure of an ideal power supply system that defines state of the power being supplied. Crux of the issue is - utilities and end user consumers are prominently concerned about power quality related network technology.

Power quality concept may be exemplified from the fact that if a standard light bulb is concerned, it is high voltage that shortens bulb life. Stabilizing voltage, improving grid efficiency and reducing losses is achieved when processes are automated, thereby efficient operation of machines and their controls become increasingly dependent on quality power. Power quality, the interaction of electrical power with electrical equipment, is a vital issue for electricity consumers in industries, domestic applications. It is good or bad depends upon whether electrical equipment operates correctly or malfunctions. It is a priority among power supply utilities and raises concern for safety, reliability and economic loss. The variety of problems and majorly voltage flickering or sags interrupts production, and may affect equipment. This depends upon how efficient is power managing.

The electric power industry comprises of electricity generation, electric power transmission and ultimately electricity distribution to an electricity meter located at end user location. When electric energy moves from the point of production to the point of consumption, variations in generation, peak demand requirement and other factors provide opportunities to affect reform in power supply. Power quality trading and emission related market mechanism for power quality issues is also an intended solution to attain optimum level.

Power management solutions include devices such as UPS, surge protective devices, power distribution units and remote monitoring. It is known fact that any deviation from normal DC or AC voltage source is classified as a power quality issue. Furthermore, if some sectors are satisfied with quality of the power provided by utilities, some others are demanding. Electricity supplies are subject to a wide range of possible problems such as voltage fluctuations, waveform corruption and partial or total failure, and any of these can affect the operation of electrical and electronic equipment.

The quality involves many areas of interest such as power electronics, power flow studies, reliability, but economic issues are prime most. With increasing demand for power innovation in technology, exchange of scientific and technical information and replacing old equipment and technology for quality and reliability is the alternative to improve systems connectivity and continuous power supply. Moreover, improving energy efficiency is akin to power quality and these issues play a dominant role in contributing to the economic growth.

Gopal Krishna Anand

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Rinfra's Mumbai Distribution Business awarded World's First ISO 55001: 2014 Certification

Reliance Infrastructure Ltd. (RInfra), India's leading integrated infrastructure and power utility company announced that it has been certified with the ISO 55001:2014 Asset Management Standards for the best practices in effectively managing the Distribution Network Assets in its Mumbai Distribution Business. RInfra became World's first power utility to achieve this prestigious Bureau Veritas Certification. Speaking on the development, RInfra CEO Lalit Jalan said, "This is a validation of our good practices that makes RInfra the first ever Indian Company to be certified against the asset management standards. This certification will not only result in enhancement of service levels for our customers but also generate better results on Safety and Environment Consciousness fronts for our stakeholders". He added, "Our ultimate aim has always been to provide reliable and quality power to customers in the most efficient manners. We are consistently endeavouring to match the needs and expectations of our customers and achieving the required service levels." In the context of an electricity distribution utility, the distribution network assets management can be defined as a systematic process of operations, maintenance and upgrading of electrical assets in an efficient manner by combining best engineering models with sound business practices. R·Infra has always pioneered to lead the application of Best Practices in its power distribution in India. This certification is one of such best practices & can be helpful for the utilities in India as a future roadmap. Assets covered under the scope of the ISO 55001:2014 certification are power transformers, switchgears, distribution transformers, capacitors, cables, and automation systems. RInfra had earlier been conferred upon ISO 27001, India's first CMMI level 3 and First ever energy management ISO 50001. ■

CG to Pioneer Manufacture of Smart Grid Devices

Avantha Group Company CG launched its state·of the·art Smart Grid facility at the Global Village, in Bangalore, for full·fledged manufacturing of Smart Grid devices. Besides manufacturing Smart Grid devices, the facility will support economic development, foster job creation and boost an understanding of Smart Grid solutions in the energy field. The Smart Grid devices manufactured in this facility will offer numerical solutions to Indian Utilities and Industries in the T&D segment and provide improvement in the electric grid to make it more efficient and reliable. CG has invested 80 million INR in this facility which can employ more than 100 people. The Smart Grid facility will manufacture Substation Automation products, Distribution Automation devices, Protection and Control systems, Advanced Metering Infrastructure (AMI) and Telecommunication Solutions. ■

Govt to launch a National Smart Grid Mission

Indian government will launch a national smart grid mission and monitor implementation of policies and programmes envisioned in smart grid road map for power sector, said joint secretary, Ministry of Power at Trafotech 2014, an international conference at the Elecrama 2014 in Bangalore. "This will help in finding solutions for some of the daunting challenges the Indian power sector is faced with, such as enabling better access to electricity, providing lifeline supply to all households, reducing T&D losses, etc. This will also guide planning and investments for future power projects and T&D activities". The government had recently unveiled the Smart Grid Vision and Road Map for the future for both modernizing the aging grids as well as for transition towards low carbon power economy by integrating renewable generation with the grid. ■

Galaxy wins new contracts valued at Rs 164 Crores

Galaxy Transmission Pvt Ltd, a diversified group with interests in aluminium, power transmission and distribution, announced that it has received three new contracts for manufacture and supply of bare overhead power conductors. These contracts have a cumulative value of approximately Rs 164 Crores (~US$ 27 Million). Based on clients' required delivery schedules, the conductors would be supplied within FY 2014·15. The first contract was received from M/s Megha Engineering & Infrastructures Limited, which is executing a 400kV Quad DC transmission line project on behalf of APTRANSCO in the Indian State of Andhra Pradesh. The second contract was received from Ashoka Buildcon Limited, which is executing the MSEDCL Infra – II and MSEDCL RAPDRP projects in the Indian State of Maharashtra. The third contract was received from M/s Jyoti Structures Limited, which is executing a 400kV Quad DC transmission line project on behalf of APTRANSCO in the Indian State of Andhra Pradesh. "A nation's infrastructure development is a fundamental facet in its economic growth. A fast growing economy warrants an even faster development of infrastructure." Says Sameer Vhora, Managing Director – Galaxy. Keeping with the sustained growth in demand from the Indian and global power sectors, Galaxy has recently completed its current phase of capacity expansion, executed through new Capex investments, equipment upgrades and improvements in process efficiencies. Galaxy currently has a cumulative manufacturing capacity of 60,000 MT per annum, distributed between its facilities at Sangli (Maharashtra) and Rakholi (Union Territory of Dadra & Nagar Haveli). This cumulative capacity includes 10,000 MT of alloy conductors. As part of its growth strategy, Galaxy would continue to focus on growing its market share in India and increasing its global customer footprint. ■

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Legrand launches DX³ in India, a comprehensive range of safety & protection devices targeted at premium segment

The Indian arm of the EURO 4.5 billion global specialist in electrical and digital building infrastructure Legrand, Legrand India has launched a new product, DX³· a comprehensive range of MCB, Isolators, RCBO, RCCB, Accessories, Measure, Time·Switch, Contactor that meets requirements across the board. This offering positioned at the premium end of the market is aimed at large industrial, commercial and residential complexes and comes with 12 patented features. All these are safety & protection devices that ensure that the home and commercial establishments are more secure places. Many of the new patented features ensure that the level of compliance is in excess of what is demanded by Indian regulators. Legrand India enjoys the distinction of being the pioneer in Miniature Circuit Boards (MCBs) –devices that cause tripping if there is excessive current flow and thus ensures safety and enjoys a leadership position in the market. Sameer Saxena, VP·Marketing, Legrand India comments on the launch saying, "The introduction of DX3 is the next step for us and will create a paradigm shift in the industry. Legrand India has always enjoyed substantial brand equity since the launch of the MCB more than a decade back. The launch of DX3 and its host of new features will help us in offering the customer an even better product experience in terms of safety, reliability and sheer efficiency. It is also a reiteration of our commitment to and belief in the Indian market as we have chosen to launch this product when there has been a slowdown in economic growth." The DX3 features a complete range of MCBs, from 10 KA to 50 KA and observes homogeneity with the power range and effective energy distribution. ■

Nathpa Jhakri Hydro Power Station Awarded

Global Consecutively for the 3rd year in a row, SJVN's flagship 1500 MW Nathpa Jhakri Hydro Power Station has been selected for `Silver Shield` for the year 2012·13, and `Bronze Shield` for the year 2011·12, while for its meritorious performance in the year 2010·11 it had been awarded `Gold Shield` by the Ministry of Power, Govt. of India. The prestigious awards will be presented by Minister of State for Power (I/C), Jyotiraditya Scindia, at a function at Vigyan Bhavan, New Delhi on 4th February, 2014. Ministry of Power had instituted this Comprehensive Award Scheme for recognizing meritorious performance in Power Sector in the year 2004·05. The Nathpa Jhakri Hydro Power Station (6 x 250 MW) of Satluj Jal Vidyut Nigam Limited (SJVNL) has been selected for the `Silver Shield` for the year 2012·13 and the `Bronze Shield` for the year 2011·12 by the Central Electricity Authority in the category of "Performance of Hydro Power Stations". ■

PM lays Foundation Stone of 2800 MW Gorakhpur Haryana Anu Vidyut Pariyojana

PM laid the foundation stone of 2800 Megawatt Gorakhpur Haryana Anu Vidyut Pariyojana (Nuclear Power Project) in the Gorakhpur Village of Fatehabad district of Haryna. Detailing the specifications of GHAVP Dr. Manmohan Singh said the 1st phase will see the commissioning of two units producing 1400 MWe of electricity. The Commissioning of 1st phase will be completed by 2020·21. The second phase will start after that which will double the capacity tio full 2800 MWe. Nuclear Energy is one of the safest and clean option for electricity. India is among those few nations where technology to establish nuclear power projects has been developed. He said India is capable of producing 4800 MW power and in coming 10 years we will be able to produce more than 27,000 MW of electricity. ■

India'S Switchgear & Control Gear Industry to grow at a 10% CAGR till 2017

Despite being the 5th largest producer & consumer of electricity in the world, there has only been a marginal boost to the demand for distribution machinery · India's switchgear and control gear industry, valued at INR 135 billion, is expected to be worth approximately INR 215 billion by 2017. The industry is facing challenges such as cheap imports from markets like China, and a slowdown in the power sector India is the fifth largest producer and consumer of electricity in the world. According to the 11th five year plan, the country was only able to achieve 69% of its planned capacity of 78,700 MW. To overcome the demand and supply deficit, the Indian government is gradually increasing the planned capacity addition. Despite this, there has only been a marginal boost to the demand for distribution machinery such as switchgears and control gears. The switchgear and control gear industry in India, currently accounting for ~10% of the overall electrical equipment sector, was valued at INR 135 billion (~USD 2 billion) in FY2013. ValueNotes estimates that the industry will be worth approximately INR 215 billion (~USD 3.5 billion) by FY 2017 · a slower CAGR of ~10%, compared to 15% between FY2010 and FY2012. This diminished growth is due to an increase in cheap imports, an uncertainty and delay in the implementation of power reforms, and the lack of adoption of international standards in manufacturing by local players. "The rise in imports, especially in low voltage switchgears, is the biggest challenge that Indian players are facing, along with the entry of sub·contractors with limited technical know·how," says Tejaswee Shrestha, research analyst at Value Notes. ■

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Uninterrupted Direct Current Power from Grid

Asho Uninterrupted Direct Current (UDC) is first of its kind system which guarantees uninterrupted power supply from the grid even during black out situations. Designed by Prof Ashok Jhunjhunwala and Prof Bhaskar Ramamurthi, and their team at Indian Institute of Technology Madras, the system attempts to address three problems: When demand for power exceeds supply, the power distribution companies (Discom) are forced to cut power in some localities resulting in a "power cut" or black out. Power cuts exist in most parts of the country and can be as high as 20 hours a day in some remote locations. In recent years, it is known that DC (direct current) driven Brushless DC fans and LED lights consume less than half as much power as their AC counterparts. Also, all electronics (TV, PC, cellphones, etc) use low power DC power, and AC to DC convertors used to power/charge these devices are energy inefficient. Yet, energy efficient alternatives could not be used in the absence of a DC line at homes. Power from solar panels is known to have reached grid parity in terms of cost per unit of D.C. power generated. Decentralised use of roof top solar panels tosupplement grid power would enable home users to draw significantly less power from the grid during the day time, and therebyreduce load on the grid during the day time peak period. However, the additional cost, inefficiency and complexities of DC AC conversion has prevented any pull from being created for decentralised solar installations. Besides, rooftop solar panel solutions available today provide supplemental power only when grid power is present! This makes them useless during blackouts. The team at IIT Madras has come up with a technology that addresses all these problems in an innovative manner.The solution involves the following: A second power line at 48V DC is installed at homes, which provides limited, but un interrupted (by black outs) power to homes. ■

Alstom T&D India will supply turnkey substation at Bihta for BSPTCL

Alstom T&D India secured an order worth Rs 544 million approximately, for a turnkey 220kV Air Insulated substation (AIS) at Bihta and associated 220/132/33kV bays extensions at various locations for Bihar State Power Transmission Company Limited (BSPTCL) in Bihar. Bihar plans to add a number of new 400kV/220 kV voltage level substations at various locations in the state in near future. It is the first in the series in the energy expansion plan of the state. It also aims to strengthen the state's transmission network at 220kVlevel. Turnkey contract covers design, engineering, manufacture, supply, testing, erection,commissioning of 220/ 132 / 33 KV AIS substation including supply of 2 Nos. 160 MVA & 2 Nos. 50 MVA transformers. ■

BORG Energy India committed to invest USD 45 Million in India

BORG Energy India Private Limited, a subsidiary of BORG Inc, Texas USA with rich experience in Alternative Energy and Smart Grid Technology having successful project experience across North America, Europe, Africa, China and SE Asia announced its plans to invest USD 45 Miliion in Indian market for rural electrification and EPC (engineering, procurement and construction) projects within next six months. The company plans to power 18,000 homes in northern India in next 150 days with BORG Astra Plus Home Series, a Range of fully loaded micro solar power plants, specially designed to meet the energy needs of domestic households and Solar Farm Master Series Controller targeted at generating power for irrigation projects in India. While inaugurating the press conference along with Joseph Fournier, Director, BORG Inc., Mr. M.S. Sundararajan, Ex Chairman Indian Bank & Independent Director, BORG Energy India, Mr. T.S. Krishnamurthy, Ex Chief Election Commissioner of India & Independent Director, BORG Energy India and Senior Executives of BORG Inc. in Delhi, Dr. Boaz Augustin Jr., BORG Energy Managing Director – Asia Pacific said, "We will invest 45 Million USD in India within next six months. We commit 25 million USD for rural electrification projects using solar power and 20 million USD will be used for EPC Projects in U.P., Tamil Nadu, Rajasthan, Bihar and Andhra Pradesh. We have ambitious plans to install BORG Power plants in 2.5 million households in various states of India over the next 3 years. We are currently developing appropriate retail network of 220 Borg Power Play show rooms in India. ■

Schneider Electric: VarPlus Can and EasyCan capacitors for power factor correction and power quality improvement

Schneider Electric announced the introduction of VarPlus Can and EasyCan capacitors for power factor correction applications.These additions to the power quality portfolio are engineered for ease of use, quality, safety and high performance. This range is manufactured in the state-of-the-art manufacturing facility in Bangalore which also serves over 40 countries worldwide. The new range covers the full spectrum of power factor and power quality applications across multiple end user segments and conforms to IEC 60831 (Parts 1 & 2). VarPlus Can capacitors are available up to 50kvar in a single can and help users save up to 30% panel space due to their compact design. These capacitors are specially engineered for high performance in networks polluted with harmonics and in critical applications. The unique built-in three phase pressure sensitive disconnector ensures safe disconnection at end of life.VarPlus Can capacitors are fully compatible and type tested with Schneider Electric solutions (Prisma& Blokset) allowing partners to build type tested solutions. EasyCan capacitors are optimized to meet standard application needs and are fully type tested as per IEC standards. The capacitors are available from 1kvar to 30kvar and are engineered and tested for maximum safety and reliability. Built-in and tamper proof discharge resistors combined with the three phase pressure sensitive disconnector makes these products safe during installation, operation and maintenance. User friendly labels are a first in the industry and provide installation and safety tips on the usage of the product. The unique Clamptite termination system is designed to maintaintightness and reduce risk of loose connections. Schneider Electric offers a complete complementary range of detuned reactors, power factor controllers, power meters and switchgear. ■

MidAmerican Solar, SunPower Corp. synchronize Solar Star Development to the Grid

MidAmerican Solar and SunPower Corp. announced the first portion of 579 MW Solar Star development – two projects co-located in Kern and Los Angeles counties in California – was synchronized and is now delivering energy to the California ISO grid. "This announcement is significant for the state of California," said Mike Fehr, MidAmerican Solar's general manager at the Solar Star projects. It demonstrates promise to local community & regulators and delivering expected results, based on our construction timeline, to help California meet its mandate to generate 33% of its power from renewable sources by 2020. Many stakeholders made this milestone possible, including California ISO, Southern California Edison, county officials, local community members and contractors. Construction on the projects began in early 2013 and is expected to be complete by year-end 2015. ■

Innovation is need of the hour to make T&D sector cost effective – IEEMA

Indian Electrical and Electronics Manufacturers' Association (IEEMA) held "Innovation Day" at the recently concluded ELECRAMA 2014 in order to promote the process of 'idea into product'. "Innovation is defined as the process of converting an idea into a product or service that creates value for which people are ready to pay. So the real innovation, or an innovation to become a reality in a country like India, it must be aimed at people at the grass root level and it must also embrace the future", said Raj Eswaran, President IEEMA in his opening remarks at the Innovation Day organized by IEEMA as a part of the Elecrama-2014. IEEMA, continuing its exposure and support to engineering students, invited hundreds of engineers from various colleges to attend the event. Along with the students, the event saw attendance of distinguished people. ■

L&T Electrical & Automation displays new range of MCBs, Meters, Relays; focuses on safe & intelligent solutions

Larsen & Toubro, leaders in low voltage switchgear and total solutions provider in the electrical and automation space, has displayed an array of innovative products, systems and solutions for the current and future needs at Elecrama 2014. Depicting the theme of 'touching lives' the products/solutionsfocus on human protection and asset safety as well as energy efficiency, communication and security in the day-to-day utilization of electrical and automation applications in industry, utility, buildings/homes and the farm segments. Thehighlight of the display is L&T's in-house designed and developed AU series of final distribution products comprising miniature circuit breakers (MCBs), residual current devices (RCDs), isolators, change-over switches, energy meters, time switches, surge protection devices (SPDs), modular contactors, communication devices, distribution boards etc. The range offers complete solution in the areas of distribution, protection, control and monitoring including communication with building management systems. Speaking on the display, senior Vice President and Head of L&T Electrical & Automation, Mr. S. C. Bhargava said, "This series of final distribution productsensures highest level of safety and convenience to the end users as well as offers safety and reliability to the installations. It combines both conventional and intelligent system solutions in a simplistic way for the purpose of main distribution of electrical energy. The AU series is a unique blend of novelties and benefits to the users. It will cater to the industry and building segments and reach the market in April-May this year." Another highlight of display is smart meters and remote meter reading for residential and commercial meters through low power radio. ■

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CECEP Solar Energy Technology Co Ltd achieves 18.32% Cell Efficiency using Applied Materials' Double Printing Technology

Applied's Fine Line Double Printing enables a 0.2 percent cell efficiency gain for CECEP to meet the Chinese government requirement to qualify for capacity expansion Production proven upgrade path to double printing accelerates CECEP's roadmap to high efficiency SHANGHAI, January 15, 2014 – Applied Materials, Inc. announced that CECEP Solar Energy Technology Co Ltd, a Chinese state-owned company focused on the research, production and installation of crystalline silicon solar cells and modules, achieved a key milestone of 18.32% average cell efficiency for its multi-cells. This increase was achieved on conventional production lines using a standard process upgraded with Fine Line Double Printing (FLDP) enabled by Applied's Baccini Esatto Technology. The milestone was reached in early December 2013, and the production line continues to maintain stable operation. This result is crucial to meeting the "Photovoltaics Manufacturing Industry Standards" minimum cell efficiency requirement recently mandated by the government to qualify for capacity expansion, and to drive the development and advancement of China's photovoltaic (PV) manufacturing and renewable energy industry. "As new markets for solar PV emerge across China and competition increases, it is essential to accelerate the pace of innovation to achieve higher cell efficiencies," stated Li Kai Jiang, CECEP General Manager. "CECEP is extremely proud to have reached its 18.32 percent efficiency target by upgrading to Applied's Fine Line Double Printing with Esatto Technology. CECEP was able to conveniently and quickly implement double printing on existing systems to enhance the efficiency of our optimized standard multi cells. This result represents a 0.2 percent efficiency gain over our previous production baseline. Based on the high value of this collaboration, CECEP looks forward to working with Applied on further solutions to advance solar cell technology." ■

Cyan's CyLec wireless technology

Cyan Holdings plc, integrated system design company delivering wireless solutions for lighting control and utility metering, attended Elecrama. With their CyLec wireless technology, which features in L&T's new smart meter.John Cronin, Executive Chairman of Cyan, commented, Cyan entered into a strategic alliance with L&T to deliver 865 MHz based smart metering solutions to the India energy market. Our team, both in India and UK, has developed this partnership and we are now proud to be able to display the results of our collaboration. Cyan's CyLec technology provides end-to-end communication, to and from the meter, enabling functions such as remote tamper detection and reporting. Smart Grid Roadmap for India highlighted requirement for an indigenous low cost smart meter by 2014. L&T's CyLec enabled smart meter provides an answer to this requirement and is capable of interoperable two-way communication and remote collection of metering data and meter control. ■

Hydrogenics awarded CAD$3.8 million Energy Storage Contract

Hydrogenics Corporation ("Hydrogenics"), leading developer and manufacturer of hydrogen generation and hydrogen-based power modules, announced it has been awarded a CAD$3.8 million contract to supply a micro-grid energy storage application in Canada. This energy storage project will store surplus wind energy as hydrogen using a Hydrogenics HySTAT60TM electrolyzer operating at 320 kW of energy absorption. The hydrogen will be stored on-site and then converted back to energy when needed using a Hydrogenics HyPM-R200TM fuel cell system generating 200kW of energy. This project, when complete, will replace a current system that uses diesel generation thus resulting in a much lower carbon footprint. Hydrogenics expects to deliver this project in late 2014. ■

Emerson wins Contract to Provide Backup Power Systems For Shell prelude Natural Gas Project Off Australian Coast

Emerson Network Power, a business of Emerson and a global leader in maximizing availability, capacity, and efficiency of critical infrastructure, has been selected as the main uninterruptible power supply (UPS) systems provider for Shell's Prelude FLNG project, the world's first floating liquefied natural gas (FLNG) project, currently under construction in Korea for deployment to the Browse Basin off the coast of Western Australia. Emerson Network Power will help provide reliable standby power for critical process functions, such as the main automation systems, fire and gas detection systems, and telecommunications. Emerson's Chloride industrial-grade UPS systems are designed to supply backup power in the most demanding environments for a lifetime of more than 20 years. "Mission-critical facilities on Shell's FLNG facility require the highest levels of availability, and backup power supplies are key components of making sure infrastructure like this remains always-on," said Scott Barbour, business leader for Emerson Network Power. "This is a great opportunity for us to join our colleagues at Emerson Process Management to put some of our best solutions and services into practice, in an extraordinary application." In 2010, Emerson Process Management, another global business of Emerson, was selected as the Main Automation Contractor for the Shell Prelude development. Emerson Network Power, delivers software, hardware and services that maximize availability, capacity and efficiency for data centers, healthcare and industrial facilities. ■

In emergencies, how fast you restore power can mean how effectively you restore confidence.

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Transmission lines are vulnerable to mechanical failure during natural disasters or acts of sabotage. This has significant economic and political costs as well making it imperative to restore electrical power swiftly, effectively and efficiently. For nearly 65 years and with over 1000 Emergency Restoration Systems working reliably across 20 countries, Lindsey ERS are well-proven in addressing calamities and challenges. In India, Lindsey ERS is available through PCI Limited - the company that, in association with global technology majors has brought hi-tech solutions for various sectors of the Indian economy for 25 years now.

Lindsey ERS are designed to be user-friendly especially during mission-critical situations and can be deployed swiftly - a complete tower can be erected within a matter of hours. All ERS tools and accessories such as insulators, hardware, anchors and gin poles, can be safely stored and transported in standard 20 foot containers. PCI can also provide the necessary orientation and training of your technical disaster management personnel.

These highly reliable and quick-to-deploy ERS have played a significant role in the restoration of normalcy of power supply in the aftermath of various natural calamities in India such as the 1998 cyclone in Gujarat, the 1999 Orissa cyclone and the severe floods that had paralyzed vast districts in Bihar and Assam during 2010.

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Siemens signs service contract for Nyagan combined cycle power plant in Russia

Siemens and Fortum have signed a long-term service contract for the Nyaganskaya GRES combined cycle power plant in Nyagan, Russia. Nyaganskaya GRES is the world's largest thermal power plant operating above the latitude of 62 degrees North and is the largest thermal power plant greenfield construction project in Northern Russia. The power station consists of three combined cycle power units totaling 1,254 megawatts (MW). The first unit, with a capacity of 420.9 MW, began commercial operation in April 2013. The commercial operation of the second unit began at the end of 2013, and the third unit is currently under construction. Under terms of the long-term agreement, Siemens will provide service and maintenance for the gas turbines, steam turbines and generators of all three combined cycle plants for a period of six years. "As one of Russia's largest combined cycle power plants, Fortum's Nyaganskaya power plant plays an important role in contributing to the region's energy supply," said Alain de Cat, Head of Siemens Energy Service Fossil, Region Europe and Africa. "With our new regional hub in St. Petersburg, Siemens will have the resources and technical abilities available nearby to help ensure the plant operates with high availability, reliability and economic efficiency. Siemens supplied its SCC5-4000F power train solution consisting of an SGT5-4000F gas turbine, SST5-3000 steam turbine, SGen5-2000H generator and SPPA-T3000 automation system for each of the three units of Nyaganskaya GRES. Earlier this year after the successful Kirishi repowering project, Siemens also signed a long-term service agreement for the Kirishskaya GRES power plant in the Leningrad region. ■

EU and India join hands to facilitate Offshore Wind

The Global Wind Energy Council (GWEC) and partners have announced the launch of a four-year project to develop a roadmap for offshore wind development in India, with a focus on the states of Gujarat and Tamil Nadu. Supported by a EUR 4 million contribution through the European Union's Indo-European Cooperation on Renewable Energy program, the project will work in close cooperation with the Ministry of New and Renewable Energy, state governments and other relevant offices of the Indian government to look at the challenges and opportunities presented by offshore wind. "We look forward to working with our Indian and European partners to help fuel India's development with clean renewable energy," says Steve Sawyer, GWEC's secretary general. ■

PHI and U.S. Department of Energy: Completion of Smart Grid Investment Grant Programs

Officials from U.S. Department of Energy and Pepco Holdings Inc (PHI) for a two-day event to acknowledge funding and completion of multiple smart grid programs. The projects were accelerated by Smart Grid Investment Grant funds awarded by the Department of Energy as part of the American Recovery and Reinvestment Act (ARRA). Executives and team members from both organizations saw presentations on the status of projects including advanced metering infrastructure, direct load control and distribution automation. "These funds have allowed PHI's utilities to install new technologies that will give customers a better experience and enable them to save money through energy efficiencies," said Karen Lefkowitz, PHI VP, Business Transformation. ■

F&S: Waste-to-Energy Solutions crucial to Combat High Per Capita Waste Generation and Population Growth Rate

The global trend of increasing urbanisation and higher disposable income being directly proportional to increase in per capita waste generation has been mirrored in the Gulf Co-operation Council (GCC) countries as well. The increasing volume and complexity of waste is posing a threat to the ecosystem and human health. At the current rate, Global Municipal Solid Waste (MSW) Generation volumes are likely to nearly double by 2025. The GCC countries stand out in terms of lavish lifestyles, unsustainable consumption levels, rapid urbanisation, and rapid growth in population. Owing to this, the total volume of the waste generated in the GCC is likely to touch 130 Million Tonnes in 2014 at a CAGR of 10.7% from 2009 to 2014. As per recent F&S analysis, one of the key factors driving the market for waste management services is the shift to alternative integrated waste management solutions and Waste-to-Energy (WTE). However, WTE is an emerging market in the GCC with only 0.25-0.3 terrawatt-hours (TWh) of energy being produced from waste in the countries presently. Qatar is the first GCC country to implement WTE on a large scale with its Domestic Solid Waste Management Centre (DSWMC) deploying a WTE plant with a capacity to generate 50 Megawatt (MW) of electricity. These facts, along with other similar insights on the WTE market in the Middle East, were presented in an exclusive F&S Whitepaper titled, 'Middle East Waste Management Market: Transforming Liability Into Value' at EcoWASTE 2014. Kumar Ramesh, Industry Manager, Environment and Building Technologies Practice, Middle East and North Africa, Frost & Sullivan also moderated a panel discussion on WTE at the prestigious 7th World Future Energy Summit. ■

TOSHIBA

Leading Innovation >>>

Toshiba launches global manufacturing hub at Hyderabad, Andhra Pradesh, India for T&D business

Toshiba Corporation, Japan has acquired the businesses of Power Transformers, Distribution Transformers & Switchgear from **Vijai Electricals Limited,** Rudraram works – Hyderabad in December 2013 and thus formed **Toshiba Transmission & Distribution Systems (India) Pvt. Ltd. (TTDI).**

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420kV, 63kA Gas Insulated Switchgear

245kV Gas Insulated Switchgear

245kV Live Tank Circuit Breakers

Surge Arrester for GIS

Surge Arrester for Transmission Lines

Prefabricated Substation

Solid Insulated Switchgear up to 36kV

12kV Indoor Vacuum Circuit Breaker

12kV & 36kV Outdoor Vacuum Circuit Breaker

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Voltage Transformers
12kV to 245kV

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NREL Study: Active Power Control of Wind Turbines can improve Power Grid Reliability

National Renewable Energy Laboratory (NREL), along with partners from the Electric Power Research Institute and the University of Colorado have completed a comprehensive study to understand how wind power technology can assist the power grid by controlling the active power output being placed onto the system. The rest of the power system's resources have traditionally been adjusted around wind to support a reliable and efficient system. The research that led to this report challenges that concept. The study, "Active Power Controls from Wind Power: Bridging the Gaps ", finds that wind power can support the power system by adjusting its power output to enhance system reliability. Additionally, the study finds that it often could be economically beneficial to provide active power control , and potentially damaging loads on turbines from providing this control is negligible. Active power control helps balance load with generation at various times, avoiding erroneous power flows, involuntary load shedding, machine damage, and the risk of potential blackouts. "Utilities and independent system operators are all seeking strategies to better integrate wind and other variable generation into their electric systems," NREL Analyst Erik Ela said. "Few have considered using wind power to support power system reliability." The study included a number of different power system simulations, control simulations, and field tests using turbines at NREL's National Wind Technology Center (NWTC). The study developed proposals for new ancillary services designs in U.S. wholesale electricity markets, studied how wind power affects system frequency in the western U.S. with and without active power control, and tested the use of active power control at the NWTC to better understand the performance and structural impacts on wind turbines when providing active power control to the electric system. ■

TrendForce: USA's Anti-Dumping Investigation may affect Taiwanese Cell Manufacturers

SolarWorld once again requested anti-dumping and countervailing investigation against Chinese modules shipped to USA. This time, the investigation will include module with third-party solar cells. EnergyTrend, a research division of TrendForce, indicates that the total amount of PV installation was 4.3GW in 2013, in which 90% (around 3GW) of modules were from China. Although it cost US$0.7/watt for Chinese modules shipped to USA, the cost was very close to the minimum price set between EU-China. However, due to the Chinese government's great support towards the PV industry these years, Chinese manufacturers can sell relatively low-priced products as they are under deficit. It's projected that US has a moderate chance of establishing the case. ■

S&C's Wanda Reder receives IEEE Richard M. Emberson Award

S&C's Wanda Reder, Vice President, Power Systems Solutions, was recently awarded the Institute of Electrical and Electronics Engineers (IEEE) Richard M. Emberson Award. Reder was chosen for her leadership in the IEEE Smart Grid program and in the continued growth of the IEEE Power and Energy Society, including the creation of its Scholarship Fund. The award was established in 1986 to honor Dr. Richard M. Emberson. Emberson's 23-year commitment at both staff and volunteer levels demonstrated loyal and dedicated service to IEEE. The award is presented to those who demonstrate these traits and volunteer their time to the development, viability, advancement, and pursuit of IEEE's technical objectives. Reder will receive the award at the IEEE Honors Ceremony taking place August 23, 2014 in Amsterdam. ■

Crestron Asia: Innovation Leadership at 2013 China Intelligent Building Top 10 Brands Awards

Crestron Asia Limited ("Crestron Asia"), the Asia headquarters of Crestron Electronics, Inc. ("Crestron"), the world's leading manufacturer of advanced control and automation systems cemented its industry leadership in design and innovation for home products and conference systems when it was awarded two prestigious awards at "2013 China Intelligent Building Top 10 Brands". Both the "China Intelligent Building Top 10 Smart Home Products Brand" and the "China Intelligent Building Top 10 Conference Systems Brand" were presented at the "2013 China Intelligent Building Top 10 Brand Awards Ceremony" held in Beijing, China in front key industry luminaries and leading firms. The fact that Crestron Asia won these awards for the second consecutive year reaffirmed its strong commitment to improve productivity and convenience through product innovation. The "2013 China Intelligent Building Top 10 Brand" award was organized by the "Engineering Intelligent Design Branch of the China Exploration and Design Association", and the "Beijing Intelligent Building and City Information Magazine Agency". Featuring strong media and industry interests across the region, the industry event annually highlights organization that set new benchmarks for intelligent building design in China. The 2013 Awards saw keen competition and innovative entries. The judging and screenings for both awards were held from September to October 2013. Industry professionals, experts and end users were invited to vote during the two months of assessment using a transparent judging process. The Awards featured seven categories altogether, covering key aspects of intelligent building design. ■

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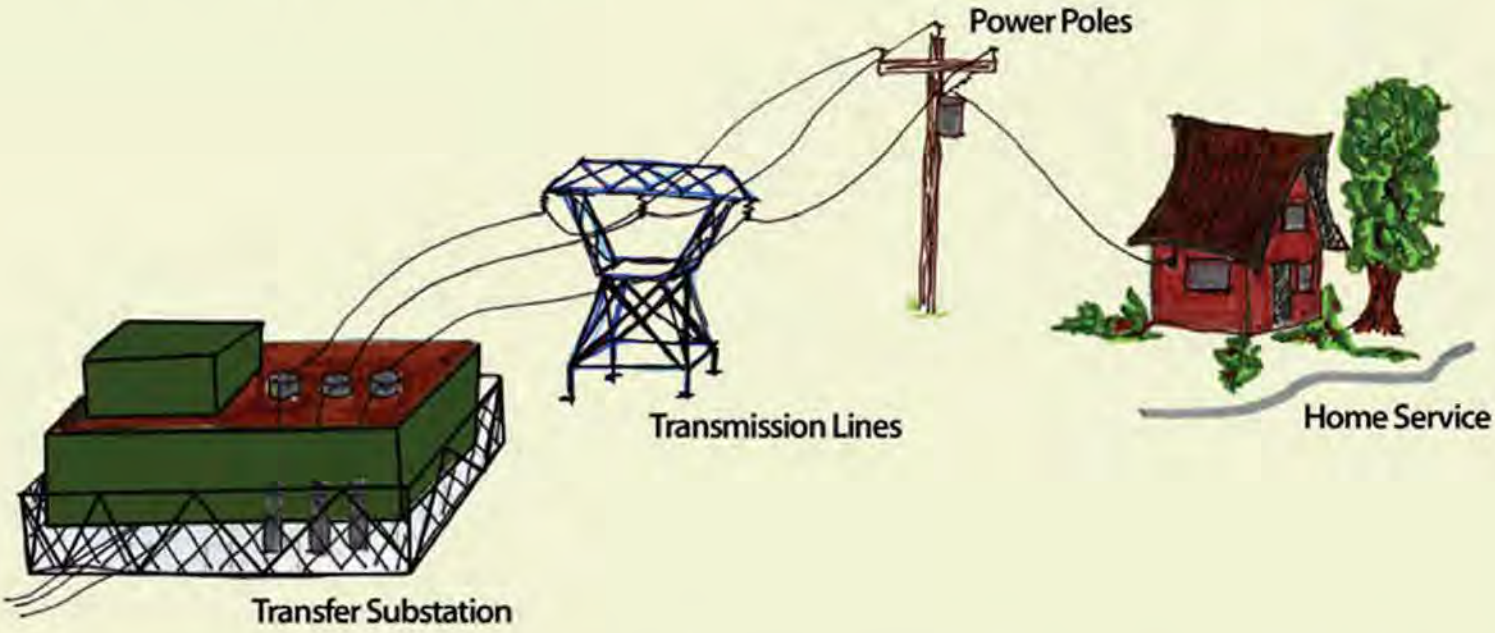
Improvement of Reliability of Power Supply in Distribution System



Reliability means "The ability of the power delivery system to make continuously available, sufficient voltage, of satisfactory quality, to meet the consumers' needs". "Reliability" as normally applied to power distribution means continuity of service to the utility's consumers. Reliability, in the context of power distribution system, can be defined as the ability of the system components to deliver electricity to all points of consumption, in the quality, quantity and at a reasonable price. In other words, Reliability is the degree of performance of the components of system that results in electricity being delivered to consumers within accepted standards and in the amount desired at a reasonable price.

- Shivananda.K.R and Dr. M. S. Shashikala

Reliability is often related in terms of failure rate and outage time. Thus, the power cuts and power outages (interruptions) play a vital role in Electric Power Distribution. Mostly it is the power outage which disrupts the business than any other factor. Reliability of service needs to be always given primary importance by an electric distribution utility.

A reliable power system provides power without interruption. An availability of 99.9% might sound impressive, but it means eight and three quarters hours without electric service each year.

Reliable power supply is directly associated with the following:

- Proper asset utilization.
- Adequate and timely maintenance.

- Power availability & redundancy.
- Fixing of performance targets and future improvements.

Reliability Indices

The degree of reliability may be measured by the frequency, duration and the magnitude of adverse effects on the electric supply. To measure system performance, the electric utility industry has developed several performance measures of reliability.

The reliability indices include measures of:

- Outage duration.
- Frequency of outages.
- Type of outages.
- System availability and
- Response / Restoration time.

Indices are based on the duration of each power supply interruption and the frequency of interruption. It is clear that all three major functional components of the power system-generation, transmission and distribution contribute to overall reliability of the electric supply. As far as the consumer is concerned, transmission and distribution outages are important.

Reliability indices are the tools for the utility for internal as well as external comparisons. The indices are used by the electric utilities to measure their present performance against past history and to compare their performance to other utilities.

Thus, the Reliability Indices are very important, and where a utility falls on the scale can have a great impact on its operations, along with the relationship between the utility, consumers and regulators.

There are many indices for measuring reliability. The most common distribution reliability indices include the System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), Customer Average Interruption Duration Index (CAIDI), Customer Average Interruption Frequency Index (CAIFI) and the Average Service Availability Index (ASAI). However, SAIFI, SAIDI and CAIDI are the measures commonly used to report the average frequency and duration of sustained outages. They are defined over a fixed time period, usually a month or a year. These indices can be measured over the entire electric distribution system or over smaller portions of the system, such as an operating area or individual circuit.

Categories of Reliability Indices

There are two basic categories of indices:

Customer based indices – Record the frequency and duration of outages for individual customers and are most informative in mainly residential areas.

Load based indices – Monitor information on the duration and frequency of interruption of load and are relevant for circuits that are mostly industrial or commercial.

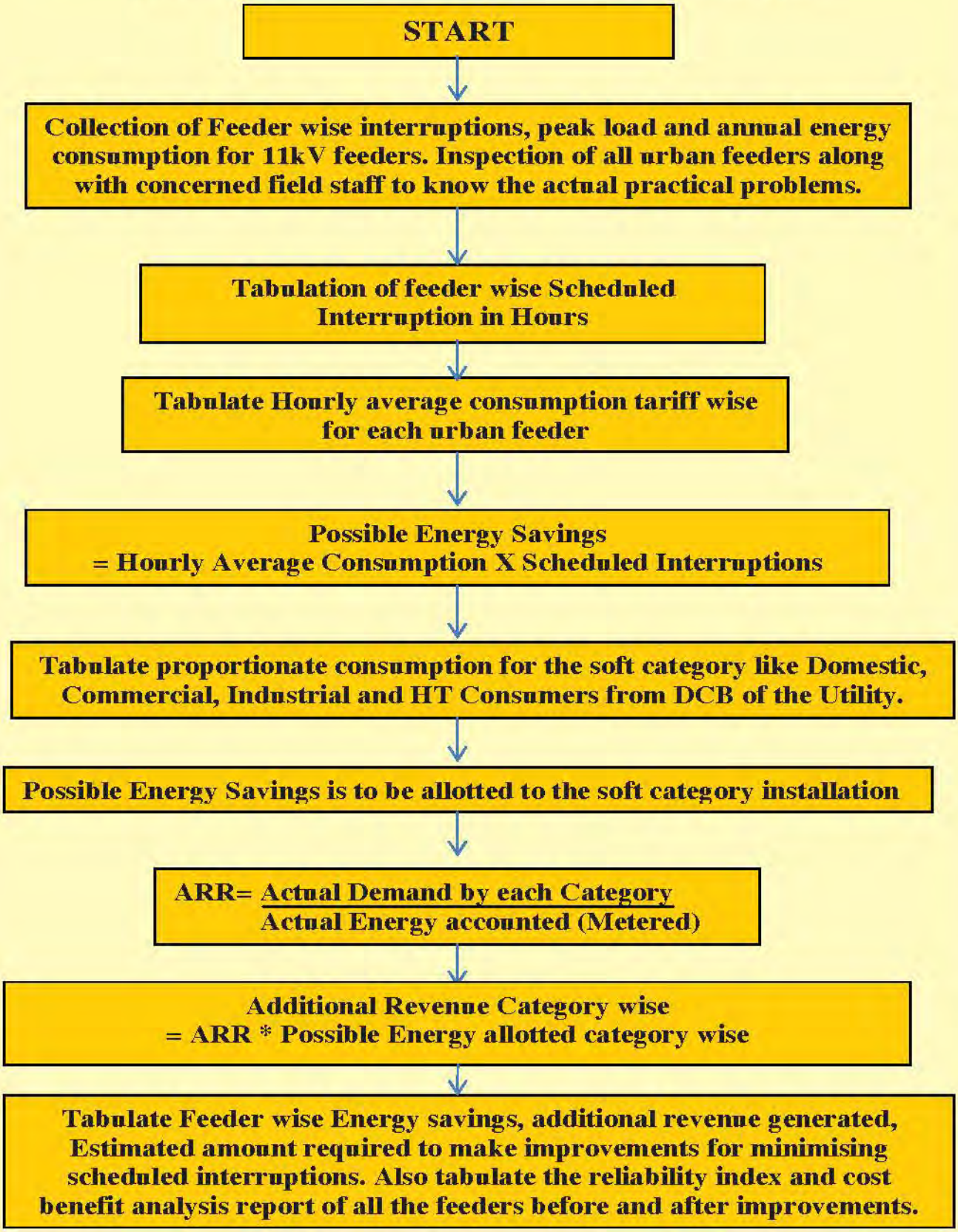
It is important to calculate both sets of indices to get a true picture of reliability.

Methods for improving reliability in electric distribution system

Some of the methods for improving reliability in electric distribution system are:

- To improve the physical plant i e, replacing small i.e., conductors with larger ones.
- Change the way the system service the load i.e., reconfiguring the system or switches.
- Alter the load itself to reduce the compounding effects of the I2R losses on the delivery system components i.e. adding capacitors or load management.
- By drawing additional circuits in parallel with the existing overloaded line.
- By drawing express feeder to transfer the tail end load from exiting feeder on to express feeder to overcome low voltage problems and to avoid overloading of lines.
- Replacement of overhead bare conductor by Aerial Bunched Cable in 11kV and 440 Volts LT lines to avoid unnecessary interruptions.
- Dynamic Optimal feeder reconfiguration for quick service restoration there by improving the system security and reliability.
- Keeping redundancy in distribution system.
- Enhancement of over loaded distribution transformer where ever essential to avoid failure of overloaded distribution transformers.
- Providing group operating switches to all branch lines at tapping point to isolate branch line during fault and to carryout regular maintenance in branch lines.
- Providing proper size fuse units on both LT and HT side to all distribution transformer centers to have protection against local faults which avoids complete isolation of lines during local faults.
- Providing new additional distribution transformers to overcome low voltage problems and to avoid failure of over loaded distribution transformers.
- Proving Auto-reclosers in distribution line for isolation of faulty section automatically and avoids complete isolation of distribution line during local faults.
- Conversion from LVDS to HVDS to minimize losses.

Process flow chart for improving reliability in distribution system



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Methodology for improving reliability in distribution system

Input Data

Feeder wise Demand Collection Balance Sheet:

The feeder wise DCB sheet contains Tariff wise Demand, Collection, Balance, Number of Installations and Energy consumed by each tariff category.

Consolidated DCB of 11Kv Feeder for the Period of One Year

Feeder Name

Sl No.	Tariff with Description	Number of installation	Consumption in units	Opening balance in Rupees	Demand in Rupees	Collection in Rupees	Closing balance	Average Revenue Realisation per unit in Rupees
1	LT-1 Bagyajyothi							
2	LT-2 Lighting and AEH							
3	LT-3 Commercial							
4	LT-4 IP Sets							
5	LT-5 LT Industries							
6	LT-6 Water supply							
7	LT-7 Temporary supply							
8	HT-HT Industries							
9	Total							

Feeder wise Interruption

The feeder wise Interruption contains the number of Scheduled and unscheduled Interruption and its duration in hours.

Statement Showing the details of Interruptions of 11Kv Urban Feeder for the Period of One Year

Feeder Name:

Scheduled interruption		Unscheduled interruption		Total interruption	
Numbers	Duration in hours	Numbers	Duration in hours	Numbers	Duration in hours

Scheduled interruption
= Hand trip + Line clear
Unscheduled interruption
= OCR trip + EFR trip + Main supply (Incomin supply to MUSS) failure

Feeder wise Energy Audit statement

Feeder wise Energy Audit statement contains the Input energy to the feeder, meter consumed and assessed unmetered energy consumed. The categories like IP set, street lights are not been metered so for, here assessed consumption is being taken for these category. Assessed Consumption on IP set is based on the pilot meter fixed to predominantly feeding to IP set distribution transformer. The Total Consumption in that transformer is divided by the number of IP set connected to this transformer gives the assessed consumption per each IP Installations.

The assessed consumption for streetlight is calculated by taking 360 units per kilowatt per month of connected load.

Analysis of Feeder wise Energy savings by Scheduled Interruption

- The fresh data has considered, hence the analysis has to be done on 12-months data.
- Here, the Total duration of the Scheduled Interruption in hours is available.
- The hourly average Consumption is calculated by

$$= \frac{\text{Total Input Energy for the period 12 months}}{24 \times \text{No. of days in 12 Months [i.e. 365 Days]}}$$

- This average hourly consumption multiplied by the duration of Scheduled Interruption thereby, we get the possible energy saving by reducing the Scheduled Interruption.
- The feeder wise proportionate consumption by the soft category like Domestic, commercial, Industrial and HT consumers is taken from the actual percentage of consumption from feeder wise DCB.
- The possible energy saving by minimising Scheduled interruption is allotted to these categories on above percentage.
- The Average rate of realization per unit of the above category is found out.

$$ARR = \frac{\text{Actual Demand by each category}}{\text{Actual Energy Accounted [Metered] by each category.}}$$

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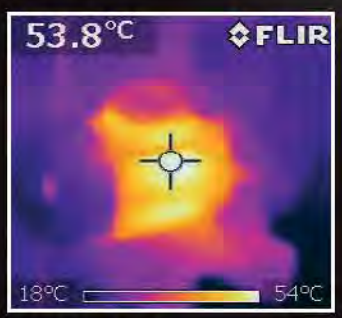
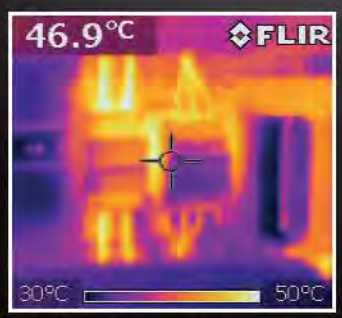


Engine Inspection



Overheated connection

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[Note: All the above category is 100% metered]

- The possible energy allotted to each category is multiplied by the ARR of each category. Thereby, we know the how much additional revenue would have generated by giving the saved energy through scheduled interruptions.
- The feeder wise energy savings and additional revenue generated by reducing Scheduled interruption is given below.

Peak Load and Consumption of 11Kv Feeders for the Period of One Year

Peak load		Energy consumption in units
MW	Amperes	

- According to Karnataka Electricity Regulatory Authority (KERC), the energy loss of all city feeders shall be less than 15% hence this base margin is being compared to all feeders.
- If the Feeder energy loss is more than 15%, then the difference between base margin and actual energy loss has been considered as the savable energy.

% of savable energy = {Actual % of energy 15% [Base Margin]}

- The Feeder wise proportionate consumption by the soft category like Domestic, commercial, industrial and HT consumers is taken from the actual percentage of consumption from feeder wise DCB.
- The savable percentage would be quantamised in terms energy units by multiplying % of savable energy by the input energy of that feeder.

Quantity of saved energy = % of savable energy X input energy.

- The average rate of realization per unit of the above category is found out.

ARR= Actual Demand by each category

Actual Energy Accounted [Metered] by Each category.

[Note: All the above category is 100% metered]

- The possible energy allotted to each category is multiplied by the

Calculation of energy savings by reducing Scheduled interruption				Feeder Name:
From January to December				
Scheduled Interruption in Nos.	Duration in Hours	Total input Energy in units	Average per Hour Consumption In units	Energy Saving by Reducing Scheduled Interruption in Units
1	2	3	4=3/8760	5=2X4

Tariff	Proportionate Allocation of Energy for High value Category	Energy Allocations	Average Rate of Realization	The Expected Cost in Rupees	The Total Expected Cost in Rupees
6	7	8=5x7	9	10=8x9	5
LT-2 (domestic)					
LT-3 (commercial)					
LT-5 (industrial)					
HT consumers					

Note:

- Input energy to this feeder is taken at the 66/11KV station end where it emanates.
- The consumption is taken for the period of one year.
- The proportionate consumption to the above tariff is made as per actual % age of consumption in this feeder.

Sl. No.	Name of the Feeder	Energy saved in Units	Additional Revenue Generated by allotting saved Energy to different tariff in Rs.
1			
2			

Analysis of Feeder wise Energy savings by Reducing Energy Loss

- The fresh data has considered, hence the analysis has to be done on 12-months data.
- Feeder wise peak load and energy consumption for the period of one year has to be considered.

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Pumps upto 150 HP	• Performance measurement up to 150 HP, 8" delivery pipe size for submersible and surface mounted pumps • Type testing and routine tests as per IS/ UL
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ARR of each category. Thereby, we know the how much additional revenue would have generated by giving the saved energy through reducing the energy loss.

- The Feeder wise energy savings and additional revenue generated by reducing energy loss is given below:

huge investment. But depending upon the average revenue realization per unit, the utility should give more attention to reduce the energy loss in lucrative area and materialize this loss in terms of money.

So Improvement of reliability of 11kV distribution system by carrying out improvement works is essential for both utility and consumer. ■

Calculation of energy savings by reducing energy loss to minimum level of 15% on 11kV feeder for the period of one year					
Feeder Name:					
Total input Energy in Units	Metered Energy in Units	Unmetered Energy in Units	Total Accounted Energy in Units	Percentage Energy loss	The savable Quantity of Energy in units
1	2	3	4=2+3	5=((1-4)/1) X100	6=(5-15%)x1

Tariff	Proportionate Allocation of Energy for High value Category	Energy Allocations	Average Rate of Realization	The Expected Cost in Rupees	The Total Expected Cost in Rupees
6	7	8=5x7	9	10=8x9	5
LT-2 (domestic)					
LT-3 (commercial)					
LT-5 (industrial)					
HT consumers					

Note:

- Input energy to this feeder is taken at the 66/11KV station end where it emanates.
- If the % age energy loss of the feeder is less than 15%, then the energy savings by reducing energy loss is zero.
- The proportionate consumption to the above tariff is made as per actual % age of consumption in this feeder.

Feeder wise Feasibility analysis of the work

Sl. No.	Name of the Feeder	Energy saved in Units	Additional Revenue Generated by allotting saved Energy to different tariff in Rs.
1			
2			

From the above table feeder wise cost benefit analysis and payback period has to be analysed.

Priority has to be given to low payback period and good cost benefit ratio feeders.

Conclusion

To improve the reliability of 11kV distribution system, it needs

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Dr. M. S. Shashikala, BE, MSc (Engg), PhD is currently Professor in the Department of E&EE, SJCE, Mysore. Her areas of research are Demand side management & Energy conservation. She has many publications in the area of Demand Side Management.

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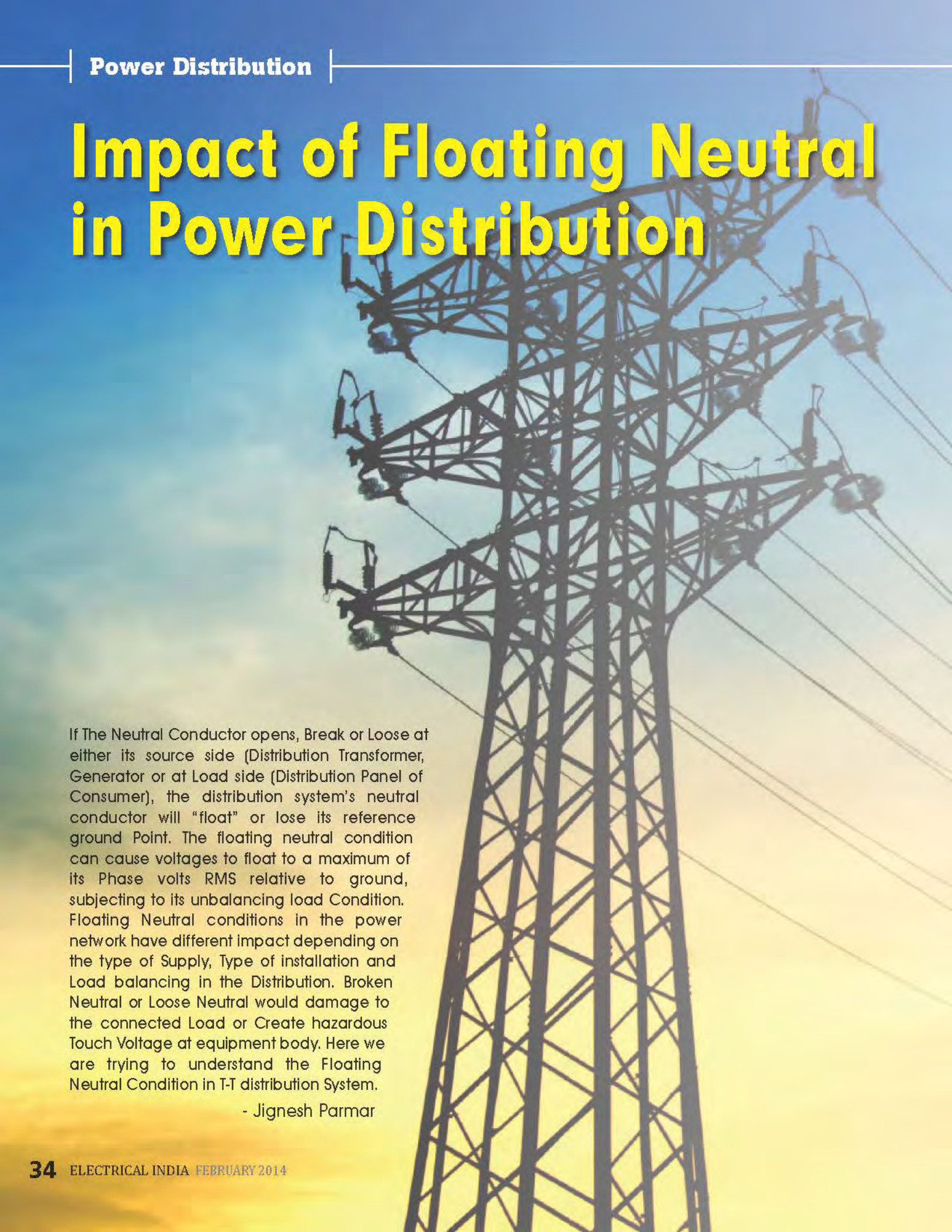
Impact of Floating Neutral in Power Distribution



If The Neutral Conductor opens, Break or Loose at either its source side (Distribution Transformer, Generator or at Load side (Distribution Panel of Consumer), the distribution system's neutral conductor will "float" or lose its reference ground Point. The floating neutral condition can cause voltages to float to a maximum of its Phase volts RMS relative to ground, subjecting to its unbalancing load Condition. Floating Neutral conditions in the power network have different impact depending on the type of Supply, Type of installation and Load balancing in the Distribution. Broken Neutral or Loose Neutral would damage to the connected Load or Create hazardous Touch Voltage at equipment body. Here we are trying to understand the Floating Neutral Condition in T-T distribution System.

- Jignesh Parmar

If the Star Point of Unbalanced Load is not joined to the Star Point of its Power Source (Distribution Transformer or Generator) then Phase voltage do not remain same across each phase but its vary according to the Unbalanced of the load.

As the Potential of such an isolated Star Point or Neutral Point is always changing and not fixed so it is called Floating Neutral.

Normal Power Condition & Floating Neutral Condition

Normal Power Condition

On 3-phase systems there is a tendency for the star-point and Phases to want to 'balance out' based on the ratio of leakage on each Phase to Earth. The star-point will remain close to 0V depending on the distribution of the load and subsequent leakage (higher load on a phase usually means higher leakage).

Three phase systems may or may not have a neutral wire. A neutral wire allows the three phase system to use a higher voltage while still supporting lower voltage single phase appliances. In high voltage distribution situations it is common not to have a neutral wire as the loads can simply be connected between phases (phase-phase connection).

3 Phase 3 Wire System

Three phases has properties that make it very desirable in electric power systems. Firstly the phase currents tend to cancel one another (summing to zero in the case of a linear balanced load). This makes it possible to eliminate the neutral conductor on some lines. Secondly power transfer into a linear balanced load is constant.

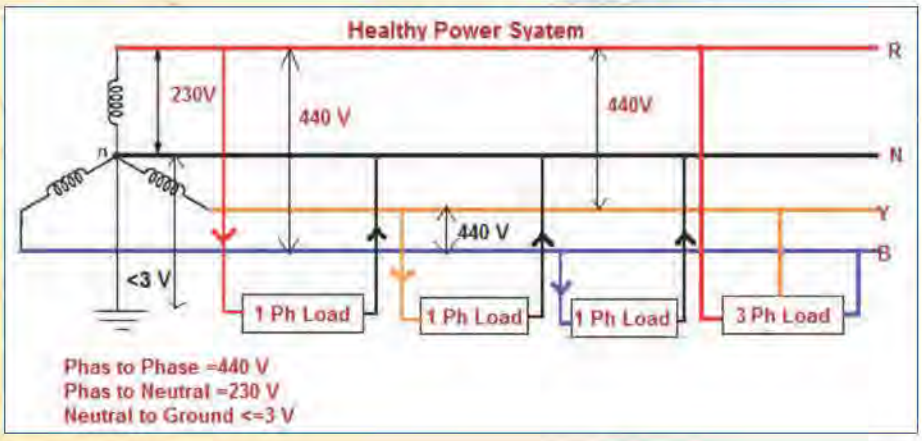
3 Phase 4 Wire System for Mix Load

Most domestic loads are single phase. Generally three phase power either does not enter domestic houses or it is split out at the main distribution board.

Kirchhoff's Current Law states that the signed sum of the currents entering a node is zero. If the neutral point is the node, then, in a balanced system, one phase matches the other two phases, resulting in no current through neutral. Any imbalance of Load will result in a current flow on neutral, so that the sum of zero is maintained. For instance, in a balanced system, current entering the neutral node from one Phase side is considered positive, and the current entering (actually leaving) the neutral node from the other side is considered negative.

This gets more complicated in three phase power, because now we have to consider phase angle, but the concept is exactly the same. If we are connected in Star connection with a neutral, then the neutral conductor will have zero current on it only if the three phases have the same current on each. If we do vector analysis on this, adding up $\sin(x)$, $\sin(x+120)$, and $\sin(x+240)$, we get zero. The same thing happens when we are delta connected, without a neutral, but then the imbalance occurs out in the distribution system, beyond the service transformers, because the distribution system is generally a Star Connected.

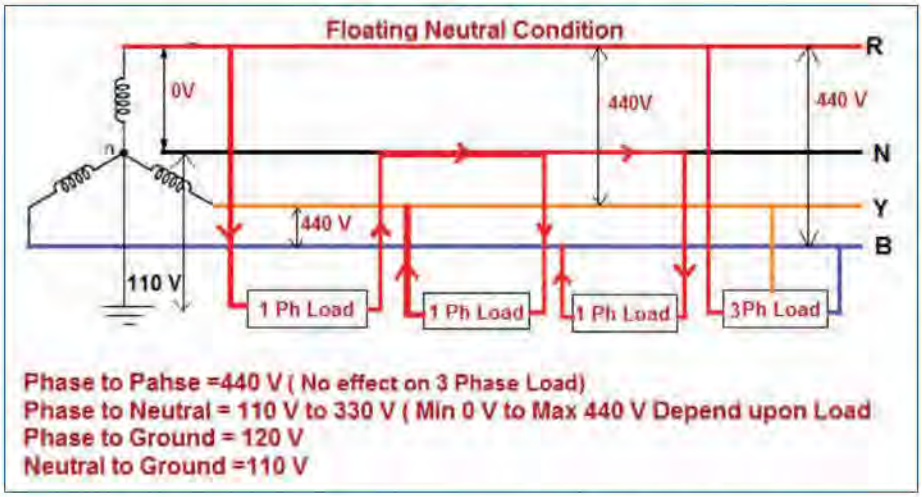
The neutral should never be connected to a ground except at the point at the service where the neutral is initially grounded (At Distribution Transformer). This can set up the ground as a path for current to travel back to the service. Any break in the ground path would then expose a voltage potential. Grounding the neutral in a 3 phase system helps stabilize phase voltages. A non-grounded neutral is sometimes referred to as a "floating neutral" and has a few limited applications.



Floating Neutral Condition

Power flows in and out of customers' premises from the distribution network, entering via the Phase and leaving via the neutral. If there is a break in the neutral return path electricity may then travel by a different path. Power flow entering in one Phase returns through remanning two phases. Neutral Point is not at ground Level but it Float up to Line Voltage. This situation can be very dangerous and customers may suffer serious electric shocks if they touch something where electricity is present.

Broken neutrals can be difficult to detect and in some instances may not be easily identified. Sometimes broken neutrals can be indicated by flickering lights or tingling taps. If you have flickering lights or tingly taps in your home, you may be at risk of serious injury or even death.



Voltage Measurement between Neutral to Ground

A rule-of-thumb used by many in the industry is that Neutral to ground voltage of 2V or less at the receptacle is okay, while a few volts or more indicates overloading; 5V is seen as the upper limit.

Low Reading: If Neutral to ground voltage is low at the receptacle than system is healthy, If It is high, then you still have to determine if the problem is mainly at the branch circuit level, or mainly at the panel level. Neutral to ground voltage exists because of the IR drop of the current travelling through the neutral back to the Neutral to ground bond. If the system is correctly wired, there should be no Neutral to Ground bond except at the source transformer (at what the NEC calls the source of the Separately Derived System, or SDS, which is usually a transformer). Under this situation, the ground conductor should have virtually no current and therefore no IR drop on it. In effect, the ground wire is available as a long test lead back to the Neutral to ground bond.

High Reading: A high reading could indicate a shared branch neutral, i.e., a neutral shared between more than one branch circuits. This shared neutral simply increases the opportunities for overloading as well as for one circuit to affect another.

Zero Reading: A certain amount of Neutral to ground voltage is normal in a loaded circuit. If the reading is stable at close to 0V. There is a suspect an illegal Neutral to ground bond in the receptacle (often due to lose strands of the neutral touching some ground point) or at the subpanel. Any Neutral to ground bonds other than those at the transformer source (and/or main panel) should be removed to prevent return currents flowing through the ground conductors.

Various Factors which cause Neutral Floating

There are several factors which are identifying as the cause of neutral floating. The impact of Floating Neutral is depend on the position where Neutral is broken.

At The Three Phase Distribution Transformer

Neutral failure at transformer is mostly failure of Neutral bushing.

The use of Line Tap on transformer bushing is identified as the main cause of Neutral conductor failure at transformer bushing. The Nut on Line Tap gets loose with time due to vibration and temperature difference resulting in hot connection. The conductor start melting and resulting broke off Neutral. Poor workmanship of Installation and technical staff also one of the reasons of Neutral Failure.

A broken Neutral on Three phases Transformer will cause the voltage float up to line voltage depending upon the load balancing of the system. This type of Neutral Floating may damage the customer equipment connected to the Supply.

Under normal condition current flow from Phase to Load to Load to back to the source (Distribution Transformer). When Neutral is broken current from Red Phase will go back to Blue or Yellow phase resulting Line to Line voltage between Loads. Some customer will experience over voltage while some will experience Low voltage.

Broken Overhead Neutral conductor in LV Line

The impact of broken overhead Neutral conductor at LV overhead distribution will be similar to the broken at transformer. Supply voltage floating up to Line voltage instead of phase Voltage. This type of fault condition may damage customer equipment connected to the supply.

Broken of Service Neutral Conductor

A broken Neutral of service conductor will only result of loss of supply at the customer point. No any damages to customer equipments.

High Earthing Resistance of Neutral at Distribution Transformer

Good Earthing Resistance of Earth Pit of Neutral provide low resistance path for neutral current to drain in earth. High Earthing Resistance may provide high resistance Path for grounding of Neutral at Distribution Transformer. Limit earth resistance sufficiently low to permit adequate fault current for the operation of protective devices in time and to reduce neutral shifting.

Over Loading & Load Unbalancing

Distribution Network Overloading combined with poor load distribution is one of the most reason of Neutral failure. Neutral should be properly designed so that minimum current will be flow in to

neutral conductor. Theoretically the current flow in the Neutral is supposed to be zero because of cancellation due to 120 degree phase displacement of phase current.

IN= IR<0 + IY<120 + IB<-120.

In Overloaded Unbalancing Network lot of current will flow in Neutral which break Neutral at its weakest Point.

Shared neutrals

Some buildings are wired so that two or three phases share a single neutral. The original idea was to duplicate on the branch circuit level the four wire (three phases and a neutral) wiring of panel boards. Theoretically, only the unbalanced current will return on the neutral. This allows one neutral to do the work for three phases. This wiring shortcut quickly became a dead-end with the growth of single-phase non-linear loads. The problem is that of zero sequence current.

From nonlinear loads, primarily third harmonic, will add up arithmetically and return on the neutral. In addition to being a potential safety problem because of overheating of an undersized neutral, the extra neutral current creates a higher Neutral to ground voltage. This Neutral to ground voltage subtracts from the Line to Neutral voltage available to the load. If you're starting to feel that shared neutrals are one of the worst ideas that ever got translated to copper.

Poor workmanship & Maintenance

Normally LV network are mostly not given attention by the Maintenance Staff. Loose or inadequate tightening of Neutral conductor will effect on continuity of Neutral which may cause floating of Neutral.

How to detect Floating Neutral Condition in Panel:

Transformer Secondary is star connected, Phase to neutral = 240V and Phase to phase = 440V.

Condition (1): Neutral is not Floating

Whether the Neutral is grounded the voltages remain the same 240V between phase & Neutral and 440V between phases. The Neutral is not Floating.

Condition (2): Neutral is floating

All Appliances are connected: If the Neutral wire for a circuit becomes disconnected from the household's main power supply panel while the Phase wire for the circuit still remains connected to the panel and the circuit has appliances plugged into the socket outlets. In that situation, if you put a voltage Tester with a neon lamp onto the Neutral wire it will glow just as if it was Live, because it is being fed with a very small current coming from the Phase supply via the plugged-in appliance(s) to the Neutral wire.

All Appliances are Disconnected: If you unplug all appliances, lights and whatever else may be connected to the circuit, Neutral will no longer seem to be Live because there is no longer any path from it to Phase supply.

Phase to Phase Voltage: The meter indicates 440V AC.

Phase to Neutral Voltage: The meter indicates 110V AC to 330V AC.

Neutral to Ground Voltage: The meter indicates 110V.

Phase to Ground Voltage: The meter indicates 120V.

This is because the neutral is "floats" above ground potential (110V + 120V = 230VAC). As a result the output is isolated from system ground and the full output of 230V is referenced between line and neutral with no ground connection.

If suddenly disconnect the Neutral from the transformer Neutral but kept the loading circuits as they are, Then Load side Neutral becomes Floating since the equipment that are connected between Phase to Neutral will become between Phase to Phase (R to Y,Y to B), and since they are not of the same ratings, the artificial resulting neutral will be floating, such that the voltages present at the different equipments will no longer be 240V but somewhere between 0 (not exactly) and the 440 V (also not exactly). Meaning that on one line Phase to Phase, some will have less than 240V and some will have higher up to near 415. All depends on the impedance of each connected item.

In an unbalance system, if the neutral is disconnected from the source, the neutral becomes floating neutral and it is shifted to a position so that it is closer to the phase with higher loads and away from the phase with smaller load. Let us assume an unbalance 3 phase system has 3 KW load in R-phase, 2 KW load in Y-phase and 1 KW load in B-phase. If the neutral of this system is disconnected from the main, the floating neutral will be closer to R-phase and away from B-phase. So, the loads with B-phase will experience more voltage than usual, while the loads in R-phase will experience less voltage. Loads in Y-phase will experience almost same voltage. The neutral disconnect for an unbalanced system is dangerous to the loads. Because of the higher or lower voltages, the equipment is most likely to be damaged. Here we observe that Neutral Floating condition does not impact on 3 Phase Load but It impacts only 1 Phase Load only.

How to Eliminate Neutral Floating

Some Point needs to be considered to prevent of Neutral Floating.

Use 4 Pole Breaker/ELCB/RCBO in Distribution Panel

A floating neutral can be a serious problem. Suppose we have a breaker panel with 3 Pole Breaker for Three Phase and Bus bar for Neutral for 3 Phase inputs and a neutral (Here we have not used 4 Pole Breaker). The voltage between each Phase is 440 and the voltage between each Phase and the neutral is 230. We have single breakers feeding loads that require 230Volts. These 230Volt loads have one line fed by the breaker and a neutral. Now suppose the Neutral gets loose or oxidized or somehow disconnected in the panel or maybe even out where the power comes from. The 440Volt loads will be unaffected however the 230V loads can be in serious trouble. With this Floating neutral condition you will discover that one of the two lines will go from 230Volts up to 340 or 350 and the other line will go down to 110 or 120 volts. Half of your 230Volt equipment will go up in high due to overvoltage and the other half will not function due to a low voltage condition. So, be careful with floating neutrals. Simply use ELCB, RCBO or 4 Pole Circuit Breaker as income in the 3ph supply system since if neutral opens it will trip the complete supply without damaging to the system.

Using Voltage Stabilizer

Whenever neutral fails in three phase system, the connected loads will get connected between phases owing to floating neutral. Hence depending on load resistance across these phases, the voltage keeps varying between 230V to 400V.A suitable servo stabilizer with wide input voltage range with high & low cutoff may help in protecting the equipments.

Good workmanship & Maintenance

Give higher Priority on Maintenance of LV network. Tight or apply adequate Torque for tightening of Neutral conductor in LV system.

Conclusion

A Floating Neutral (Disconnected Neutral) fault condition is VERY UNSAFE because If Appliance is not working and someone who does not know about the Neutral Floating could easily touch the Neutral wire to find out why appliances does not work when they are plugged into a circuit and get a bad shock. Single phase Appliances are design to work its normal Phase Voltage when they get Line Voltage Appliances may Damage. Disconnected Neutral fault is a very unsafe condition and should be corrected at the earliest possible by troubleshooting of the exact wires to check and then connect properly. ■

Jignesh Parmar has completed his BE(Electrical) from Gujarat University. He has more than 11 years experience in Power Transmission-Power Distribution-Electrical energy theft detection-Electrical Maintenance-Electrical Projects (Planning-Designing-coordination-Execution). He is Presently associate with one of the leading business group as a Assistant Manager at Ahmedabad. He is Freelancer Programmer of Advance Excel and design useful Excel Sheets of Electrical Engineering as per IS, NEC, IEC, IEEE codes. He has published numbers of technical papers in various journals.He is regular technical Blogger.

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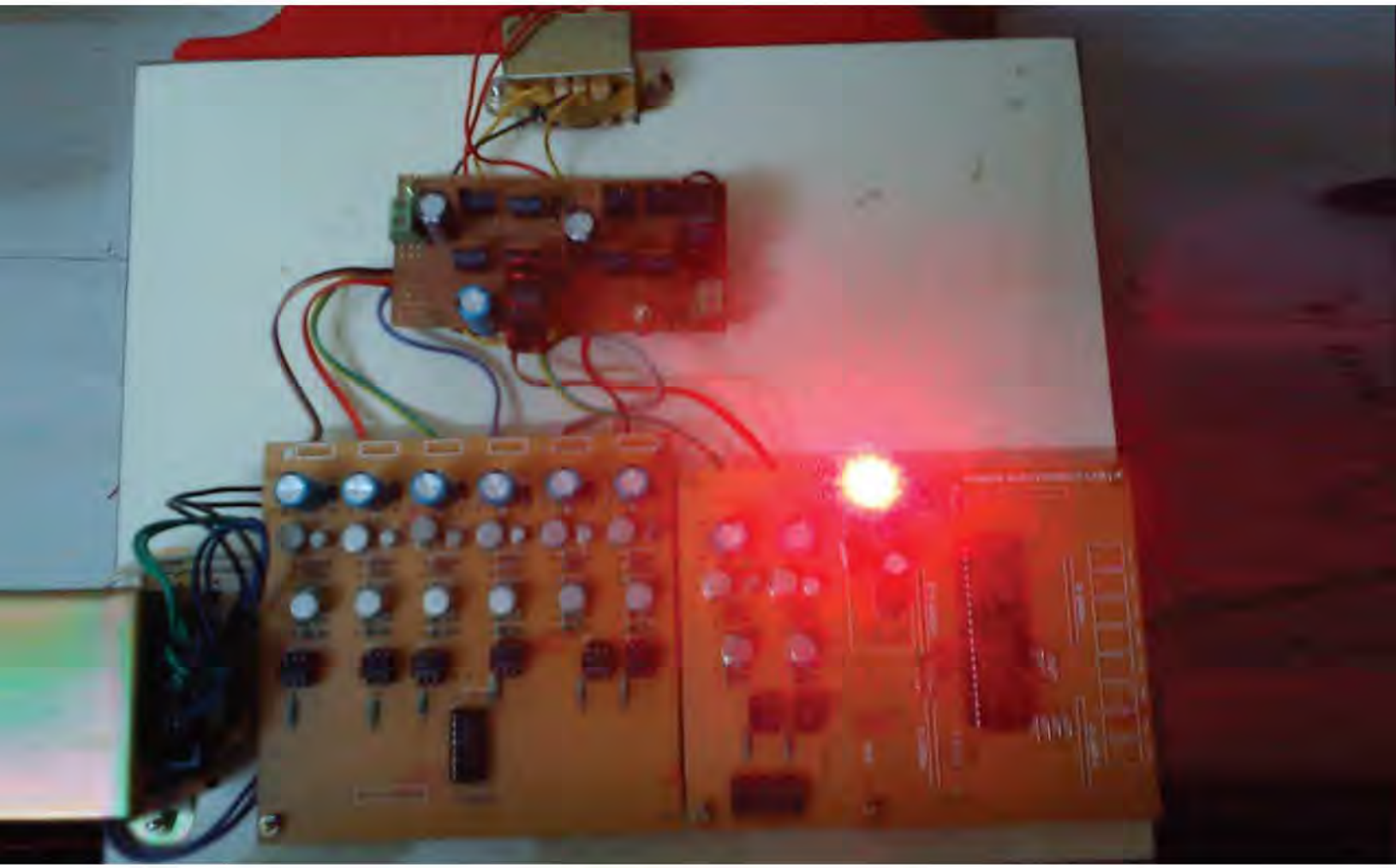

Recently, energy sources such as wind power system, photovoltaic cells, and fuel cells have been extensively studied in response to global warming and environmental issues. A grid interconnection converter using an isolation transformer is preferable for power grid distribution systems in terms of surge protection and noise reduction. In addition, size reduction and high efficiency are essential requirements. One of the problems in the fuel cell system is that lifetime is decreased by the ripple current. Therefore, in order to extend the lifetime, the fuel cell ripple current must be reduced in the grid interconnection converter. However, when a single-phase pulsewidth-modulated (PWM) inverter is used for grid connection system, the power ripple is twice the frequency of the power grid. Therefore, in conventional grid connection inverters, large electrolytic capacitors are connected in parallel to the fuel cell in order to reduce the current ripple. However, the use of large-sized electrolytic capacitors increases both the device volume and cost. In order to reduce the current ripple in the fuel cell, some approaches use high-speed current control. This method incorporates a current-loop control within the existing DC–DC converter voltage loop. However, a large capacitor or reactor is required as an energy buffer. Other approaches have been proposed that do not require the use of large-sized electrolytic capacitors,an active filter is applied in the DC-Link part. The DC active filter consists of a small capacitor as an energy buffer, a reactor to reduce the switching ripple, and a DC chopper. The DC chopper injects the ripple current to avoid a power ripple capacitance

Design of Ripple free DC Source for a Single Phase Isolated converter using active filter

A ripple current reduction method is proposed, that does not require additional switching devices. A current ripple that has twice the frequency component of the power supply is generated in the DC part when a single-phase pulse width modulated inverter is used for a grid connection. The current ripple causes shortening of the lifetime of electrolytic capacitors, batteries, and fuel cells. The proposed circuit realizes a DC active filter function without increasing the number of switching devices, because the energy buffer capacitor is connected to the center tap of the isolation transformer. In addition, the buffer capacitor voltage is controlled by the common-mode voltage of the inverter. The features of the proposed circuit, control strategy, and experimental results are described, including the result of ripple reduction, to approximately 20% that of the conventional circuit.

- A Sandhiya M E & Dr Peer Fathima

can be lower, because the terminal voltage of the capacitor can be varied over a wide range. How- ever, the number of the switching devices is increased, requiring a high-cost DC chopper and resulting in a large volume device. Other configurations of DC active filters have similar problems. This article proposes a new circuit topology including a DC active filter function without extra switching devices. The proposed circuit consists of an isolated DC/DC converter and interconnection inverter, and achieves the DC active filter function using the center tap of the isolation transformer. One feature of the proposed converter is that the primary-side inverter in the DC/DC converter is individually controlled by the common-mode voltage and the differential voltage. The ripple current is suppressed by the common-mode voltage control of the DC/DC converter, and the main power flow is controlled by the differential mode voltage.

Conventional and proposed circuit topologies with the principle of current ripple suppression are first introduced. The control method of the proposed circuit is then described. In addition, the design of the energy buffer capacitor and transformer by which the maximum power ripple can be accepted is indicated. Furthermore, experimental results are presented in order to confirm the validity of the proposed circuit.

Proposed circuit configuration

Fig. 1 shows the proposed circuit, which combines the first stage inverter and DC active filter functions. The energy buffer

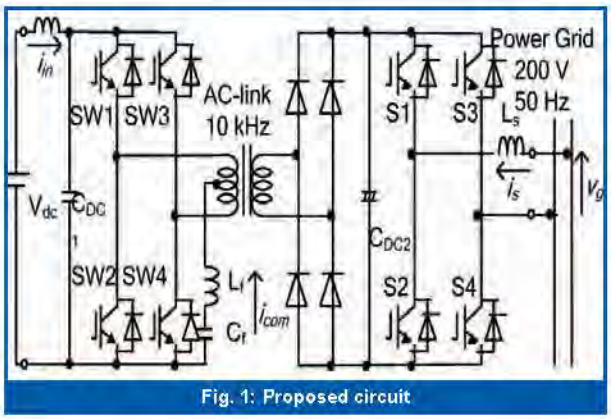

Fig. 1: Proposed circuit

capacitor Cf is connected to the center tap of a medium- frequency transformer. The zero vector of the full-bridge first- stage inverter is used to control the center tap potential voltage. In addition, the leakage inductance of the transformer is used to suppress the switching current in addition to the boost reactor Lf. If the leakage inductance is large enough, then the boost reactor is not required.

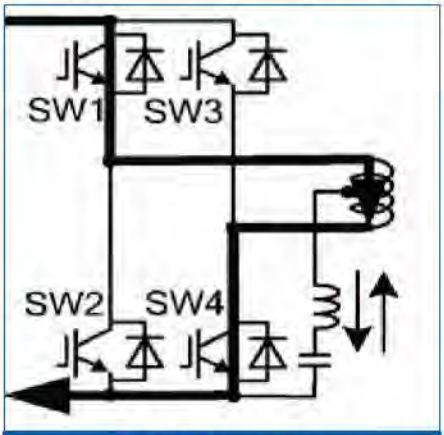

Fig. 2: Differential mode

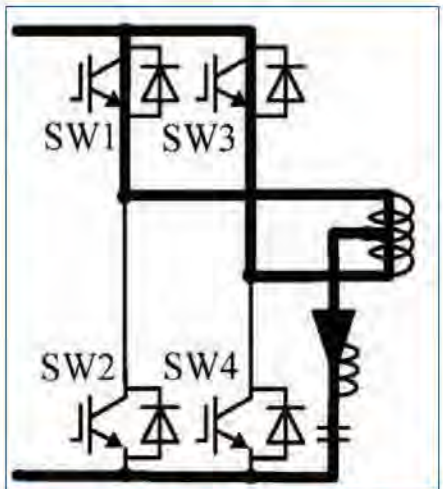

Fig. 3: Common mode

Switching pattern generation

Fig. 2 illustrates the two switching modes of the first-stage inverter in the proposed circuit. In the differential mode, the terminal voltage of the transformer is controlled, as shown in Fig 2 In the common mode, the center tap voltage is controlled, as shown in Fig. 3. When the differential mode is selected, the power transfers to the secondary side. When the capacitor voltage is greater than half of the DC voltage, the buffer capacitor is charged.

When the capacitor voltage is less than half of the DC voltage, the buffer capacitor is discharged. The inverter outputs the zero voltage vectors (00 and 11 are two) in common-mode operation. When the zero voltage vectors are selected, the line- to-line voltage of the transformer is zero. However, the center tap voltage is either VDC or zero, depending on the zero vectors. Thus, by controlling the ratio of the zero vectors, the buffer capacitor can be charged or discharged. The differential-mode current increases when the common-mode voltage increases, because the power transmission period is reduced by the common-mode voltage. Therefore, a large common mode voltage causes a large current in the transformer.

Transformer current consists of the common-mode current, which is the buffer current, and the differential-mode current. The common-mode current increases while S1 and S2 are turned on, and decreases during differential mode, because the capacitor voltage is greater than half of the DC voltage.

Principle of Operation

In order to suppress the ripple current of the DC source, all the current ripples are provided by the energy buffer capacitor. Therefore, the capacitor Current is obtained by

Calculating the power ripple. The capacitor current Icom in the active buffer is controlled by a proportional integral (PI) regulator to agree with the capacitor current Icom, and the DC active filter voltage vcom is output by the PI regulator. In order to obtain the maximum terminal voltage of the trans-former, the differential-mode voltage v is set maximum value. However, the output period of the common-mode voltage is limited by the output period of the differential mode, i.e., the duty ratio Ddif for the differential mode can be constrained by where Dco m is the duty ratio for the common-mode voltage.

$$Ddif + Dco\,m = 1$$

The energy buffer capacitor Cf is connected to the center tap of a medium frequency transformer. The transformer current Itran is equaled to the sum of the active filter current Icom and the current Idif, according to the output power shown in

$$^{I}Tran = {}^{I}Tran + Icom/2$$

The common-mode voltage controls the capacitor voltage variation, and the differential-mode voltage controls the transformer current.

Single-Phase Pwm Full-Bridge Inverter and DC Active Filter Function

As the capacitor voltage variation increases smaller active filter capacitor Cf can be achieved. However, as the capacitor voltage variation becomes larger, it results in a system that requires a large current capacity transformer.

The auxiliary inductor is connected to the center tap of the transformer,

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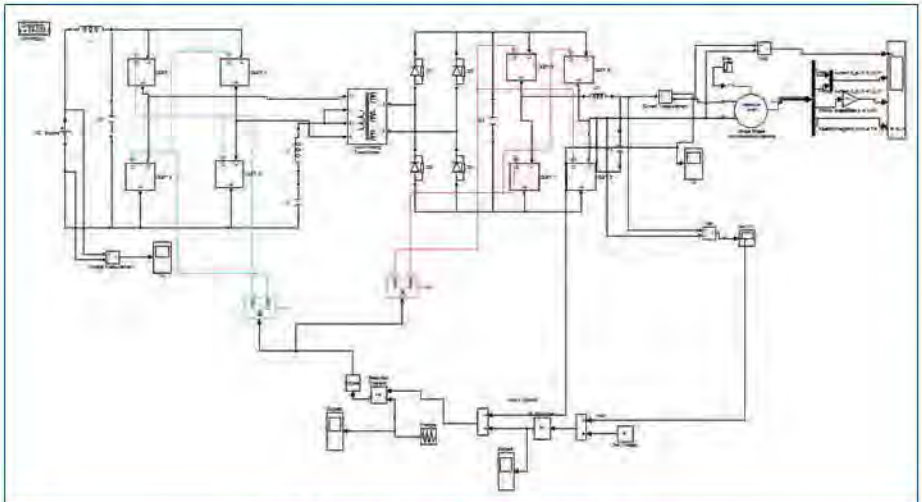

Fig. 4: Simulink model of proposed circuit

because the leakage inductance of the transformer is not sufficient to reduce the switching ripple current. A sinusoidal grid current waveform and unity power factor are obtained; however, the DC input current has a large ripple current component of 100 Hz.

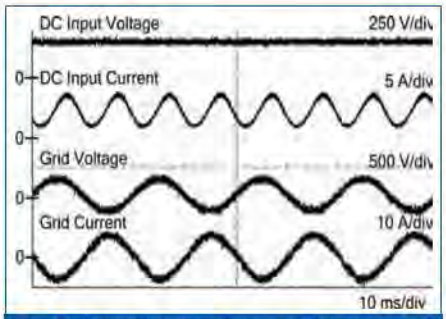

Fig. 5: Operation waveforms of the proposed circuit

The ripple of the DC input current is suppressed to 20% that of the conventional circuit, which indicates that the DC active filter function is effective. The grid current waveform maintains the sinusoidal waveform and unity power factor. The major harmonic component in the input current is 100 Hz. In a conventional circuit, the DC input current THD increases according to the increment of the output power.

In contrast, the DC input current THD decreases despite the increment of the output power in the proposed circuit, i.e., the proposed circuit is suitable for high-power applications, due to its effectiveness in the high-output power region. One of the reasons for the increase in power loss is the increasing current in the transformer.

Therefore, the efficiency of the proposed circuit can be improved if the design of the transformer is optimized. Note that the proposed converter has good performance as a grid interconnection converter, because both power factors of the proposed circuit and the conventional circuit are 99%.

Experimental results

The experimental results confirm that the proposed converter is valid for the reduction of the DC input ripple current in a DC power supply, without the need for large electrolytic capacitors. The ripple current is suppressed by the common-mode voltage control of the DC/DC converter, and the main power flow is controlled by the differential-mode voltage. The following Fig. 6 shows the gating signals for each IGBT at 50Hz fundamental frequency.

Simulation results predict waveforms across input and the load side The proposed circuit was designed with filter elements connected in DC side. Trigerring pulse was generated using PWM technique by comparing reference and carrier signal shown herein.

DC input to the first stage inverter results an alternating output signal. Its again given to isolation transformer. The diode rectifier given back DC to main circuit which supplies output power to load or any type of grid arrangement.

Single-phase full-bridge DC–AC inverter circuit that has been used in the study. The inverter is implemented with a sinusoidal pulse width modulation (PWM) method at 20kHz switching to ensure a clean output voltage. With a linear load, the output current has the same 50Hz frequency and sinusoidal wave shape as the output voltage. The inverter input voltage and current are DC, but the current contains high frequency switching noises and a low frequency ripple component. The ripple component is considered the rectification effect through the inverter switches, and thus it appears to be a 100 Hz pulsating current.

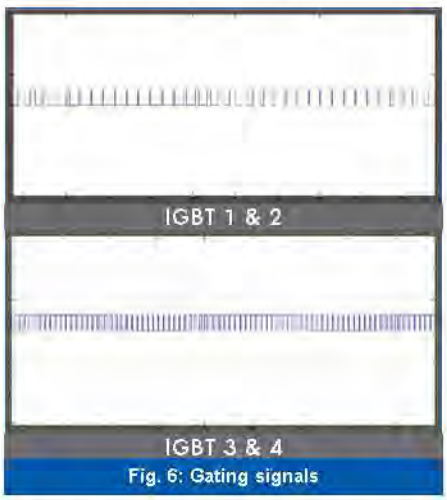

Fig. 6: Gating signals

The PWM switching noise is filtered with a high-frequency DC bus capacitor,, but the energy of the 100 Hz ripple is too high to be absorbed. A bulky DC bus capacitor can then be used to smooth the 100-Hz ripple, but a significant part of

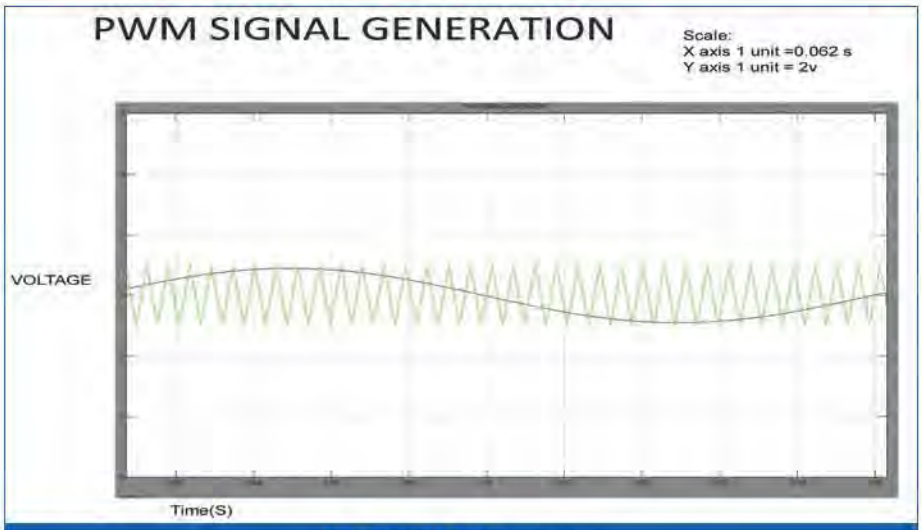

Fig. 7: PWM Signal generation

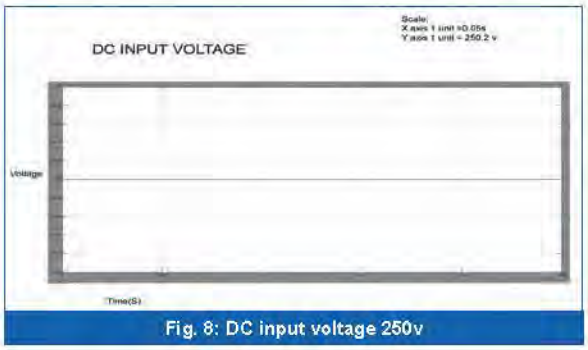

Fig. 8: DC input voltage 250v

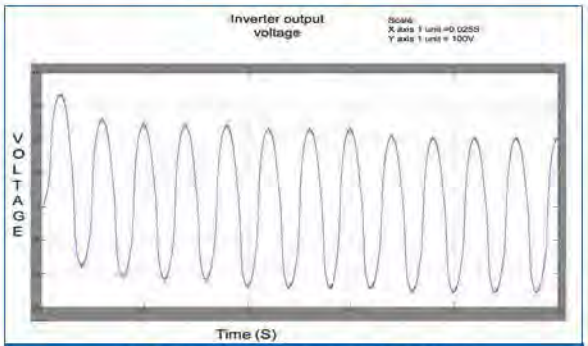

Fig. 9: Inverter AC output voltage 400 v

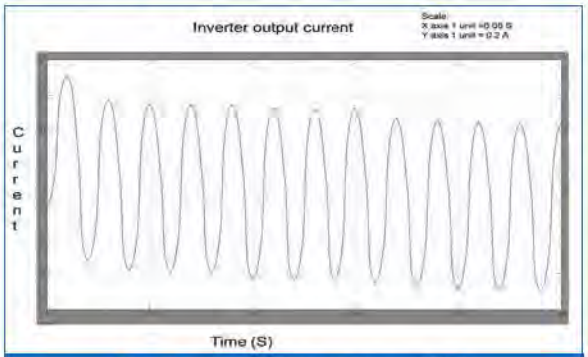

Fig. 10: Inverter AC output current 0.8 A

the 100-Hz ripple remains and continues to propagate through the entire DC–DC converter and back to the DC source. Therefore, the configuration is often referred to as an active parallel filter. It illustrates the concept of the harmonic current cancellation so that the current being supplied from the source is sinusoidal.

The voltage source inverter used in the active filter makes the harmonic control possible. This inverter uses DC capacitors as the supply and can switch at a high frequency to generate a signal which will cancel the harmonics from the nonlinear load.

Conclusion

A novel single-phase isolated converter was proposed for grid interconnection applications. The ripple current in a DC power supply, such as a fuel cell, battery, or photovoltaic cell, can be reduced by the appropriate operation of a DC active filter.

The main feature of the proposed circuit is that it does not require additional switching devices, because the zero vector of the first-stage inverter is controlled as the DC active filter.

A 1-kW prototype was constructed based on the proposed circuit, and the following experimental results were obtained.

- The ripple current can be decreased to 20% that of the conventional circuit.
- The proposed circuit shows a degree of effectiveness for high output power applications.
- The total electrolytic capacitor requirement of the system is decreased to 25% that of the conventional circuit.
- The DC active filter operation in the proposed method circuit does not interfere with the grid interconnection current control.

In future work, optimization of the transformer and construction of a high-power prototype will be undertaken. ■

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A Sandhiya, ME, Power Electronics and Drives is currently working as a assistant professor in SRM University, Chennai.

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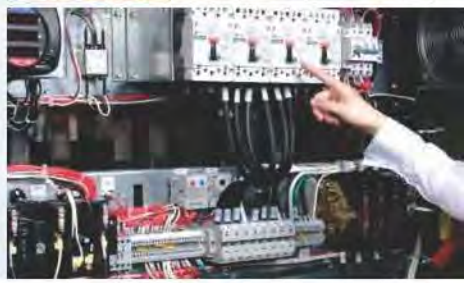

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"Launched a comprehensive suite of Miniature Circuit Breakers"

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Legrand is the global specialist in the electrical & digital building infrastructure. Be it residential, commercial or industrial, Legrand proposes a complete solution for every project. Legrand is a Euro 4.5 bn group based in Limoges, France, The group has manufacturing facilities in 60 countries and its products are sold in over 180 countries. Legrand India offers a wide range of products in the categories of Energy distribution, Wiring devices, Home Automation, Structured Cabling, Lighting Management Solutions, Cable Management and Industrial application products. It is an undisputed leader in MCBs, RCDs and DBs and a strong No. 2 in wiring devices Apart from this, the company also holds a remarkable position in Home Automation, MCCBs and Cable management systems. In an exclusive interview with **Electrical India, Sameer Saxena** says, The Legrand Group has grown both organically and inorganically in India. We are extremely bullish on India.

You have been working in Legrand for many years. What is the market structure in India?

The market which we address is basically low voltage switch gear. This market starts from the switch which is in what we call as the final stage of the distribution and is backwardly integrated with circuit breakers. So we have the entire range.

So yes, we do have a good product range. We have the maximum number of products in this range compared to the competition and enjoy a leadership position in the market. In addition to this we are present in home automation systems.

What according to you is the scope for the Electrical Industry in India?

From the point of view of pure potential, it is immense. Till recently this industry was growing in double digits in percentage terms. In the last two to three years though

the growth has been in single digits. We expect 2014 to be a good year where we expect the industry to grow further and we are confident that all the players will participate in this growth.

What product ranges are you providing to the Indian market?

We have a whole range of products like circuit breakers, low voltage circuit breakers, MCCBs, air circuit breakers and an entire product basket for our wire and devices business. We have home systems for the residential market. Legrand in India operates in the residential, commercial, hospitality, industrial and infrastructure segments. Our sales team has strength of around 900 catering to the pan India market. And it is not that we are only growing in metros or the urban areas for we are also expanding well into the Tier II and Tier III towns. The range of products is good and in two or three categories we are leaders in the market. In circuit breakers we are the market leaders, for wiring devices we are positioned at No. 2.

One of the key philosophies of the Legrand is focusing on R&D initiatives. Legrand is investing around 5% of its revenues in R&D. The new innovations are the outcome of our R&D and so it really helps us to bring in new trends and products into the market. Being the market leader it is our duty to expand the market and make the customers aware about new technologies. The new technologies we bring in are not in terms of just basic technical products but also in terms of products for installation and safety. Most of our products are ISO compliant and are easily available.

Are you planning to come out with new products in the market?

Yes! In Elecrama 2014 we have just launched a comprehensive suite of Miniature Circuit Breakers called DX3. It has 22 ground-breaking patents and shows Legrand's commitment to provide quality energy distribution and power solutions. Through this we are sure we will achieve the trust of our customers like we have done in the past. We are determined to come out with modern & technical solutions which will cater to the market of the future. We are confident of securing a good response for these.

What new solutions have you got for the industrial department?

These solutions are used across industries but the applications are different for different segments like residential and hospitality. We have the sales team to aid people to understand the entire gamut of products and their applications. We have a strong team of engineers who work with the consultants and managers to understand their needs and advice them on how the products are suitable for specific applications. Similarly for the industrial range, downtime is very essential and our products are tailored accordingly. We do understand the process, the customers and their requirements. This has prompted us to move to a solutions oriented approach from a product oriented one. We package our products to give an exhaustive range of solutions. We also believe in partnership models. So we have system integrators, contractors and panel readers in place to bundle these products and offer specific solutions to customers.

What solutions does your company provide to the remote part of the country?

This year we are poised to grow aggressively in the rural market. We are adapting to new technologies and integrating them with our offerings consistently. We feel that while these markets may not necessarily need the latest technology they have certainly evolved over time. Sometimes it may not be the complex product\ solution that they are looking at but our suite of products which help with the basic safety and security aspects. We feel very proud that the customers are responding enthusiastically to such products and accepting them.

Can you mention some of the major projects that you all have done so far?

There are many we have collaborated with over the years. In the hospitality sector for instance, we have worked with The Taj, ITC, Sheraton and Marriot groups. As you can see, these projects have been in the premium segment. It's not only that we provide them with one product but an entire assemblage of MCBs, home automation, lighting management solutions and wiring devices. etc.

What are you views on the power supply in India?

I think its improving and we need to be optimistic about it especially with the government supporting this sector. Things have been moving in the right direction over the last few years. I think, with the government as a firm supporter, many players including us are moving in the right direction. In the future we can definitely see power output in the country improving in terms of both quantity and quality.

What challenges and role did you face while handling the three individual departments as you are in marketing?

I have been associated with the

Legrand brand for the last four years. It has been a pleasure as well as a challenge. Legrand is an extremely credible brand and the challenge has been live up to the expectations of the customers. What has helped is a 360 degree process to meet the customers' requirements. This entails investing in research and development to come out with innovative products, and the willingness to learn from our mistakes.

I think Legrand has been doing very well with the customers in the last 15 years or so and we are hopeful that this will continue in the future.

What about the updation of the new technology in the Indian facilities?

We get huge support from the group's R&D initiatives but we have also put in place people in India to create products. This gives us the twin advantage of being able to leverage the group's global R &D efforts but at the same time create products & solutions keeping Indian sensibilities in mind.

Could you share something about Channel Partners and expansion geographically?

I think Legrand has one of the best channel partner programmes in the industry. A testimony to this is its network of around 900 distributors and channel partners. They are the key to market access as our products flow from the distributor to panel builder\contractor or retailer and then to the end customer. I think we are fortunate to have a pan India presence and a good loyal set of distributors who really value their partnership with Legrand.

We expand in two ways –one is geographic and the other is by increasing the number of products. From the product perspective we will be definitely increasing the number of products in our home systems range. Also like I said earlier, we will be focusing on the Tier II and Tier III towns and cities.

To bring your product in the market what marketing strategies do you adhere to?

We start it by listening to the customers and understand them through a largely structured process. We get valuable inputs on how products are being used and how the contractors & electricians perceive our products.

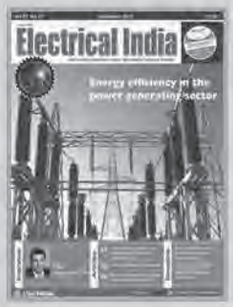
We take these inputs to our laboratories and see what can be done. The other aspect is to keep in pace tact with the technological trends. We focus on making simple products which are more readily accepted by our customers. This is challenging as it is actually simpler to make complex products which however do not find ready acceptance in the market. Once we have a product we ensure that it is quickly available to customers. And this is how we have built a loyal portfolio of customers like the Tata Group over the years.

How would you compare Legrand India with other countries?

Legrand's commitment to India is very strong. We are a good support to the group from the business perspective. The Legrand Group has grown both organically and inorganically in India. We are extremely bullish on India. We believe that the Indian economy will weather the present slowdown and will do well in the long term. India is an important component of the Legrand Group's focus on new economies.

What do you anticipate from Elecrama 2014?\How has the participation ion Elecrama 2014 helped you ?

It has been held for the first time in Bangalore. Earlier, it used to be Bombay but we have been pretty excited about our participation this year. We are sure that some of the insights that we have gained here will contribute to Legrand's overall success in India. ■



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- P S Shah

Safe Practices in Electrical Installations

Many people either get injured or die due to electrocution, electrical fire and due to suffocation or inhalation of obnoxious gas emission during fire. The safe practices must be followed during all the three stages of an electrical installation namely design, installation, operation & maintenance. I shall try to enumerate some aspects for each of these phases in brief as under. These are not exhaustive but illustrative.

Design

It is said the best safety device is the knowledge. Always entrust your electrical design work to a well qualified and experienced person. In case of simple installation an electrician may be deployed, but if the installation is sizable and the power requirement is high, it is advisable to take help of an electrical engineer or a consultant.

Always specify your requirements as a user, to the design person properly. If the input is wrong or insufficient, the output may also be wrong. This may defeat the very

purpose of deploying an expert. Always insist on use of BIS certified electrical goods and procure the same from an authorized as well as reputed vendor. Sometime, the duplicate or spurious goods may not perform the desired task for which they are deployed. If the ELCB or RCCB may not operate when required, the consequences may be disastrous. So take the help of experts and follow it.

Always plan for a couple of extra lighting point socket outlets. This will prevent the use of multi appliances from a single socket and thus possible overloading, heating and flashovers or fires.

The proper selection of protective devices such as circuit breakers, fuses, relays, MCBs etc is an essential prerequisite of a safe electrical installation. This is the prime responsibility of the electrical system designer. The higher the usage and power rating of the system, the higher is the care required. In case the expansion of the electrical system is planned at a later stage, the provision of some of the requirements of future growth may be planned well in advance, but the system should work safely for the present loading. Some such practices are use of higher size fuse base and carrier with lower rating fuse links, or lower settings of protective relays.

Always plan for a power point socket outlets, typically 15 Ampere in each of the room in case of houses and offices. This will prevent the use of high power appliances from a lighting socket which is typically of 5 Ampere rated and thus prevent the possible overloading, heating and flashovers or fires. Always use proper size of cables to prevent heating and short circuits. Remember the protective devices such as fuse, CB, MCB may operate only after such unsafe conditions take place.

Proper design of the system earthing as well as equipment earthing is very essential for the safety of humans, cattle and equipments.

They are meant to reduce the extent of damage, but cannot prevent occurrences of unsafe conditions. It is a well established fact that each accident occurs either due to unsafe conditions or unsafe act or sometimes due to both of these. We can prevent the unsafe conditions with proper design and installation.

Installation

A well designed electrical system is the first step, but the installation as per the design and with well proven BIS practices is equally important. The qualified licensed electrical contractor will take care of this aspect. Some of these are as under.

- The cable's insulation must not be damaged while laying or pulling through a conduit pipe.
- While crimping a lug, the strands of multi stand cables must not be cut reducing the size of cable and creating a potential hot spot.
- The use of anti oxidant paste must be resorted while using the cables or lugs of different materials.
- Proper tightening of screws or bolts as well as proper use of lugs and fasteners is essential.
- 5: Location of switch boards at atleast 4' height so that children do not play with it. It is better to use 3 pin sockets with safety shutters.
- Avoiding use of concealed pipes and location of switch boards, where wall thickness is 5" and the wall is exposed to atmosphere. It is observed that such walls usually get damp in the monsoon and may become a potential source of danger.
- In case of high power and vast electrical system, the power distribution boards, lighting distribution boards, motor control centers may be located in such a way that no hindrance is caused to operating and maintenance personnel. Use of rubber mats in front of such electrical equipments and placement of suitable fire extinguishers nearby is equally important.
- Remember that no electrical installation should be casually treated; even if it is for a short duration. There is no such thing as temporary electrical installation, use may be temporary but the installation must be safe secure and sound. The most potential danger points are poor cable joints at construction site which may get into water creating a very unsafe condition for all.

Maintenance and Usage

These together are popularly known as operation and maintenance (O&M). Some pertinent points for these aspects are enumerated as under.

- Deployment of qualified personnel is the most basic requirements. Like driving need a license, so is the case with operating & maintenance staff. Beside qualification, they must be thoroughly trained and must be skilled enough to carry out normal as well as emergency operations like fire fighting, first aid as well as artificial respirations. It is advisable to train them for such emergencies from proper institutions.
- Avoiding working on live equipments is foremost requirement; however low voltage is there. This is must where flammable gases or vapours are present. Because some low voltage but high current equipments may produce a heavy spark, resulting in catastrophe.
- Adhering to the manufacturer's O&M guidelines is recommended for proper and safe functioning of the equipments as well as system. This calls for use of standard operating procedures (SOPs),

preventive maintenance schedules (PM Schedule) as well as continuous monitoring of time related wear and tear. In a big electrical system, the monitoring of certain critical and essential parameters as well as study of trend behaviour is also required. This varies from place to place and depends on the size, complexity of the system and the consequence of the untoward events.

- Testing of critical safety devices like relays, circuit breakers, releases and earthing stations must be done regularly and strictly. This will ensure the operation of the safety devises during abnormal situation and will reduce the extent of damages.
- Use of three pin top and three core cable of suitable size is must for all portable and domestic appliances. Avoid installation of switchboards inside a bathroom and other wash place to prevent possible leakage currents. Use of suitable earth leakage circuit breaker or residual circuit breaker in sub circuit of freeze, geysers, micro oven is desirable.

Typical Three Phase RCCB

Typical Moulded Case Circuit Breaker (MC CB)

Typical Single phase MCB

Excerpts

The ever increasing usage of electricity in all fields of life and the casual approach towards the use of it results in a large number of accidents, some fatal and some non-fatal. The most common of all these places are construction sites, temporary pandals and shelters created for gathering etc., the agriculture farms and last but not least houses. In most of the places, an invisible, silent and a potential danger in the form of electricity is present like a proverbial Damocle's Sword. So we must be ever vigilant for the safe use and prevention of unsafe acts and conditions as far as usage of electrical energy is concerned. The famous saying 'Familiarity breeds contempt' is perhaps coined for electricity. We are so much used to the usage of electricity that we tend to overlook the danger associated with it. This article is written in a laymen's language as far as possible so that the very purpose "accident free electrical installations "for which it is written is accomplished. ■

P S Shah, BE (Electrical) I Class, since last 8 years working in Surat Special Economic Zone as Head of Electrical Department. The job involves liasioning with electricity board, electrical inspectorate, and various Government bodies for matters pertaining to electricity for SEZs and creation and maintenance of infrastructure. He spent 15 Years in steel plants including ten years with SAIL in various capacity, mainly in project and maintenance of electricals and seven Years in Citurgia Bio-chemicals Limited, a bio-chemical company of Bombay Dyeing Group at Surat as HOD of EED, in projects and maintenance of electricals. Five of my articles are published in Electrical India a leading and India's oldest monthly magazine on electrical power and electrical products.

Frost & Sullivan Perspective on India and UAE signing Cooperation Agreement for Sustainable Energy

India and United Arab Emirates' (UAE) energy demands are expected to soar at a fast pace over the next couple of years, making the share of renewable energy pivotal to meet the increasing energy demands. This cooperation between the nations is clearly beneficial for both countries. Aspects like providing and training scientific and technical personnel would assist UAE in addressing the issue of qualified manpower for this sector, which we see as one of the greatest challenges facing the renewables sector in the country. On the other hand, the UAE has been able to commit substantially to areas like research and development and can hence, contribute positively to India when it comes to aspects like equipment and technology. Apart from collaboration in workshops, R&D and technology areas, this cooperation also serves as a platform for learning and sharing best practices and technical know-how considering India's progress towards ramping up solar generation, post the announcement of Jawaharlal Nehru National Solar Mission as well as State specific Solar policies. With these synergies, both the countries are most likely to benefit mutually and enhance their capabilities significantly. ■

Perspective by: *Amol Kotwal, Associate Director, Energy & Power Systems Practice, F&S.*

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Riello S.p.A (Italy) and PCI Ltd (India) entered into joint venture to form Riello PCI India Pvt Ltd on the 7th day of July 2010. At Riello PCI, workforce is continuously striving hard to bring the best technology and create integrated Power Backup solutions. They develop end to end UPS solutions to solve the unique power protection challenges. Riello PCI India Pvt Ltd, has PAN India presence, covering major cities of the country. Riello PCI India Pvt Ltd, has recently announced its new state-of-art production unit at Manesar India, with highly integrated manufacturing facility that is designed to produce world class UPS systems meeting up specific industry needs. Besides, Riello UPS systems were majorly operated from two Global Research and Manufacturing facilities in Italy. In an exclusive interview with **Electrical India, Anil Munjal** remarks laser-like focus on single product business is of critical importance and is necessary to excel in business domain.

You had been associated with Riello/PCI India for about two decades and had been instrumental for UPS system for business critical operation, collaboration and PCI's presence in key industrial segment. Could you share your journey and achievements so far?

From the very starting we had been fighting against big bulls in this field, Riello PCI could only succeed because of the superior products and high quality services. And Because of these 2 factors, Riello PCI has become significant UPS player in the market. Our key focus areas have always been high quality reliable UPS systems rather than supplying cheap & inferior products.

What unique features led the joint venture collaboration of PCI with Riello, leading to the birth of your present company?

We can say, the focus & dedication of our highly experienced technical team and support from our high quality products had promoted us to structure the new joint venture between Riello and PCI Ltd to further enhance our activities in this area.

What is the status of UPS market in India and what further scope do you perceive for it in the power industry?

As per the latest Indian market statistics, the Last decade witnessed exponential growth in the services

sector of the country, resulting into accelerated power demand. Despite of Indian government's focus towards power generation, the country has been experiencing about 8.5% of power deficit during 2012. Out of which, only 17% of the overall power deficit is being addressed by the power back market in India, leaving huge potential market for UPS players to penetrate. Keeping all these statistics in mind, Riello PCI holds a virtuous opportunity to capture the unattended Indian markets dealings in service sectors such as banking, education sector, IT & IT enabled Services, Data centers and Hospitality segment where the demand for UPS systems is expected to be keep on expanding for the coming years. Even critical sectors like Defence and Healthcare are significant users of power backup solutions. In comparison to all sectors, Data centers had been becoming more & more dependent on Cloud computing applications which have subsequently made them as the biggest demand drivers for UPS Systems.

Could you detail about the company's product range of UPS system and customised solutions?

Our UPS range is from 1KVA-6400 KVA. We also deal in Solar inverters and offer customised UPS solutions with different frequency, also customised; UPS to meet JSS-55555 requirement for defence applications.

Do share with us about your production facilities and tell something about products being produced at Manesar manufacturing unit?

Riello PCI's Manesar factory is a very new set up, in fact it is the 1st factory of Riello Ups that is based out of Italy. At the moment, the factory is producing one model catering up to 200 KVA of UPS system and soon planning to upgrade production up to 400 KVA by adding more models. The Indian factory is following the similar manufacturing standards which are followed as in Riello's Italy Plant and also the quality of products is as per the Europeans Standards. For Riello PCI, the key focus still remains the same i.e to continue manufacturing high quality products.

Riello UPS- Complete range of UPS Systems

What marketing strategy do you follow for evolving growth and expansion of the company?

Today, We are the prominent supplier of UPS systems in the market. The Strategy of our company is to further strengthen ourselves in low end three Phase systems and single Phase systems.

What is your perception about quality standards? Could you share highlights about various recognitions your company has earned?

For us, Quality remains the ultimate strength of our company which is within us from long-terms and also we are committed to keep it headed high for forthcoming many more years. Also, Our Company is qualified as per ISO standards and yet other standard credentials like ISO 14001 and OSHO etc. are in pipeline.

What is your vision in the next two years?

To become the prominent player in all business verticals and in all refined ratings of Ups systems and positively to export UPS systems in all unattended markets.

How important is service to your business and what are the steps you take to assure timely and reliable service to your customers?

After sales services are very important to our business. Most of the buyers look for the after sale Service. In fact Services areas are one of the key areas of buyer requirement when it comes to UPS sales. We provide 24x7 service availability throughout the country, thanks to our huge network of offices in India and skilled service engineers. We encompass engineering, installation, project management and total on-site operations management, preventive maintenance and energy-consumption monitoring. Good after sales services not only ensures customer's satisfaction but also helps in getting repeat business from the clients. We firmly believe that excellence in quality of product has to be always complimented with good technical support.

What distinguishes your products from your competitors?

Our Single Product concentration in UPS only, differentiates us from the competitors. For us, UPS is our primary business zone, whereas most of our competitors have multiple product basket to deal with. We are committed towards excellence in this highly specialized sector of uninterruptible Power Supply Technology. We believe that laser-like focus on single product business is of critical importance and is necessary to excel in business domain. ■

Synch-Check Relay

The operation of paralleling two alternators is known as synchronizing, and certain conditions must be fulfilled before this can be effected. Synchronizing, in its simplest form, is the process of electrically connecting additional generators to an existing bus. The incoming machine must have its voltage and frequency equal to that of the bus bars and, should be in same phase with bus bar voltage.

- Ankush N Bahale

Synchronization of Generators - An Introduction

Some of the benefits of placing multiple generators in parallel include increased reliability, expandability, flexibility, serviceability and cost effectiveness.

Reliability

The redundancy inherent in parallel power generation provides significantly greater reliability for critical loads. For example, if the reliability of a standby generator is defined at 98%, an N+1 configuration has a reliability of 99.96% and an N+2 configuration has a reliability of 99.999%. In a parallel configuration, if one generator fails, the most critical loads are redistributed among the other units in the system. Given typical applications and load factors, the load requiring the highest degree of reliability is often only a fraction of the total generation capacity. Redundancy is achieved without the addition of costly under-utilized generators.

Expandability

When sizing generators, it is often difficult to adequately plan for anticipated load growth. If load projections are too aggressive, initial capital expenditures may be higher than necessary. If load projections are too low, the facility may be left without reliable standby power or may require expensive generator upgrades. Synchronization allows generators to be added as needed.

Flexibility

Utilizing multiple smaller generators instead of a single large unit offers greater location flexibility. The ability to distribute weight over a wider area makes rooftop installations more feasible.

Serviceability

With multiple generators available, individual units can be taken out of service for repair or maintenance without losing standby power for critical circuits. This feature enhances reliability. The built-in redundancy of a parallel system provides multiple layers of protection for critical circuits. The necessity for synchronizing and parallel generator operation is often based on the following:

- The rated generating capacity of an existing system has been exceeded by new load demands.
- Enhanced reliability (multiple generating vs. single unit generating) is to be considered.
- Operating efficiency of generator sets is a valid concern.

These additional generators will be connected to operate in parallel with each other and supply power to the same load. The additional oncoming generators must be synchronized properly to ensure:

- Minimal disturbance to the bus.
- Minimal shock to the generator, mechanical and electrical.
- Rapid loading of the oncoming generator to take on its share.
- The synchronizing equipment selected depends on the generating equipment.

Basic Condition for Synchronization

Basic conditions to be satisfied before synchronization of an generator to a bus bar are:

- Terminal voltage of the alternator (incoming voltage) should be approximately same as the bus bar voltage. The difference should be less than 5%.
- Incoming frequency and bus bar frequency should be the same. Maximum difference should be less than 1%.
- The incoming supply and bus bar supply should be at the same phase position. The machine can handle 10° phase mismatch between incoming and busbar voltages.
- The phase sequence of incoming and bus bar supplies should be same.

The major instrumentation in synchronizing section (as shown in Fig. 1) consists of

- Running (bus bar) and incoming voltmeters.
- Running and incoming frequency meters.
- Synchroscope to indicate relative phase positions of incoming and running voltages.
- The synch-switch (synch-key) contact.

The control panel has line circuit breaker, field circuit breaker and the generator circuit breaker inputs. Wattmeter and VAR meter and sometimes vector meter are provided.

Synchroscope Operation

The most common and oldest method of synchronizing two systems is to use a manual synchroscope (See the fig: 1 and fig:2). A synchroscope is equipment that is used to monitor the three synchronizing variables. A basic inputs voltage waveforms from the two sides of the open circuit breaker. If the voltage waveforms are at the same frequency, the synchroscope does not rotate. If the generator frequency is running slower or faster than the bus frequency by causing the synchroscope pointer to rotate in counterclockwise or clockwise

Fig. 1: Synchroscope in a Synch Panel

direction. The synchroscope needle always points to the voltage phase angle difference. A voltage is provided from step-down potential transformers (in high voltage applications) for the input signal to these devices. Note that single phase, line to line voltages from the same phases are used. In most cases, single phase sensing for synchronizing equipment is adequate, because the mechanical design of the generator dictates that the three phases of the generator are displaced 120 electrical degrees apart. Before the generator is synchronized the first time, it must be confirmed that the phase rotation (phase sequence) of the generator matches the same sequence as the station bus. Matching the phase sequence can be accomplished by the appropriate physical connections at the generator terminals or other suitable locations.

The operator manually adjusts the prime mover speed or the frequency control set point of the governor to match the generator frequency to the system frequency. Similarly, the operator manually adjusts the excitation level or voltage regulator set point of the exciter to match the generator voltage to the system voltage. The operator then initiates closing the breaker when the phase angle (angular difference) between the incoming generator voltage and the system (running) voltage is near 0 degrees . A good operator will judge how fast the phase angle difference is coming together and energize the breaker close coil in advance to account for the closing mechanism delay of the generator breaker so that

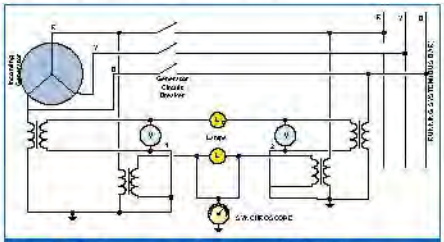

Fig. 2: Schematic of a Manual Synchroscope

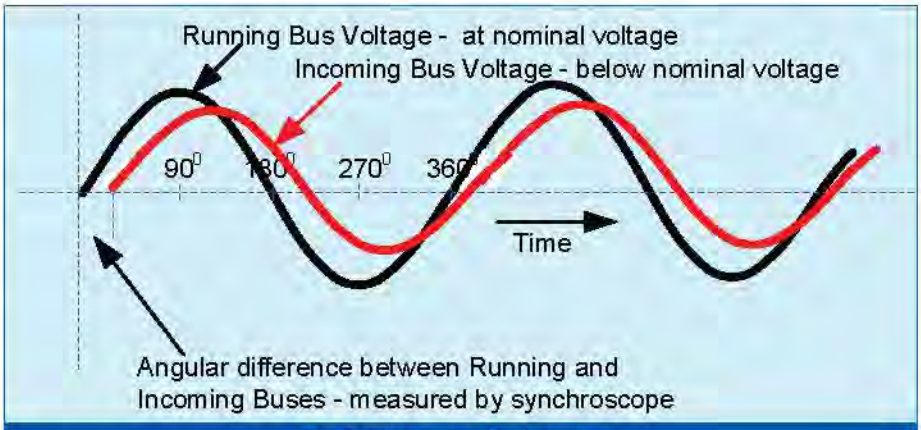

Fig. 3: Phase angle displacements

the main contacts make as close to a zero-degree angle difference as possible.

Typically, there is an interlock associated with circuit breakers at synchronizing points. Before manually closing a circuit breaker, the operator is required to enable the synchroscope. This allows the operator to visually observe the phase angle difference across a breaker as well as monitor the rate of frequency-slip (rotational difference between two systems), if frequency-slip exists. The operator would then decide if and when to close the breaker. The synch-switch (synch-key) contact only supervises local (manual) control of the circuit breaker and switches the voltage inputs to the synchroscope for the synchronizing circuit breaker. The operator performing this operation must be familiar with this equipment or be able to quickly learn while working with the system operator.

Importance of Matching voltages

The voltage magnitudes on the two sides of the circuit breaker should be as close as possible to one another. The greater the voltage difference translates into a greater reactive power (MVAr) that will flow when the breaker is closed. The large MVAr flow can cause sudden changes in voltage and cause protective relays to operate. A large MVAr surge can cause undesirable relay operations and cause problems at nearby generation stations. Ideally, the voltage magnitudes will be identical; however, this is not always possible. A rule of thumb would be to close the circuit breaker with no more than 5% voltage difference between incoming and running system.

Importance of Matching frequencies

The frequencies of two systems will likely be different because the generation for each system is being independently controlled. Before the circuit breaker can be closed the frequencies must be very close together and "in phase".

When the circuit breaker is closed, the two systems will attempt to lock in step and establish a common frequency. The allowable difference in frequencies before closing the circuit breaker is system and equipment specific. Under normal conditions, the difference may be no greater than 1%.

Again, if the frequencies of the two systems are different, the voltage phase angle is constantly changing. Active power (MW) will flow from the system with the faster frequency and to the system with the lower. When frequencies are the same, the voltage phase angle is constant. No power will flow when the breaker is closed when the synchroscope reaches the "12

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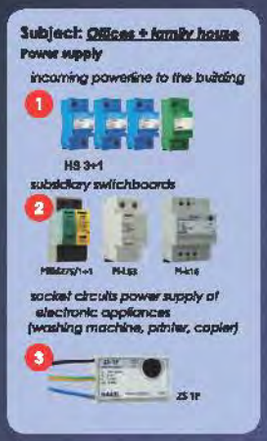

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o'clock" position (the point when the two systems are exactly in phase).An operator can adjust frequency by controlling the generator speed changer (governor) and therefore the speed of the system. This process requires close coordination among the generator operator(s) controlling the throttles, the system operator directing the process and the field operator closing the circuit breaker.

Using the power transfer formula, we can mathematically see the problem caused by mismatched voltages and phase angles.

From the above formula you can see that given matched voltages (V1 and V2) and a fixed system reactance (XL), the angle difference (Sine)

$$P = \frac{(V_1)(V_2)}{X_L}(\text{Sine}\Phi)$$

between two systems will have the greatest effect on the power transfer between the systems, as they pull each other into synchronism. The larger the phase angle difference (Sine), the larger the power flow. A large power surge can cause undesirable relay operations and damage to nearby generators.Make small incremental changes to the speed of a generator until the frequency matches the larger system. Wait for the synchronizing equipment (synchroscope) needle to slow and approach top dead center.

Synch-Check Relay

The primary function of a synch-check relay is to prevent a circuit breaker from closing if the power angle is too large across the circuit breaker. A synch-check relay electrically determines if the difference in voltage magnitude, frequency and phase angle fall within set limits. The allowable differences are determined by engineers and will vary with location on the power system. Typically, the further away from generation and load, the more difference can be tolerated. The relay does not provide any display of information but decides internally whether the conditions for closing a circuit breaker are satisfied.

A synch-check relay determines (checks) that systems on each side of the breaker are in synchronism. It also requires the systems be within a set phase angle. (Typically 10 degrees). The supervisory relay compares the slip frequency, phase angle, and voltage differences between the oncoming generator and the station bus. These parameters and some typical ranges are listed below. The supervisory relay does not close its output contacts until all system parameters are satisfied.

Parameters	Range
% Slip Frequency	0.07% to 0.45%
Phase Angle	±10 degrees (adjustable)
Voltage difference	0 to 10 %

Fig. 4: Parameters

The relay's output contacts are placed in series with the operator's control switch. Closure of the circuit breaker only occurs when i) the operator manually attempts to close the circuit breaker, and ii) the supervisory relay contacts are closed. This is illustrated in Fig. 5

Automatic Synchronizer (25A)

Another type of automatic relay used in some substations is the auto-synch relay (Fig. 6). It is used mainly on generator breakers. It is more sophisticated than a synch check relay. The relay measures the speed and voltage of the generator against the system. It then gives raise/lower signals to the generator governor (speed) and voltage regulator to match the system. It then anticipates when the generator will be in exact synch with the system, taking into account speed differences and breaker closing time. This type of relay will generally not be useful to the operator when synchronizing island.

Because of the importance of restoring electrical power following an emergency outage, a dedicated synchronizer is desired for each

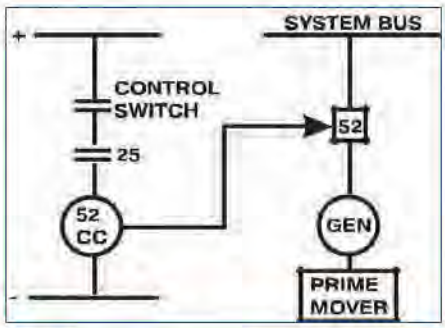

Fig. 5: Breaker Closure with Supervisory Control

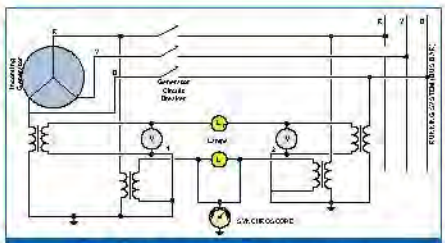

Fig. 6: Automatic Synchronizing

machine. This allows the machines to parallel to each other as quickly as possible. If the automatic synchronizing equipment includes a dead bus provision, it will allow one of the machines to pick up the dead bus and to start the synchronizing process for the remaining machines.

Types of Automatic Synchronizers

Automatic synchronizers may be either the phase lock type or the anticipatory type.

Phase Lock Type Automatic Synchronizers

The phase lock type synchronizer operates on the principle of providing correction signals to the governor and voltage regulator until the two waveforms are matched in phase and magnitude and then initiating breaker closure. Until recently, this

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Fig. 7: Automatic Synchronizer Module

type of synchronizer was capable of operating only with electronic governors Phase lock type synchronizers are intended primarily to be used one per generator.As the prime mover brings the oncoming generator up to speed, the generated voltage is applied to the synchronizer. When the voltage reaches a minimum threshold, the synchronizer begins to sense both the oncoming generator and the existing bus for frequency, phase angle, and voltage.

- Compare Voltages
- Compare Frequency
- Change Voltage to match bus
- Change Frequency to match bus
- Compare Phase Angle.

At this point, the synchronizer senses a rather large difference between the sources for frequency/ phase angle and voltage, and it begins to give corrective signals to the oncoming generator in an attempt to match it with the bus.

Anticipatory Type Automatic Synchronizer

The anticipatory type synchronizer calculates the advanced angle that is required to compensate for the breaker closure time by monitoring the slip frequency (frequency difference between the oncoming generator and the bus) and the set in value for breaker closing. It also factors in the constant of the armature movement (0.018 seconds) to complete the calculation. The calculation relationship is:

$A = 360 (TBc + TBr) FS$

Where,

A = the advance angle, which is the electrical phase angle of the generator with respect to the system bus when the synchronizer initiates closure of the controlled circuit breaker.

TBc = the circuit breaker closing time. This is the time between the initial application of the electrical stimulus to the closing circuitry and the actual contact of the breaker poles. This is considered to be a constant by the automatic synchronizer.

TBr = the response time of the output relay, which is approximately 0.018 seconds.

FS = the slip frequency, i.e., the difference between the oncoming generator frequency and the system bus frequency.

Summary

In critical installations where precise speed matching is required, there are several factors to be considered in applying a type of synchronizer First, because of the precise speed matching requirement, very low slip frequencies will be encountered. The synchronizer must be capable of measuring these small frequency differences and calculating the required advance angle.

This type of synchronizer also is desirable from the point of view of the recommendation that the generator be running slightly faster than the system to allow the generator to pick up load quickly. Other part of the synchronizing problem is the precise control of the generator's speed. This is accomplished by supplying a correction pulse once per slip cycle. As the slip frequency decreases, the interval between correction pulses increases.

Modern synchronizers have the capability to match precisely or to control both speed and voltage as well as to operate for very slow slip rates. Units furnished with voltage matching and frequency or speed matching circuits will auto-matically adjust the voltage and frequency to within limits acceptable to the synchronizer. Both voltage matching and frequency matching corrections are through relay contacts. Through this process, we have tried to establish some guidelines for the selection of the proper synchronizing system for application. ■

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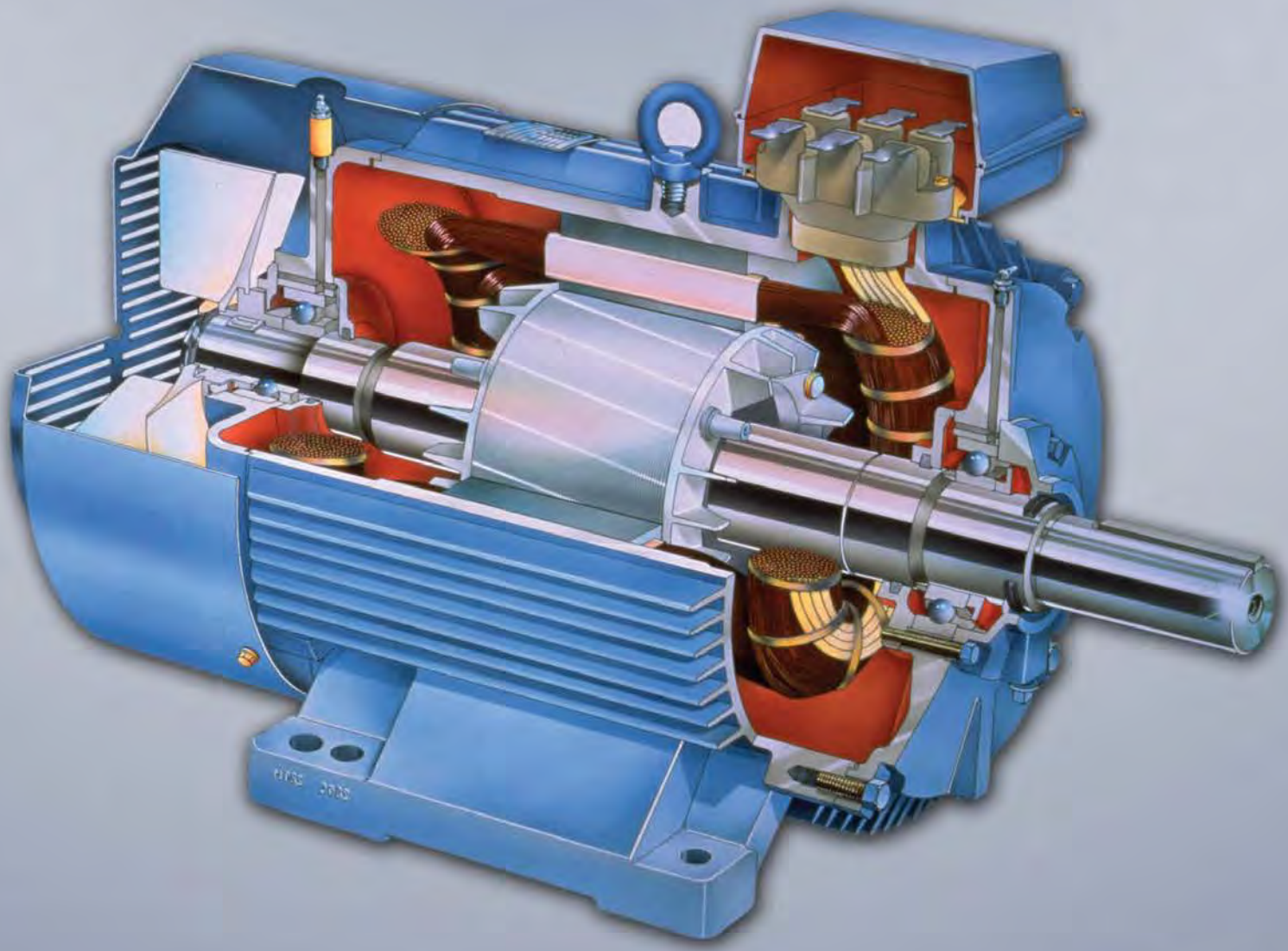
Torque Speed Curve of Induction Motor



Induction motors are the workhorse of modern industry. Three-phase induction motors are the most common and frequently encountered machines in industry because of their simple design, ruggedness, low-price, easy maintenance and wide range of power ratings ranging from fractional horsepower to 10 MW.

- Shri Kulkarni

Induction motor runs essentially at constant speed from no-load to full load. Its speed depends on the frequency of the power source. It's not easy to have variable speed control and requires a variable-frequency power-electronic drive for optimal speed control.

There are two types of rotor constructions in three phase induction motors, squirrel cage and wound rotor.

The most common motor type is the squirrel-cage motor, which has rotor windings consisting of copper or cast-aluminium bars solidly connected to conducting end rings on each end, forming a structure which resembles a squirrel cage. Due to the simple rotor construction, the squirrel cage motor is rugged and durable, and is the most common type. Wound-rotor motors are also available, usually for special application where external resistance is applied to the rotor for speed control. Induction motor works on simple principal of interaction of two magnetic fields theory. When excited by AC supply, stator produces rotating magnetic field and induces AC voltage in the rotor and this produces rotor magnetic field which tries to align with rotating stator magnetic field and hence rotor rotates.

Speed at which stator and rotor magnetic field rotates is often called as synchronous speed and given by the equation

$$n_s = \frac{120f}{p} \qquad \text{----------(1)}$$

where n_s is in RPM, f is supply frequency in Hz and p is no. of poles of motor, where as rotor or shaft speed is given by the following equation

For an induction motor, the speed will always be less than synchronous speed by a factor known as the slip of the motor. The motor speed can be expressed as

$$n = (1 - s)n_s \qquad \text{----------(2)}$$

where n is rotor or shaft RPM and s is the slip between synchronous and rotor speed.

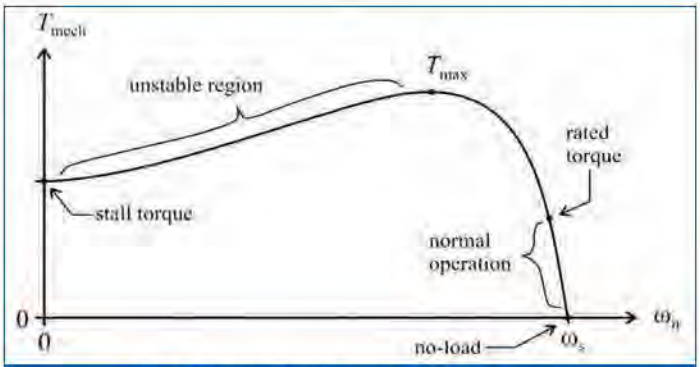


Fig. 2: Torque Speed Curve of Induction motor

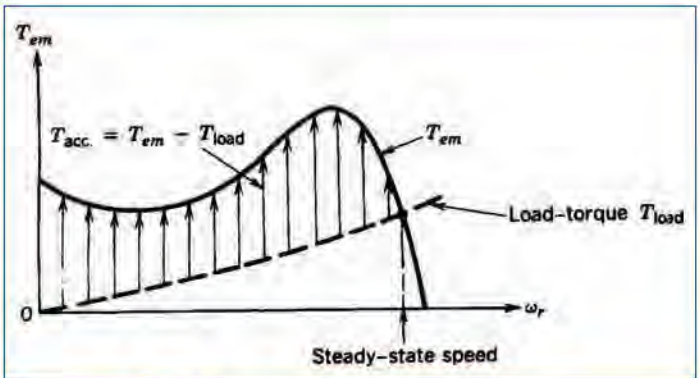


Fig. 3: Torque speed Curve of Motor and Load

Typical torque speed curve of three phase induction motor is shown above. Acceleration torque is the difference between motor torque and load torque and it accelerate the motor speed until motor torque is equal to load torque and this speed is called as steady state speed of motor for that particular load condition. In order to determine the acceleration time of a motor driving a particular load, the torque vs. speed curves of both the motor and load must be provided, in addition to the load inertia and the power system information. The torque-speed curve for a given load is a function of the specific nature of the load.

Torque refers to the turning effort exerted by the motor shaft. NEMA defines various torque characteristics for motors, which are designated as Designs A,B,C, and D with Design B being by far the most common design used in industry. For each design classification, NEMA specifies performance parameters such as locked rotor torque, pull-up torque, breakdown torque (except for Design D), inrush current, and slip. The NEMA required minimum values are dependent upon the motor size and speed. Three values of torque are generally of particular interest, and are as follows:

- Locked Rotor Torque (LRT) - the torque developed by the motor at stand still, also known as starting torque.
- Pull-up Torque (PUT) - the minimum torque developed by the motor as it accelerates from zero speed to the speed at which breakdown torque occurs.
- Breakdown Torque or Pull-out Torque (BDT or POT) - the maximum torque that the motor is capable of developing.

For instance, centrifugal loads such as centrifugal pumps and fans follow a square law relationship of torque vs. speed. That is, at zero speed, virtually zero torque is required, but the torque requirement increases as the square of the speed

Polyphase Characteristics	Locked-rotor torque (percent rated load torque)	Pull-up torque (percent rated load torque)	Breakdown torque (percent rated load torque)	Locked-rotor current (percent rated load current)	Slip (%)	Typical Applications	Relative Efficiency
Design A Normal locked rotor torque and high locked-rotor current	70-275a	65-190a	175-300	Not Defined	0.5-5	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low	Medium or High
Design B Normal locked-rotor torque and normal locked-rotor current	70-275a	65-190a	175-300a	600-800	0.5-5	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low	Medium or High
Design C High locked-rotor torque and normal locked-rotor current	200-285a	140-195a	190-225a	600-800	1-5	Conveyors, crushers, stirring machines, agitators, reciprocating pumps and compressors, etc., where starting under load is required	Medium
Design D High locked-rotor torque and high slip	275	Not defined	275	600-800	≥5	High peak loads with or without flywheels such as punch presses, shears, elevators, extractors, winches, hoists, oil-well pumping and wire-drawing machines	Medium
IEC Design H High locked rotor torque and high locked rotor current	200-285a	140-195a	190-225a	800-1000	1-5	Conveyors, crushers, stirring machines, agitators, reciprocating pumps and compressors, etc., where starting under load is required	Medium
IEC Design N Normal locked-rotor torque and high locked rotor current	70-190a	60-140a	160-200a	800-1000	0.5-3	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low	Medium or High

Table 1 Typical characteristics and applications of fixed frequency medium AC squirrel Induction Motor cage motors

(to 100% torque at rated speed) as the load accelerates. Loads of this nature are generally referred to as "Variable Torque" (V.T.).

Loads such as conveyors, screw pumps, etc. are generally referred to as "Constant Torque" (C.T.) loads, as they can require 100% torque (current) at any or all speeds. V.T. loads are therefore less demanding on motor starting performance, from the standpoints of torque and motor heating at less than full load speed. LRT and BDT are interdependent - each can be increased, but at the expense of the other. It is relatively easy to design a motor for a particularly high LRT, or a high BDT, but this would be at the sacrifice of the other. A thorough design should attempt to optimize both the LRT and BDT, and both should be considered when comparing torque.

The curves below shows typical torque speed requirement for each type of motor design.

Therefore it is important to know the torque speed characteristics of a motor to be used for a particular drive application. There are three methods for plotting torque vs speed of motor. In first method motor is loaded with adjustable constant load and motor torque is measured along with other parameters such as speed,

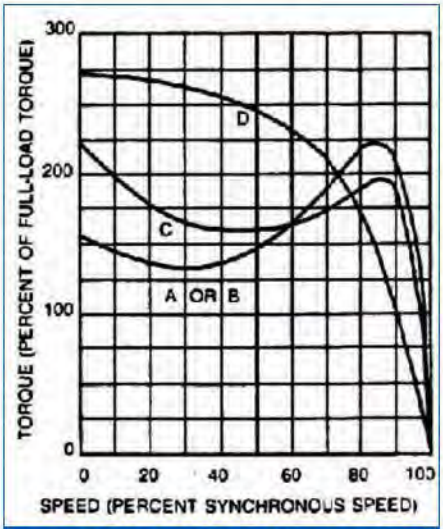


Fig. 4: Torque Speed Curve Characteristics of Type A, B, C and D type Induction motors

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motor voltage, motor supply current, pf, etc..

In second method, motor is loaded with inertia load such as fly-wheel of known inertia and then speed is recorded from starting to no-load condition. This allows acceleration to be computed using personal computer or PC. Speed is measured by a rotary encoder and microcontroller circuit over complete range of speed variation. From the following equation torque is determine at any given speed.

$$T_a = J \frac{dw}{dt} \qquad \text{---------(3)}$$

$$Te = Ta + Tf \qquad \text{---------(4)}$$

where

Te is motor electric torque produced and measured in N-M

Ta is net acceleration torque and measured in N-M

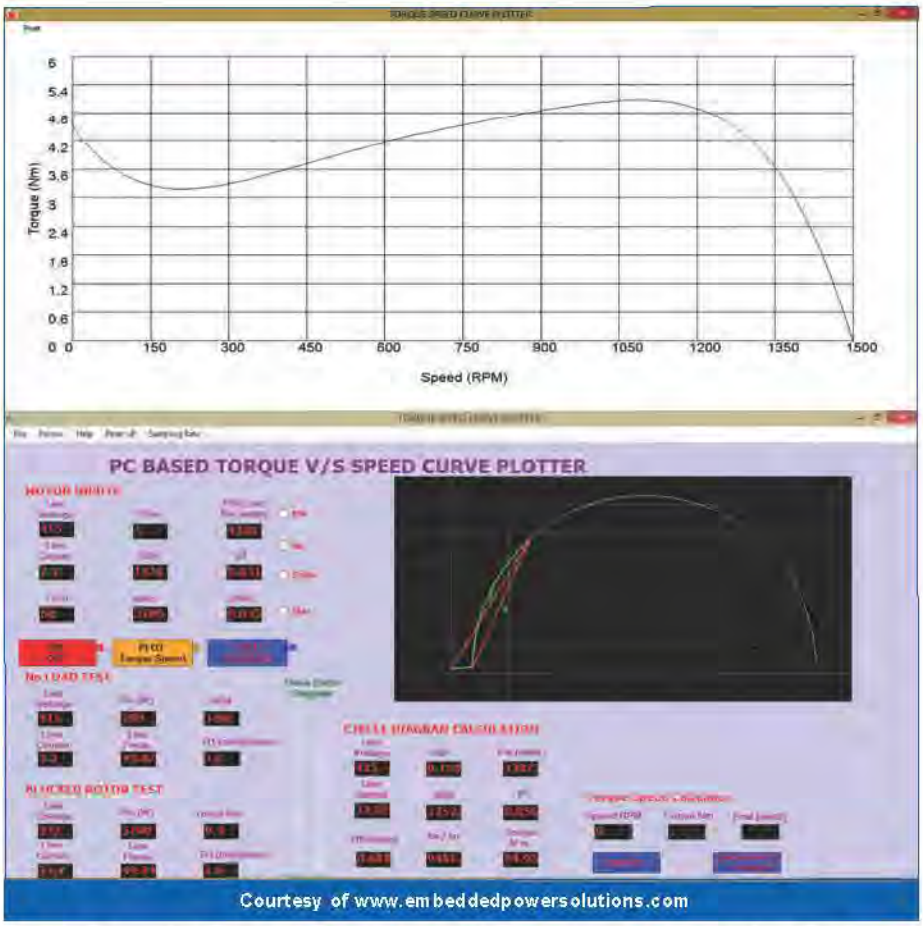
Tf is torque equivalent of friction plus windage losses and measured in N-M

J is total inertia of fly-wheel and rotor mass in Kg-m2.

w is rotor speed measured in rad/sec.

Third method involves using motor parameters and motor equations to compute complete motor performance such as graphical method called circle diagram. Most of the time motor parameters are extracted by carrying out block rotor and no-load tests.

Draw backs of first method is though this method is accurate for determining torque at given load condition but it is time consuming due to coupling, varying load condition and carrying out measurement. As during loading normally all the energy is wasted (unlike regenerative loading which is very costly). Also as the load is, though variable, it is constant type and hence can't measure torque in unstable region [fig 1] of torque speed curve.



Third method is an approximate method and high accuracy can't be guaranteed and mostly preferred by re-winders of motor who have space limitation to carry out full loading of motor and also by motor manufactures to compute torque over the full speed range. During no-load or short circuit test, small amount of energy is wasted as test is carried out quickly.

Second method has advantages over first and third as it gives accurate torque speed curve plot in fraction of time compared to other two methods. This instrument can be used from fractional horsepower motor to Megawatt ratings with only changing fly-wheel and also available at affordable price. It's PC user interface is user friendly. Major Disadvantage is it's availability in Indian market at affordable price. Fortunately now it is sold by a local company, Embedded Power Solutions at very affordable price. Apart from plotting torque speed curve of a motor, it also draws circle diagram and display all important motor parameters on PC screen.

Torque Speed data measurement is extremely important from the application point of view as well as design and development or any modification in the existing motor design. These instruments have been claimed to been very useful on production line also for quality control as testing is done in very short time and can reveal manufacturing defect in motor under test and serve as a useful quality control tool. ■

Shri Kulkarni
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"Hakel surge protectors are RDSO approved and widely used"

Pavel Hudec
Managing Director
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Hakel Ltd is major producer of surge protection devices in Europe. The company obtained ISO 9001 certificate in 1997. Surge protection devices produced by Hakel company can be applied in every industry, households, offices, hospitals and also in army buildings. Products are tested according to standard EN 61 643-11. Hakel produces and exports to countries in all continents. Insulation level drop detectors by Hakel, enable users to improve their easy application in IT systems, metallurgy, engineering, shipbuilding, in hospitals and transport facilities. In an exclusive interview with **Electrical India, Pavel Hudec** says, we would like to see ourselves in the first three listings of the leading companies in the surge and lightning protection field.

What are your plans to develop business in India?

Our history is of 20 years old and this year we celebrate 20 years of existing in the SPD market, we belong to one of the major producers of surge protections devices and relative products in the world. Our plan is to establish a very strong company and offer a complete solution on the field of surge and lightning protection. Strictly speaking, the internal & external protection devices, ground fault detectors, grounding & earthing material, testing & measuring appliances.

Could you highlight market structure of surge protectors?

Our company export basically to 52 countries, namely to Europe, Asia, South & Latin America, Middle East, Africa and Australia. In every country there are different kind of conditions, standards and needs of surge protection. We have to follow the people who are working in the market, so our strategy is to find out a local distributor with technical background, knowledge and experience. With these people we try to run the market and take care of the dealers and their customers.

Tell something about collaborations?

It is one of the biggest topics at the moment and you have to be presented in the local market, completely at all areas. Joint venture is our biggest plan and goal of the future. We will go step by step whilst providing complete solutions. The Hakel brand is known in India very well because the marketing strategy of our Indian partner "APS" is absolutely perfect. Joint venture legal things are in process between HAKEL & APS and we have scaled up the things accordingly. Initially we will be entering into the Indian market with our conventional lightning protection materials followed by the selective models of surge protection devices.

What products are you planning to launch for the Indian market?

Basically, we think about ground fault detectors, which are applicable for the hospital sectors etc. This is the product that we are planning to launch in the future. But this will be done in the future after we establish a business network across the country with a good number of channel partners. We are planning to launch few surge protectors for the domestic application through the retail market under the joint venture banner.

Could you share about major Projects that you have done so far in India?

Our products are mainly offered in India as a complete solution package for external protectors so if there is a bigger project with external protection then internal protection comes with the project. We have solutions for railway application and thousands of HAKEL surge protectors are installed in Indian Railways. Hakel surge protectors are RDSO approved and widely used. Like I said if any big building is protected with active lightning, then there is a need of surge protectors (Hakel). Many private and Government companies have installed HAKEL surge protectors for their various applications.

What are the various state-of-the-art facilities in Czech Republic?

In the premises in Hakel there are production halls, we have R&D center, training center, there is a building with test laboratory, the facility is accredited in Czech Republic which is completely used for testing our products and also as a third party test laboratory for our competitors. We maintain the quality of the products with all international & European standards like IEC, EC. All the products are certified, VDE certification from Germany, CE certification, certification from Russia and we are also working with UL certifications. We are trying for the Korean standard (KS) certification which helps us to obtain, receive bigger sales then we have to follow and push through rest.

Where would you rank Hakel in this competitive scenario?

The competition is usually healthy; we are glad that big players are here we are ready to face every challenge by providing qualitative products and we can achieve our goals with the experience of our business partners like APS in India. With the technical background company and aggressive local business partner as a team, we will be able to overcome the challenges and grab our share.

What were your anticipations from business visitors at Elecrama?

Elecrama is very huge and we are proud to be at the event to build strong and long term relationship and we will come to attend the next Elecrama as well.

We would like to be probably number one in the future in spite of tough competition and vigorous players. But as a team (Hakel & APS), company with experience, and competitive attitude we will lead to success.

We are quite happy with the quality of people who visited our stall and we also met our esteemed partners and dealers. People are well aware of the products; they try to get some new information, they know the new technology and what they want. And for this we are very happy.

What are the growth plans for the company?

We are not thinking big at the moment, that we will make it in multimillions or so because we really want to go step by step. Every small order is welcomed; we just try to push our dealers in pan-India. Since the country is very big and the population is very high, lots of manpower is required which we are planning in a structured way.

Everything will be ready in time, and then the turnover from India will be one of the best in the Hakel's history. APS is providing the best platform to achieve our growth plans in India. We have high stakeholds that is why we really put our efforts to establish a very strong co operation here.

Where would you envision Hakel in the next two years?

In the next two years we would like to be stable, also we would like to see ourselves in the first three listings of the leading companies in the surge and lightning protection field. ■

UPS the Hidden Truth

UPS- the uninterrupted power supply system has find its place in almost everywhere electricity is utilized. More importantly in IT industry servers and computers are invariably supplied power through large capacity UPS systems. Of course the necessity of UPS cannot be ruled out in the present scenario of acute power shortage and frequent power cuts. Nevertheless the sizing of the UPS is very critical in reducing power consumption. Over sizing of UPS system looking at the future expansion may lead to draining of cost due to energy loss and further it takes significant cost on batteries and its maintenance. This article discusses how an oversized UPS waste energy through a case study.

- B S Durairaj and M T Sambandam

An energy analysis was carried out in a building housing IT infrastructure. The building has four LT services with sanctioned load of 112 KW x3 and 59 KWx1 from Electricity Board. Two DG sets of 500 KVA and 380 KVA capacity are also available. These DG sets are operated only during power failures.

The average electricity consumption per day is presented in Table 1. The average monthly electricity consumption is approximately 37.156 MWh.

Service	Sanctioned load (kW)	Avg. kW	Type of load	Units/day	
				Week days	Sundays
1	112	45	UPS		
(120 KVA*2)	993	950			
2	112	30	A/c and Lights	653	620
3	112	45	A/c and Lights	793	440
4	59	35	UPS (80KVA*2) and A/c	721	589
Total	395	155		3160	2599

Table 1: Average Electricity Consumption per day

Utility	KW
UPS	59
A/c	70
Lighting	2
Total	131

Table 2: Running load in the building

The actual running load at the time of audit of the building was measured and the load values are presented in table 2. The major loads are UPS, A/c and lighting and the other loads are pump (0.75 HP) and lift which are negligible.

It is observed that the maximum load is from A/c followed by UPS. Load due to Lighting is merely 2 kW. The percentage load distribution is shown in figure 1. The average cost of electricity is INR 7.00 per unit.

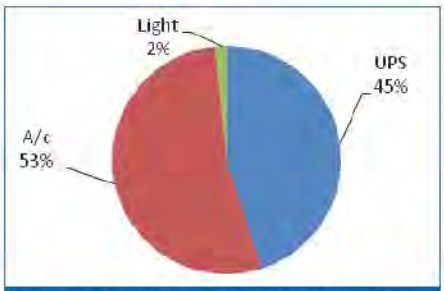

Fig. 1: Percentage distribution of Electricity Consumption

DG sets are used only at the time of power cuts/failures. These sets are kept at stand by for all the time. The average diesel consumption per hour varies from 25 litres to 45 liter depending on the load. The average unit generation was observed varying from 2 to 2.5 units. DG is operated for an average of 2hr/day. It is evident from the study that the UPS is the second largest energy consumer in the building.

Capacity	Connected load	Dedicated Service
2 X 80 KVA	Servers only	205-04-432
2 X 120 KVAc	Computers	205-004-438

Table 3: Installed UPS

Capacity (KVA)	Input (KW)	Output (KW)	P. F	Back up time (minutes)
120 (1)	25	18	0.99	56
120 (2)	21.5	12.4	0.99	80
80 (1)	8.1	3.3	0.97	474
80 (2)	5.2	0	0.94	474

Table 4: Observations on UPS Performance

Capacity (KVA)	Input (KW)	Output (KW)	Efficiency (%)
120 (1)	25	18	72.00
120 (2)	21.5	12.4	57.67
80 (1)	8.1	3.3	40.74
80 (2)	5.2	0	-

Table 5: Efficiency of UPS

UPS

The details of UPS installed are listed in Table 3.

All these UPS are connected in parallel so that at any point of time the power supply is ensured from any one of the UPS. Load on each UPS was observed and presented in Table 4.

Based on the above observation energy saving measures are discussed

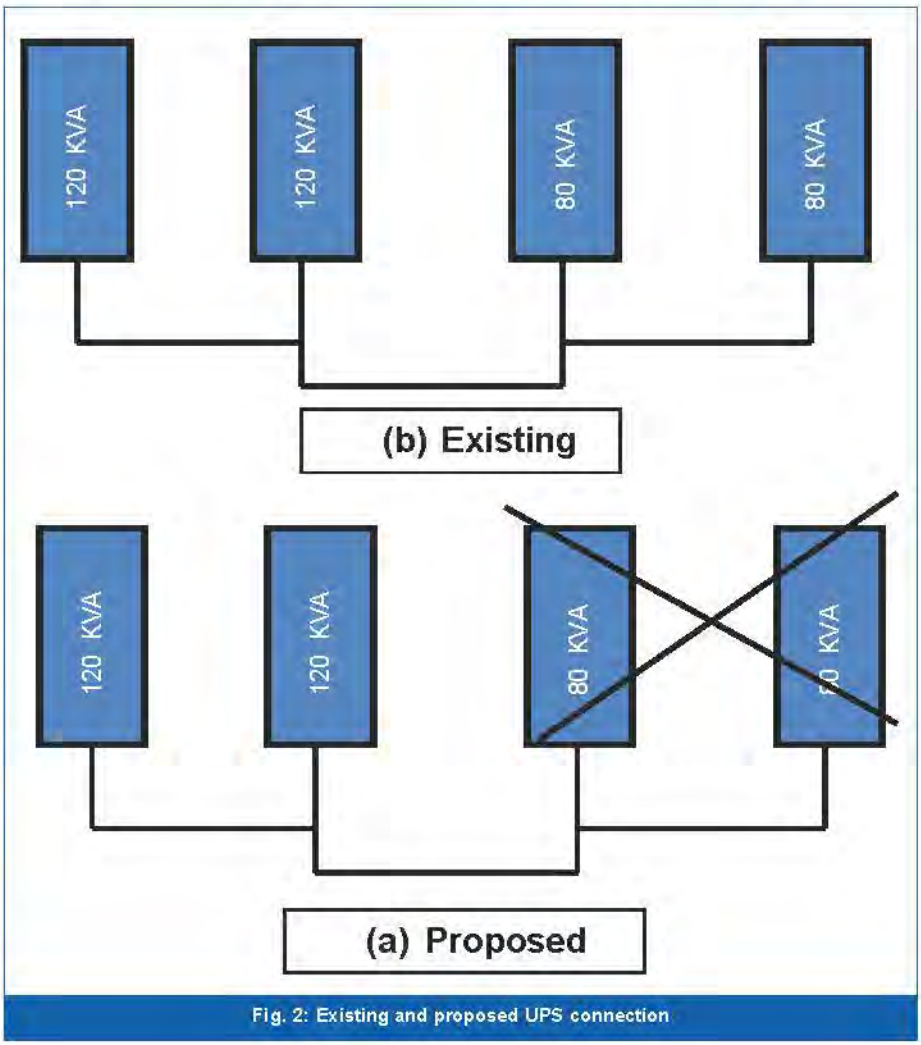

Fig. 2: Existing and proposed UPS connection

Particulars	Unit	Value	Remarks
Capacity of UPS to be disconnected	KVA	160	2*80 KVA
Present total input to the UPS	KW	13.3	8.1 +5.2
Present output from the UPS	KW	3.3	3.3+0
The expected efficiency of			
120 KVA UPS	%	0.65	After shifting the load of 3.3 KW to 120 KVA UPS
Additional load increase in the 120 KVA UPS	KW	5.07	(3.3/0.65)
Saving in power	KW	8.00	8.23 ~ 8.00
Annual working days of UPS with full load	Days	300	Sunday and other holidays are considered
Working hour per day with full load	Hr	20	Load will vary during night hours
Annual energy saving	KWh	48000	(300*20*8)
Annual cost saving	INR	336000	@ Rs. 7/kWh
Investment	INR	0	
ROI		Immediate	

Table 6: Estimation of Energy and Cost saving by disconnecting UPS

in the subsequent sections. The efficiency level of each UPS is presented in Table 5.

It is observed from the electrical measurements that the UPS is over sized and redundant. The total load on the UPS at the time of audit is only 54.6 kW on the input side and one 80 KVA UPS is at zero output.

Even at full occupancy of the building the load may increase approximately up to 75 kW on input side.

With this in focus it is suggested to disconnect the 2 x 80 KVA UPS and shift the load to 120 KVA UPS.

The proposed schematic diagram of UPS connection is shown in Figure 2.The estimated energy saving is 8 kW. Since the UPS is working for 24x7 the annual saving is 48000 kWh.

The cost saving would be INR 3.36 Lakh per annum with unit cost of INR 7.00. The investment for implementing this measure is negligible. The benefits will start immediately as presented in Table 6.

Further it needs a control system that will optimize the use of UPS and Gen-set. When power is on, UPS must be used to keep the batteries fully charged.

When power goes, the UPS must kick in. The second UPS most come in within 5 minutes. If power comes back, no need to start the second UPS. Continue to run on UPS if EB power does not come, until the UPS/ battery comes down to say 30% of capacity.

Then only switch on Gen-set. Once power comes back, wait for 5 minutes to switch back to Mains. This logic can be easily implemented.

Conclusion

The optimum use of UPS in IT industries is the need of the hour. In most of the IT buildings UPS may be the second largest energy consumer and may be over sized too. Therefore a detailed energy study on these UPS systems is needed to plug the unknown energy loss. ■

Dr B S Durairaj PhD from Madural Kamaraj University received BOYSCAST FELLOWSHIP from DST, Govt. of India for doing post-doctoral research at Queens University Belfast, UK. He also received Young Scientist Fellowship (YSF) from Tamilnadu State Council for Science and Technology (TNSCST). He worked as Professor in the Department of Electrical and electronics Engineering, Kalasalingam University, Srivilliputtur, TamilNadu, India from 1996 to 2013. Currently, he is working as a Professor in the Department of Electrical and Electronics Engineering, Kings College of Engineering, Tanjore, TamilNadu. His research interests include Reactive Power Management, Distribution Automation, and Energy Management Systems.

M T Sambandam is a Professor in Mechanical Engineering, Kalasalingam University. He has 10 years of Teaching and 15 years of Industrial experience and a certified energy auditor by Bureau of Energy efficiency and is a consultant to Triassic Solutions Pvt. Ltd, Trivandrum.

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Rittal, EPLAN and Kiesling:
Extended service partnership in switchgear engineering

By taking over Kiesling Maschinentechnik, the Friedhelm Loh Group has considerably expanded its system-solution skills for switchgear and control cabinet engineering. The three companies Rittal, EPLAN and Kiesling form a unique global service partnership in this sector. Customers will profit in future from consistent system-solution skills and increasing productivity across the whole value creation chain in control cabinet and switchgear construction – from engineering to robot-based wiring.

With forward-looking automation solutions for switchgear construction, Kiesling Maschinentechnik provides new innovation potential in the company group. Customers will in future profit from the longstanding technological expertise in the mechanical processing of control cabinets. The latest technological breakthrough is the robot-based wiring system "Averex", which will replace the time consuming manual wiring of mounting plates and ensure fully automatically generated, standard-conforming and safety-oriented connections between devices in the mounting plate.

From engineering to the wiring robot

The control cabinet constructor configures a solution based on the data from the EPLAN Data Portal, the schematic from the electrical or fluid power detail and hardware engineering as well as the system knowledge stored in the EPLAN Platform or the EPLAN Engineering Center on control cabinet components and accessories from Rittal. With EPLAN Pro Panel, they simply and comfortably set all predetermined devices and the accessories in 3D. In this way, information on fastening bores, bore threads or apertures are automatically generated or interactively supplemented if necessary.

On the basis of the 3D control cabinet prototype and the connection information from the schematic, EPLAN Pro Panel identifies the optimum routing and the required lengths of wires and cables. All information required for the material disposition, the mechanical processing or the assembly and/or laying of wires is provided by EPLAN in the form of order lists and bills of material, production and assembly drawings or as machine programs.

Fully integrated production

If the construction meets the technical specifications, the "real" control cabinet construction with components from the program "Rittal – The system" can begin. The mechanical processing of the cabinet and the mounting plate using the processing machines from Kiesling is the next step.

The wiring data and the information from the 3D model provided by EPLAN on parts and their position on the mounting plate are transferred via a dedicated machine interface on the Kiesling wiring robot "Averex".

On the basis of this information, the robot first verifies and checks the manually assembled mounting plate and then carries out the wiring of the components independently and fully automatically.

Changing the wire when the colour or cross section are changed is included. This is considerably faster than manual wiring – time and cost saving as well as a consistent workflow are the resulting success factors. ■

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Synergy of Strengths to Transmit, Transform and Deliver

Larsen & Toubro (L&T), the US$ 14 billion technology, engineering, construction and manufacturing conglomerate congratulates Power Grid Corporation of India (PGCIL) on its 25 years of enabling the nation's power infrastructure to accelerate growth and development.

L&T is among the very few companies in India possessing end-to-end capability of providing turnkey sustainable construction solutions and ably supports PGCIL's power mission. From Electrical Balance of Plant (E-BoP) solutions for power plants to ultra-high voltage transmission lines, testing of transmission towers, extra high voltage substations (Gas and Air insulated), from rural and urban power quality improvement to plant electricals and instrumentation, the company offers end-to-end solutions for power transmission, distribution and improvement.

The L&T – PGCIL synergy has achieved an impressive track record that features nearly 10000 CKM of transmission lines of various voltage levels upto 765/800 kV, more than 50 AIS and GIS substations upto 1200 kV voltage level. This also includes 130 bays of 765 kV AIS/GIS of which 36 have been commissioned.

L&T is proud to be associated with PGCIL in realizing its powerful mission of developing a robust integrated national grid by constructing high quality transmission and distribution utility networks.

L&T Construction
Power Transmission & Distribution

A brand of Larsen & Toubro Limited

We are looking for introduction of modern technologies in Nigeria

T. A. B. Disu
Managing Director
Lekki Worldwide Investments Ltd, Nigeria

During Elecrama 2014 expo **Electrical India** had numerous visitors to the booth interacting and sharing experiences. There were enquiries too regarding power companies and industries that may have interest in power related projects overseas. One of the enthusiastic overseas visitor **T.A.B Disu** who happened to visit expo, shared his experiences with **Electrical India** about power scenario in Nigeria, and the luring investment opportunities in South Africa. He remarked we have water; we need hydro electricity power to be used. We have the sun, almost 16 hours a day; we require the solar energy to be produced. He emphatically said, there is no company here exhibiting in Elecrama 2014, that do not have an opportunity in Nigeria. We are prepared to pay for it.

To begin with tell us more about Lekki World Wide Investment Limited, its activities and the core operating philosophy?

Lekki Worldwide Investments Limited is a special purpose vehicle set up by the Lagos State Government of Nigeria to promote the development of a free trade zone called the Lekki Free Zone. Lekki Free Zone happens to be the biggest Free Zone in all of West Africa. But, it is not only a free zone; the mechanism is also been used to develop a future city in Legos.

Legos been a Mega City, according to the UN definition of a Mega City, consisting of a densely trained population and you have to provide for infrastructure of housing, road, transportation, electricity, water, drainage, and all the rest of it. That is the purpose for which LekiWorld Wide Investment Ltd. is set to ensure that we actualize all these dreams.

The Free Trade Zone consists of all the activities, in which we are building an Airport, a deep-sea port- a first of its kind in West of Africa. It is such a large city,

20,000 hectares of land, for which the people will work, leave and spend there. There is no aspect of human endeavor that is not embedded in the Free Trade Zone.

We would like to know about Lekki Free Zone and the scope of tripartite agreement between Lekki Investments, the Lagos State Government and the Chinese Consortium?

In 2006 when we first mooted the idea of a Free Zone the first set of investors that came in were the Chinese consortium led by the China Civil Engineering Construction Company. We had a tripartite agreement for the development of 3,000 acres of land in to a mix industry venture. The agreement is for development in all the sectors like housing, tourism, manufacturing and the rest of it. We are also planning to have an exhibition center in order to capture the audience for the products in Nigeria and West Africa. As I am talking to you now, there is a new group called the Renaissance Group that is signing an agreement to develop the logistics for the airport, a new airport that will ease the pressure on the Murtala Muhammed International Airportin lagos. Apart from that we have more than 15 investors that have put in there money, also the biggest company in Africa the Dangotie Group are coming into establish a petroleum and petrochemical industry in the zone very near to the deep sea port so that they can benefit from the port.

With the establishment of the Leki Free Zone, what is the kind of investment that your are looking at and the benefits in terms of employment, commercialization and tourism to the state of Lagos?

When it comes to the investment in the Free Trade Zone, especially the Lekki Free Trade Zone, we are ready to compete for the last dollar in the bucket and we believe that we are on a very good platform to do this because Legos happens to be the economic hub for the whole of West Africa. It is from here that the product is transported to the most African countries.

Apart from that we have skilful and knowledgeable youths looking for jobs. So, these young men or women would easily absorb any input like finance or technology that comes in order to transform the Nigerian economy. Apart from that, the Nigerian Export Processing Zone Authority has made it so conducive for the foreign investment to come in and for you to also tap into the local market.

Where you have the population of 150-160 million people, with effective demand, you cannot just produce and take it out. The market is there, so the free zone authority makes provisions for that and that is the reason why we believe that any investment made in the free zone would take back his reward.

The exit and entry of finance is there in the free zone. We guarantee that any investment made in the free zone will surely give returns in multitude compare to other free zones in the world.

Please update us on the current status of the Free Zone, the industries currently functioning and the industries/ segments you are targeting?

Right now most of the investment in the free zone has come from the oil sector: the petroleum industry and the rest of it. We are looking for tourism. Lagos has the population of about 20 million and they work very hard. They need place to relax, they need place to spend there leisure time. The environment, because of the Antarcticoceans and the two lagoons bordering the two peninsulas that we are developing provides an excellent location for the development of tourism. What do we need there- hotels, resorts area etc. The shipping industry can also provide ships for them to be used in the lagoons and the oceans. Apart from that, in the whole of Nigeria Lagos is the only state that is bounded by water, from east to west, and yet you see people in que on the roads and we need to change that culture, for the people to get off the roads and to get onto the sea or lagoons, to get to use the other means of transportation, it is when they become familiar with that, they would know that there are many other resources in the water for them to tap and that would open a new opportunity.

What are the opportunities in terms of investment and growth, a company investing at the Free Zone, look forward to in the region?

Every Indian company that has come to Nigeria, they have never left. The secret is they have grown into big manufacturing, retailing companies because Nigeria, been a developing Nation, has offered them immense opportunities to grow and prosper. The middle class in Nigeria is growing and you need to provide to them. As you continue to do this, there is multitude of opportunity than cannot be overlook.

Apart from that, the economic transformation has provided a lot of incentives for investment in the free zone - no duty, no tax, no export charges- so that you are able to produce goods at the least cost and compete and sell all over the world. These are the areas that are open to investors coming to invest in Nigeria.

What are the opportunities that an electrical equipment manufacturers investing at the Free Zone look forward to in the region?

If you are following the trends in Nigeria, the number one requirement in Nigeria is that of supply of electricity. Not that we have not tried, in the last 8-10 years we have spend over $60 billion in this industry to be able to provide electricity.

The Small and Medium Scale Enterprises in Nigeria require electricity and yet they don't get it. Without electricity and the power supply to all these industries there can be no transformation of the economy. When you look at 160- 170 million population without electricity supply you know the opportunity is there.

There is no company here exhibiting in ELECRAMA 2014 that don't have an opportunity in Nigeria. We are prepared to pay for it. We are not looking at aids, we are looking for savvy's, and we are looking for introduction of modern technologies in Nigeria. We have large oil deposits, we require you to bring combustion engine that can utilize it. We have water; we need hydro electricity power to be used. We have the sun, almost 16 hours a day; we require the solar energy to be produced. These are the kind of opportunities that I am talking about.

Brief us on the purpose of your visit to India and Elecrama 2014? Also we would like to know your views on the event Elecrama 2014?

As I was coming from the Airport I saw huge signboards, I thought it is a carnival: the people, the color red, and the rest of it. Then I saw the exhibition center. Elecrama is a magnificent event, I have never thought of it of been as big as this. I am going to go back with a change of mind.

We will think of having an exhibition of this magnitude in the Lekki Free Zone. May be we will not be able to build it in one phase, but we will definitely attempt to do it, not only for Nigeria but for the whole of West Africa. To be able to utilize and able to make full benefit of it, it is not going to be a Nigerian Exhibition, it will be for the whole of Africa. I am believer in regional organization whereby people come together. There are small-small countries in Africa; we cannot leave them on their own. Nigeria is powerful politically, economically and with the amount of population we should be able to bring them as brothers. This kind of exhibitions will be planned in such a way to benefit about 500 million peoples in West Africa and that is what I am taking back from this Elecrama exhibition.

You must have visited and interacted with delegates at Eelcrama 2014, what is the response and what are the concerns of the industry and how would you address those concerns?

From the initial interaction I have had, people want to know- is the atmosphere in Africa conducive? what is the political situation in Africa like? I would like to assure you that what ever you hear through television and media is less than 5% of the atmosphere, 95% of it is of good stories to tell.

For the infrastructure that is required, the government is able to provide security to investors, not only for the money but also for their staff. Apart from that the Nigerian and other Africans are very friendly people. You will be shocked and surprised that when you get there within a period of no time you become a free man. Before you come in, there might be all kind of stories that must have been told. The concern of their perception is something that we need to work on. It is said that the enjoyment of the pudding is in eating, you have to eat it to know. You have to come to Africa to see the various opportunities. The time for Africa has come.

Finally, what will be your message to the industry in India about the Lekki Free Zone?

In 1994 I had the opportunity of been trained in the Exim Bank of India in Mumbai, I was there for six weeks. Then I was not in the Lekki Free Zone. The Nigerian government had just embarked on a journey of structural adjustment program trying to diversify the economy from oil to non-oil sector and we needed financial structure to be able to provide a sustainable boost. We got an opportunity from Exim Bank of India, I was send there, got all the intake that I needed to take back to develop that bank in Nigeria.

While I was there, they introduce me to so many organizations. I was in Pune to see TATA, I was with the Small and Medium Enterprises, I was with various industrial organizations. When I got back to Nigeria, the first program of Foreign Exchange Facility we put up, more than 20% of it was given to Indian community. I am very much in touch with Indian investors in Nigeria. I have given them assistance in establishing their industry, now I need their expertise to invest in the free zone and I believe they will answer my call.

I describe the Lekki Free Zone as the Dubai of Africa whereby the Indian community, the Chinese, the Europeans will be able to form a centre and exchange ideas. ■

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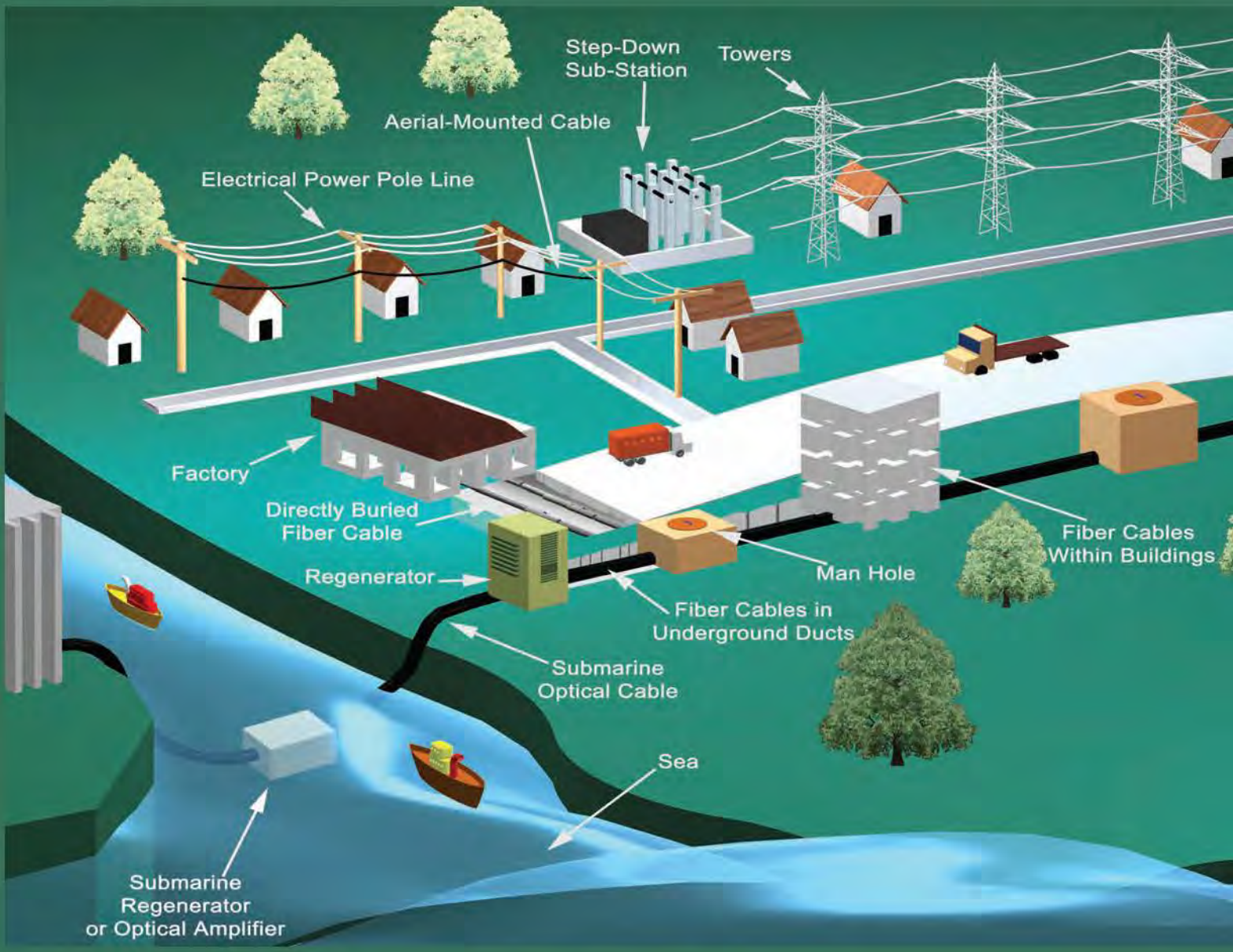


Aerial Fibre Optics

Concept, Application & Safeguards

An optical Fibre is a thin, long, transparent material (usually made of glass or plastic) that confines and propagates light waves. Fibre optics use light pulses to transmit information down fibre lines. At one end of the system is a transmitter. This is the place of origin for information coming on to fibre optic lines. The transmitter accepts coded electronic pulse information coming from copper wire.

- Harish Agarwal

ADSS is a self-supporting optical fibre cable. It has no metal component and can be installed on live lines with no outages. Hundreds of thousands of miles of ADSS have been installed all over the world, on power lines rated up to 500kV.

Area of Application

- On Power Lines
- On Street Light Pole
- From Pole to building.

Cable Selection

These cables can be designed for almost any combination of environmental and sag/ tension requirements. Based on our detailed survey of site conditions, we supply an optimal choice of ADSS cable with other accessories.

ADSS Installation Technique

The lifetime of ADSS on power lines will depend on the following factors

Aeolian Vibration is caused by low velocity wind blowing across a cylindrical conductor under tension. Vibration dampers help controlling Aeolian vibrations and ice induced galloping effects.

Corona discharge on ADSS cable generally occurs due to generates of high electrical field and in the long run causes puncture and failure of cable jacket. For protection of the cable we provide corona rings/ coils.

- High voltage conductor induces space potential on fiber optic cable
- The voltage difference between the grounded armor rod and cable generates a longitudinal field along the cable jacket
- If the jacket is covered by a conductive layer, the voltage drives a surface current along the cable.

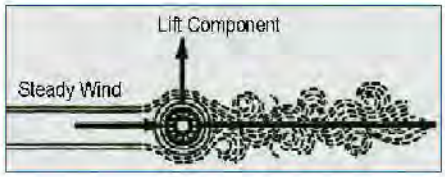
Installation of fiber optic cable on transmission line structure at a distance of 3-6 meter below the high voltage line is a general practice, which is considered to be a major cost saving installation process.

Due to this relative geometric position of the cable and high voltage line, there is a capacitive coupling between the HV line (which is at phase potential) & fiber optic cable (Which is at earth potential due to grounding of armour rod used for gripping the cable).

The electric field caused by the high voltage line is considered to be the driving force to the flow of electron through the contaminated layer that accumulates on the fiber optic cable as a result of its exposure to the polluted atmosphere in a long run.

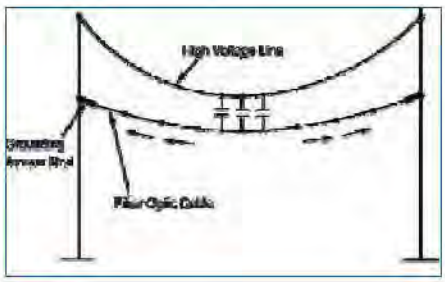
The electron flows towards the grounded armour rod and generates

Wind Velocity and Aeolian Vibration

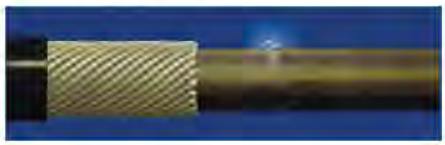


Corona Effect

Space Potential Effect

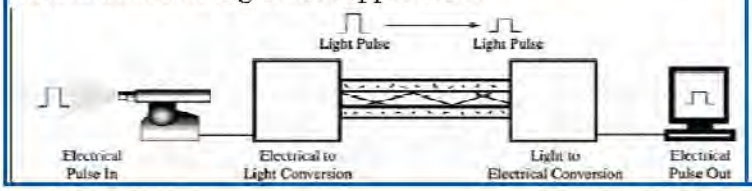


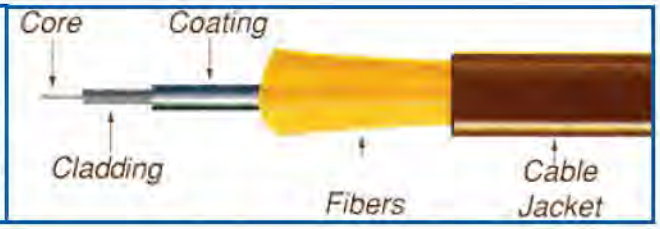
Dry-Band Arcing

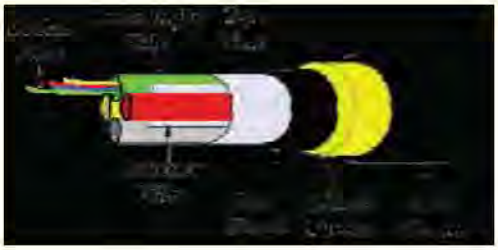


Electrical	Mechanical	Environmental
1. Space Potential Effect	1. Span Lengths and Sag	1. Wind Velocity and Aeolian Vibration
2. Corona Effect	2. Tension on Cable	2. Sheath Composition for UV Resistance
3. Dry-Band Arching		3. Temperature and Pollution Level.

information coming from copper wire.





OPGW-[Optical Power Ground Wire]	WRAP	ADSS - [Aerial Dielectric Self-Supported]
		
Provides grounding & protection form lightning stroke	Hot line installation is difficult	Installed at the center of Pylons/Poles/ Structures
Used in SCADA network	Cost more than ADSS, but less than OPGW	Cost much less than OPGW or WRAPtype
Requires long term outage	Need Shield Wire	Suitable for hot line installation without deenergization of line
Expensive	No operational problem is observed	Large Fibre capacity
Live line replacement of existing OHGW possible		

Advantages of Fibre Optic Cables over Traditional Wire Cables	
• Easier and Cheaper installation • Many more fibres and channels per cable • Uses light signals • Consumes low power • Carries digital signals • Non-Inflammable • Flexible	• Does not cause EMI effect (Electro Magnetic Interference) • Easier to access without transmission circuit outage • Easier and faster to repair and ideal for using in existing network • Does not experience temperature rise in the event of lightning strike. • Quick installation with no R.O.W. clearance required • Can be easily installed on road/ river crossing and hilly areas.

certain amount of heat, which may dry the wet contaminated layer if there is no rain fall or small quantity of moisture in the atmosphere, resulting formation of small dry band near the armour rod causing an obstruction to the flow of electrons.

When voltage difference across this band crosses the threshold level, electric arcs known as dry-band arcing gets generated causing degradation to the outer sheath and eventually the load carrying layer of the cable.

The continuation of such effect in a long run can cause the cable to tear under its own weight.

To remove Dry-band Arcing suspended armor rod assemblies with non-ceramic insulator is being used to break the arc current paths.

Fitting for Optical Fiber Ground Wire

Optical fiber overhead ground wire is a type of cable that is used in the construction of electric power transmission and distribution lines. Such cable combines the functions of grounding and communications. An OPGW cable contains a tubular structure with one or more optical fibers in it, surrounded by layers of steel and aluminum wire.

The OPGW cable is run between the tops of high-voltage electricity pylons. The conductive part of the cable serves to bond adjacent towers to earth ground, and shields the high-voltage conductors from lightning strikes. The optical fibers within the cable can be used for

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- Stringent quality / process control.
- Present manufacturing capacity of about 35,000 MT / annum
- We have various certifications
  - ISO/TS 16949:2009
  - ISO 9001:2008
  - ISO 14001:2004
  - UL approval for NEMA MW-24C, 35C, 73C, 76C, 79C & 80C
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high-speed transmission of data, either for the electrical utility's own purposes of protection and control of the transmission line, for the utility's own voice and data communication. The interior of these conductors is quite sensitive.

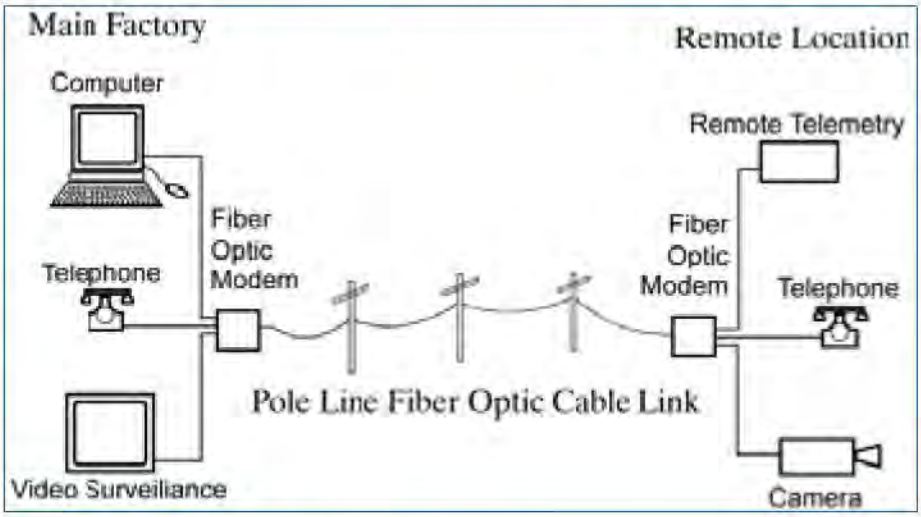
This is why it is not advisable to use standard suspension and dead end fittings as they apply radial forces that are inadmissibly high to the conductor.

For this reason, spiral fittings or specially adapted end clamps are used. These fittings distribute radial forces over a longer length of cable.

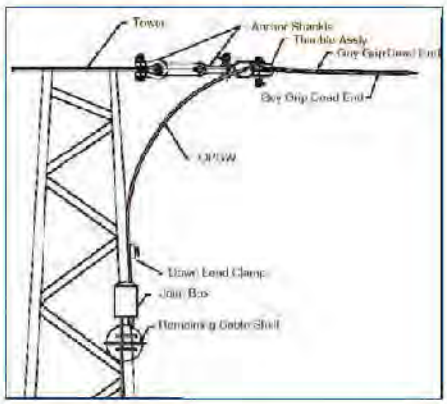
Optical overhead line cables that are free from metal and covered can not be used as earth wires due to their dielectric structure. Lower-voltage distribution lines may also carry OPGW wires for bonding and communications; however, utilities may also install all-dielectric self-supporting cables on distribution pole lines.

- **Opgw Joint Box Mounting:** The joint box for OPGW is used to protect and fix the spliced fiber. It is made of aluminum alloy. The aluminum alloy outer keep the cables firmer. It is waterproof dustproof and antirust. It is also tensile stressed.
- **Downlead Clamp:** The down lead clamps are used to fix the cable to the tower in the down lead to the joint box. Fiber optic down lead clamps is designed to attach fiber cables to structures without causing undue stress to the optical fibers. The down lead clamp consists of two parts; the clamp base and keeper. Every clamp contains two grooves which accommodates a specific range of cable diameters.
- **Vibration Damper:** The dampers are used to damp the cable vibrations. The number of dampers is determined by the environmental conditions, the distance between towers, the type of OPGW cable and the installation parameters. Vibration at clamp location. Create alternate bending stress on cable strands which may result in breaking of the strand. To reduce vibration, damper masses are attached to the cable to damp the vibration by transferring the vibration energy to heat energy generated by the inter strand friction in the messenger wire of the damper.
- **Opgw Suspension Assembly:** Suspension assembly especially designed for OPGW cables that Includes grounding clamps for tower connection. According to requirement we can use different brackets.
- **Opgw Dead End Assembly**: The deadend's helically formed rods transfer the load from the structure Attachment to the structure is provided with the

Fiber optics in an industrial environment



Few Fibre Optics & ADSS Accessories



Over Five Golden Decades of dedicated service to Power Sector

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

CPRI

TESTING & CERTIFICATION

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

RESEARCH

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

3MV, 150kj Impulse Voltage Generator

CONSULTANCY SERVICES

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

TRAINING

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

ACCREDITATIONS

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

केन्द्रीय विद्युत अनुसंधान संस्थान

CENTRAL POWER RESEARCH INSTITUTE

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Your Trusted Partner In Testing and Research In Power Sector

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Erection of Tower for Testing

Cable Testing

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

convenient built-in loop of the dead-end. The dead-end component transfers the axial tensile forces without distortion to the structure and cable.

Optical Fiber Ground Wire Enclosure

An optical fiber enclosure system having storage and splicing enclosure and one or more termination enclosures. The storage and splicing enclosure contains ports on all four of its sides that allow external fiber optic cables to access the interior of the enclosure.

The storage and splicing enclosure includes hardware for storage of excess optical fiber and outer protective cabling components, grounding and securing spliced optical fibers.

The termination enclosure includes hardware for mounting modules for terminating optical fibers. Attached to the termination modules are optical fibers that extend from the termination enclosure through ports in the termination enclosure and storage and splicing enclosure and into the storage and splicing enclosure.

Those optical fibers are spliced to optical fibers forming the fiber optic cables in the storage and splicing enclosure.

Additional fiber optic cables attached to the termination modules exit the termination enclosure through ports and run to an equipment rack at the customer premises where the optical fibers can be attached to customer equipment.

Optical Joint Box

The joint closure can be used for both outdoor and indoor installations. It can be used as a line joint, butt joint, for mid-span access or as a termination box.

The joint closure can be mounted on walls, in manholes, cabinets, racks or be buried directly in the ground. Joint closure made of stainless steel for mechanical protection of optical fiber joints. The closure comprises a bottom, a cover and separate cable bushings. The cover is mounted with screws.

Properties of OPGW Joint Box

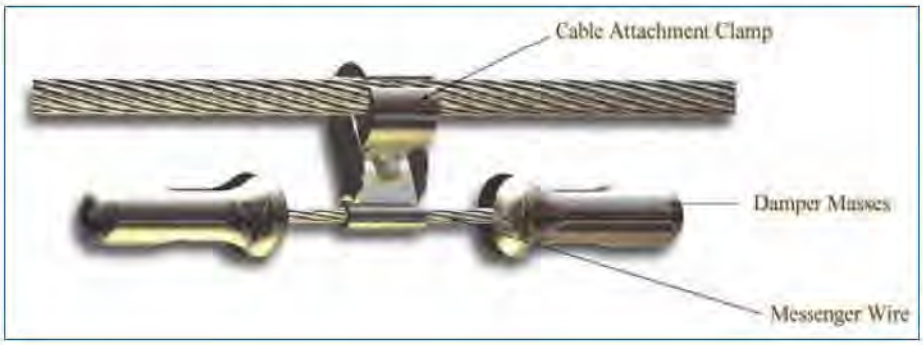
- Optical fiber ground wire joint box has excellent mechanical and protective property from external adversities.
- Suitable for different types of diameter trunk and distributing optical cables.
- Good for grounding system.
- Reliable sealing measurement.

Outdoor Optical Joint Box

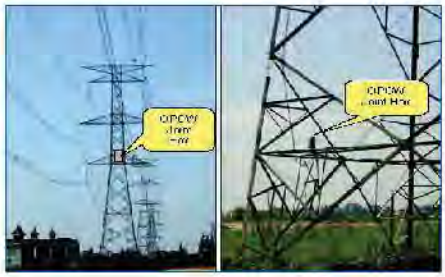
Application

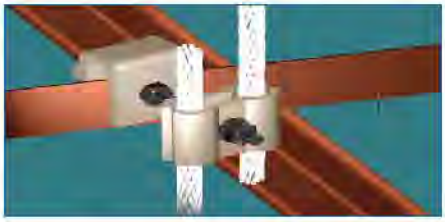
The outdoor optical joint box can be applied for jointing metallic optical cables (such as OPGW, Underground.

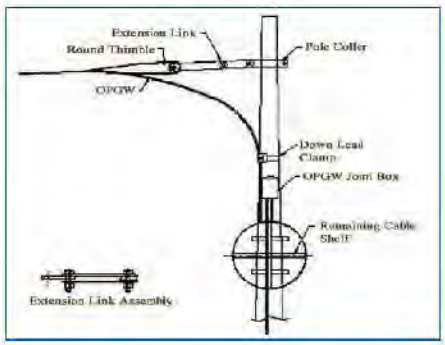
Metallic Optical Cable), non-metallic optical cables (such as ADSS, Non-metallic dust optical



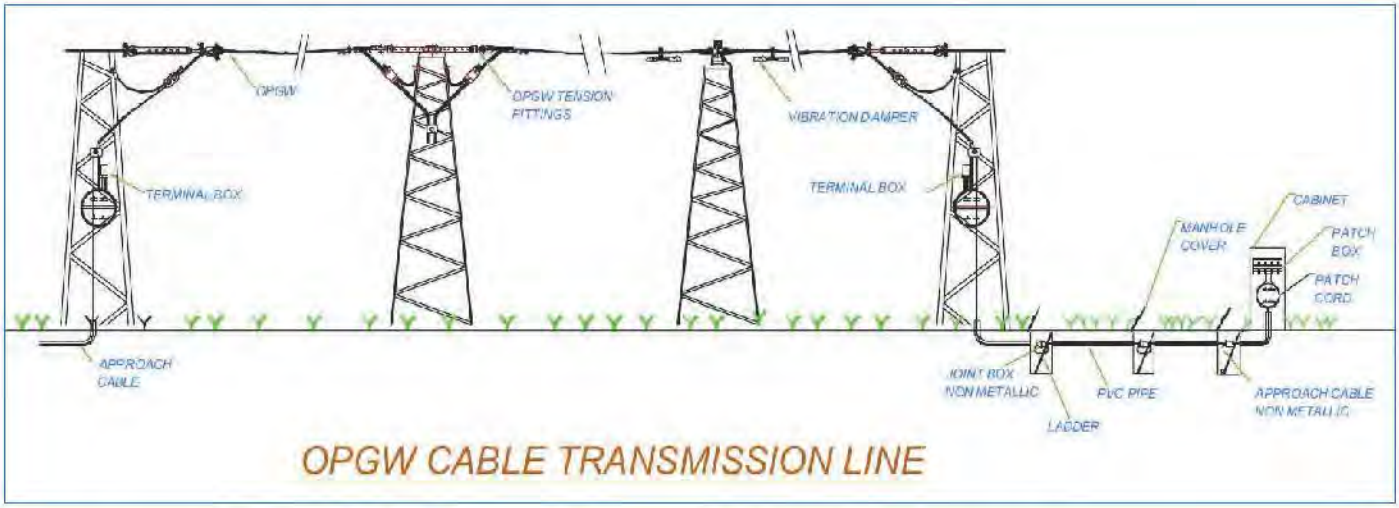
Location of Joint box fixed on tower



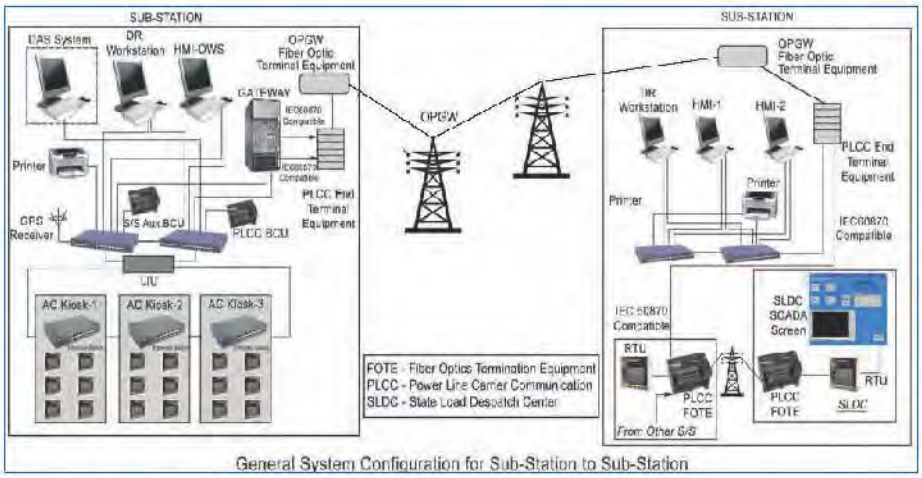




Types of Optical fiber enclosure



OPGW CABLE TRANSMISSION LINE



General System Configuration for Sub-Station to Sub-Station

Optical Joint Box Layer - 3

cable) in the open air. The spliced fibers are well protected in a closed, air-tight box.

Features

- The main composing metal parts are made of stainless steel. They are excellent in corrosion-resistance.
- The main parts include case and end plate, splicing trays, fiber protect tube, seal washer (i.e. O-ring), sealant which insure waterproof, moisture-proof and resistance of high current.
- The number of splice tray is according to the number of fibers to be fused. A optical joint box can host up to 144 fibers.
- The end plate can be disassembled repeatedly for maintenance. ■

Harish Agarwal
CEO
Supreme & Co Pvt Ltd
Kolkata

How Thermal Imaging improves Substation Surveys

California Utility Turns Up the Juice on Inspections with More FLIR Cameras

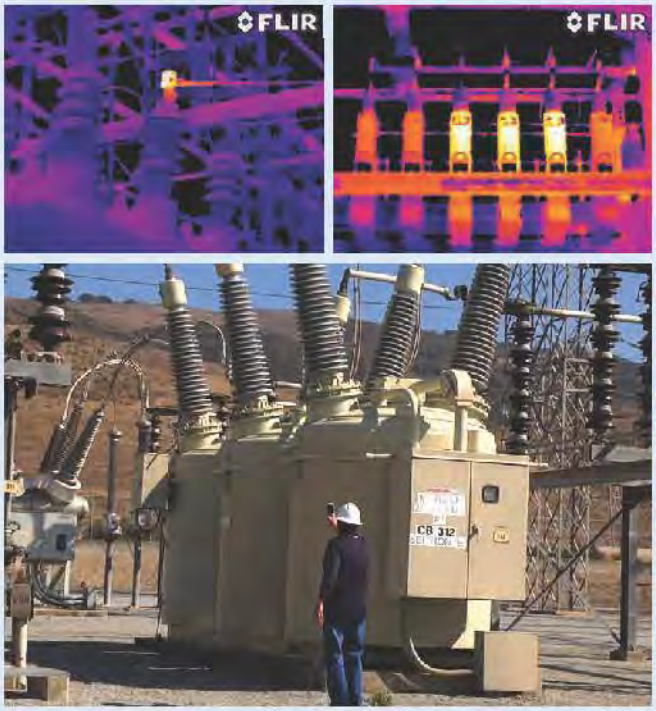
When PG&E decided to add over 200 new FLIR i7 thermal imagers recently, Substation Maintenance and Construction Supervisor Ray Friend explained the reason was simply a matter of common sense. "Safety is always the first thing we want to think about. And a big thing I get from talking to the people now using an IR camera is the confidence it gives them in the equipment they're going to be working on. They want to know if something is operating [within safety parameters] the way we expect it to, whether it's oil-filled equipment or an air switch under load." Friend says crews now routinely do a quick scan to look for unusual hotspots on a variety of components that may need maintenance. "If you're required to stand at the end of a 16-foot disconnect stick, ready to rip a switch open, you want to be able to trust that the switch is properly adjusted and going to do what it's supposed to... that's what the camera gives us." In other words, it helps them see heat anomalies that signal potential danger.

More IR Scans More Often

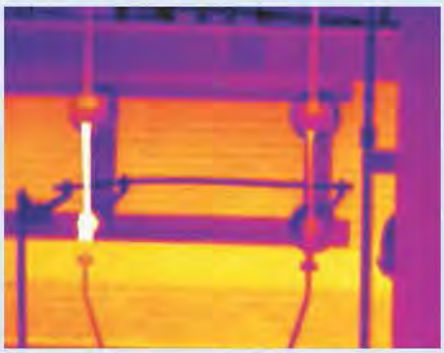
While PG&E continues to use high performance FLIR cameras for their more intensive and detailed IR inspections, Friend said the low-cost i7s make it possible for his team to use thermal imaging more frequently on their rounds and on a moment's notice. "It's simple to operate... there's no rocket science involved... you can interpret things easily on the screen... all you need to have are a [few] instructions as to what to look for. And it's portable and seems to be very rugged. We have them in trucks bouncing around and have had no issues." Since electrical equipment tends to get hot before it fails, Friend says it's good to have a FLIR handy. "Normally what they're finding is loose connections, switches out of adjustment, regulators and breakers that are running too hot. They're also finding oil-filled bushings and other equipment with abnormal temperature differences that indicate a lack of cooling." ROI: Repair vs. Replace For example, an electrician doing a routine substation inspection in the San Joaquin Valley not long ago was passing within five feet of an energized transformer bank and quickly became alarmed. "Normally, you would expect it to give off some heat but this thing he could instantly feel on his face," Friend recalled. "So he immediately grabbed his i7 from the truck and took a picture and verified within seconds that there was an issue...it was white hot. He called his supervisor from his cell phone and was able to show what the thermal camera saw. The supervisor immediately took that thing out of service." According to Friend, once offline, they found there was absolutely no oil flow in the transformer. "By catching it in time, we spent only about $300,000 to repair that transformer bank. That's a major savings compared to the roughly $3 million to replace it, which we would have had to do if it had completely failed and been destroyed." Friend pointed out that the week-long repair work requiring a crew of six was a quick turnaround. In fact, it's about one-sixth of what it would have taken to wait for a replacement, if they could have found one in that time-frame since sometimes delivery on such equipment can span months. Fortunately, in this particular substation location, detecting the problem early and distribution work-arounds helped the company and customers avoid the impact of a serious outage.

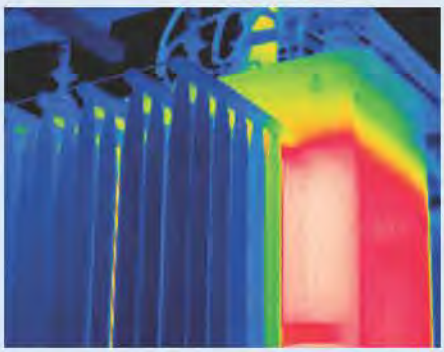
An Ounce of Prevention

Friend says that across the board thermal cameras have allowed PG&E to find issues early that would have eventually shown themselves but perhaps under more serious circumstances. "We're catching them a lot sooner in time to deal with it



properly and safely long before it fails." That gives PG&E much better control over a situation, allowing them to more effectively target and plan repairs that help prevent expensive emergencies and shutdowns. With the ability to uncover hidden problems well in advance when they can still be repaired instead of being replaced, Friend feels affordable point and shoot IR cameras like the FLIR i7 pay for themselves in no time. "If you can spend a nickel today rather than ten dollars tomorrow, why wouldn't you want to spend it now? It just makes sense operationally and safety-wise."





Covering More Ground

Efficiency is also a factor. Inspections go much faster with thermal imagers than they do with IR thermometer guns, for example. That's because temperature guns require scans to be performed close to the target for accuracy, only provide one reading at a time, and don't produce a picture, making surveys of the many electrical components in a substation a painstaking process.

Compare that to the instantaneous images and thousands of detailed measurements you can capture from a safer distance with a thermal camera, and the potential for increased productivity becomes obvious.

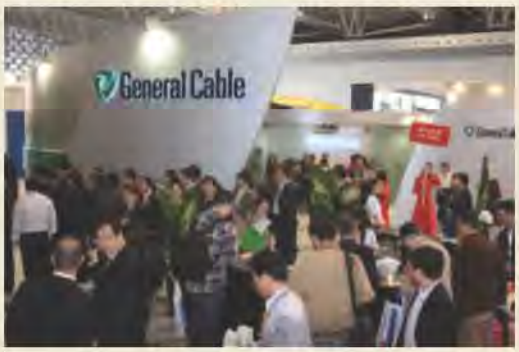
Bottom Line

As Ray Friend put it, "If you look at PG&E's vision, where we're providing reliable, safe energy to the public, any tool like this that allows us to do that, to help prevent outages and catastrophic failures it's got to pay a lot of benefits both to the company and to the public." ■

Courtesy: Flir Systems Inc.

Specialized Theme Halls Facilitate Business Matching 1,000 International Exhibitors in 8 Exhibition Halls

Organized by China Electricity Council and Adsale Exhibition Services Ltd, EP exhibition is held alternately in Beijing and Shanghai. The fair is widely recognized as the largest and the most established electric power equipment exhibition in China. With its establishment in 1986, the forthcoming EP China 2014 (The 15th International Exhibition on Electric Power Equipment and Technology) will be staged in Beijing on October 22- 24, 2014. The Organizer expects to attract 1,000 exhibitors from over 20 countries and regions, with over 25,000 trade visitors from China and overseas. The last edition – EP Shanghai 2013 drew its curtain with great success in Shanghai last October. The exhibition had a historical breakthrough in terms of exhibition scale and number of exhibitors, and was attended by 25,323 trade visitors from 52 countries and regions. Over 10 conferences and seminars were well attended by more than 1,000 industry professionals. There were also 25 buyer delegations from regional power supply bureau, electric power associations, power engineering companies, power design institutions, etc. Over 800 leading global suppliers from 22 countries and regions exhibited, and 81% of them were satisfied with their achievement in the fair.



Built on the success of EP Shanghai 2013, EP China 2014 has been receiving overwhelming responses from the exhibitors. World-renowned suppliers, including ABB, General Cable, Siemens, Schneider, Linbo, Hyundai, Legrand, Huaming, Rittal, CHINT, Deba, Deca, Emerson, S&C Electric, AEG, 3M, etc. booked their prominent booth space in EP China 2014. At the same time, overseas pavilions will join again from the United States (U.S. Embassy – Commercial Service), Germany, and Taiwan (Taiwan Electrical and Electronic Manufacturers' Association).

With the rapid growth on exhibition scale and the increasing number of exhibitors and visitors, EP China 2014 will highlight several theme halls with specialized promotion programs to facilitate the business matching between exhibitors and visitors. These theme halls include

- Smart Grid Equipment & Technology
- Electric Power Automation Equipment & Technology
- Cable, Cable Accessories and Cable Manufacturing
- Building Electricals
- Environmental Power

On top of these, "Brand Hall" will be newly featured to gather world-renowned brands. Nearly 70% of the "Brand Hall" area has already been booked / reserved. The Organizer aims at attracting more international leading suppliers and gaining larger publicity with the premium and customized services at this hall.

Under the brand of EP China, the Organizer has been putting effort to go for specialization and to strengthen the edge on its internationalization, for both exhibitors and visitors. Over 1,900 overseas visitors from 52 countries and regions attended the previous EP Shanghai 2013, which accounted for 7.6% of the total. The Organizer aims at increasing the proportion of overseas visitors to over 10% in the coming EP China 2014, so as to better help the Chinese and JV exhibitors to explore the export markets. ■

'Go Global'

11TH INTERNATIONAL EXHIBITION OF ELECTRICAL AND INDUSTRIAL ELECTRONICS INDUSTRY
ELECRAMA-2014
8-12 JANUARY 2014, BIEC, BANGALORE, INDIA

Electrical India participated in the 11th edition of IEEMA's premier flagship event that drew a very encouraging response from the clients and visitors turning in large number at its booth. The world's largest exposition of electrical transmission and distribution equipment, at BIEC was a resounding success beating all previous records.

Spread over six halls, having a gross area in excess of 70,000 Sq mtr, ELECRAMA-2014 hosted 805 exhibitors from India and 165 from 25 countries and provided globally comparable event experience at India's leading world-class BIEC exhibition centre in Bangalore. As the world's largest confluence of the power T&D community, ELECRAMA-2014 showcased products and technology through the entire voltage spectrum, from 220 V to 1200 kV, conforming to global standards and specifications.

ELECRAMA-2014 received an overwhelming response and attracted record number of visitors from the global electrical industry fraternity. The event was supported by the Ministry of Power, Ministry of Heavy Industries & Public Enterprises and Ministry of Commerce & Industry, Government of India. For the first time ELECRAMA received state level support. The Government of Karnataka, the Host State extended unstinted support. Further BESCOM was the Distribution Utility Partner and KPTCL was the Transmission Utility Partner. KREDL the state renewable energy department also supported the Event.

This time around for ELECRAMA-2014 internationally renowned industry leaders agreed to be the Brand Ambassadors and included Gregoire Poux-Guillaume, President, Alstom Grid; Jean Pascal Tricoire, Chairman & CEO, Schneider Electric SA; Tony M. Gatt, President, Energy Division; and R N Nayak, CMD of Powergrid Corporation of India.

ELECRAMA-2014 had a unique theme of 'Go Global' and the objective was to showcase to the world the strengths and capabilities of Indian manufacturers and the global competitiveness of electrical equipment manufactured in India "right technology at the right price". It provided a platform to promote the "Made-in-India" brand to a global audience.

Representatives of 50+ Indian Central and State power utilities, including over 45 chairmen, MDs and directors, were exposed to the latest products and technology on display. Procurement officials of power utilities from across the world visited exhibition to get a first-hand view of the wide array of electrical equipment manufactured in India.

Inauguration

ELECRAMA-2014 was inaugurated by Siddaramaiah, Chief

Minister of Karnataka on 8th January 2014, D K Shiva Kumar, Energy Minister of Karnataka; Devendra Chaudhry, Additional Secretary, Ministry of Power, Government of India; amongst others were also present. In his inaugural address, Siddaramaiah, called on the Indian electrical equipment industry to play a vital role in improving the country's power infrastructure and asked the manufacturers to rapidly absorb new technologies to meet the evolving global standards for efficiency and sustainability.

Shiva Kumar conveyed the happiness of the State Government to partner with ELECRAMA-2014 as Karnataka continued to be in the forefront of the country's industrialisation. Chaudhry highlighted that India was on the threshold of a major power revolution and would add 100 GW of power generation capacity in the 12th Plan period, one of the biggest additions of power capacities in the world.

CEO Summit

On the evening of 8th January 2014, the third IEEMA CEO Summit was organised concurrently with ELECRAMA-2014, on the theme 'The Power Situation in Karnataka and the State's Plan to Support Industry with Power'. Eminent Panelists for the event were. D K Shiva Kumar, Energy Minister of Karnataka; and Kaushik Mukherjee, Chief Secretary of Karnataka. Mukherjee stressed on the need to concentrate on solar energy generation and expressed optimism on the potential of India to become the solar energy leader of the world. The evening was attended by around 200 CEO/MDs. The panel discussion was conducted by Ms Mini Menon of Bloomberg TV, followed by a short entertainment programme featuring internally renowned artists like Grammy Award winning percussionist Bickram Ghosh and globally acclaimed keyboardist Stephen Devassy.

International T&D Conclave

For the first time IEEMA organised an International T&D Conclave at ELECRAMA-2014 on 9th January 2014 to present global business opportunities to the tune of USD 30 billion to the participants from the Indian T&D equipment industry. Subramaniam V Iyer, Director, Department of Sustainable Energy, The World Bank spoke about the Bank lending USD 8 billion globally to entities producing and transmitting power, including India. Estimates put the need for incremental global investments of USD 100 billion for power (including renewable sources), where the share of T&D equipment and services is expected to be around 20-25%, indicating a remarkable growth opportunity for Indian T&D players.

CIGRE Technical Sessions

For the second time, presentations by globally eminent CIGRE Experts were organised by IEEMA and CIGRE India to share recent technological advancements in the power systems concurrently with ELECRAMA-2014 on 9th January 2014. N. Murugesan, DG, CPRI, inaugurated the Sessions.

ChangeXchange 2014 – 2nd Reverse Buyer-Seller Meet, 9-10 January 2014

ChangeXchange 2014 - 2nd Reverse Buyer-Seller Meet (RBSM), organised concurrently with ELECRAMA-2014 was a resounding success, with 6,000+ meetings done by foreign buyers spread over 9th and 10th January 2014. Indian Sellers (ELECRAMA-2014 exhibitors) expressed a great

deal of satisfaction over business conducted at the RBSM resulting in an estimated business generation of over USD 150 million.

RBSM was organised with support from the Department of Commerce, Ministry of Commerce & Industry, Government of India, under the Market Access Initiative (MAI) Scheme. ChangeXchange 2014 was much bigger and power-packed than the first edition and was attended by 400+ buyers from 42 countries of Africa, ASEAN, Latin America, SAARC and Iran.

Power utility companies were the top draws. Seminar on New Generation High Performance Conductor, 10th January 2014

For over a hundred years, electricity has been traditionally delivered using bare overhead conductors such as ACSR and AAAC. However, industry today is in a flux of changes, resulting in shifting to next generation of conductor technology, that is High Performance Conductor (Low Loss and High Temperature Low Sag Capabilities). To showcase the next generation conductor technology to

the users, a Seminar was organised on 10th January 2014 concurrently with ELECRAMA-2014 giving insight to the participants to understand in detail about the types of HPC and their benefits, stringing techniques, types of hardware used, etc. Speakers included S K Negi, MD GETCO; Mataprasad, renowned technocrat; Surender Kumar, PGCIL; Ajay Bhardwaj, Sterlite Grid; and Shubhranshu Pattanaik, Deloitte. The Seminar was attended by 175+ participants from various power utilities across India.

TRAFOTECH 2014, 10-11 January 2014

TRAFOTECH 2014, the 9th International Conference on Transformers was held on 10th and 11th January 2014 concurrently with ELECRAMA-2014, with the theme 'Transformers for Smart Grid'. B.N. Sharma, Joint Secretary, Ministry of Power, Government of India, was the Chief Guest at the inaugural session and addressed the more than 500 delegates. There were six technical sessions on - Transformer Applications for Smart Grid; Transformer Efficiency; Reliability through Materials, Accessories and Processing; Sustainability Issues for Transformers; Towards Maintenance Free Transformers; and Fail Safe Transformers. In all 54 papers including 21 from overseas were presented over the two days of the Conference.

Engineer Infinite 2014 and Innovation Day

ELECRAMA believes in the power of the future, more so in the power of the youth and the student, and the Engineer Infinite initiative is geared towards unleashing the creative potential of this powerful youth, for the benefit of this country, and for the world itself. Engineer Infinite 2014 included recent trends in the subjects related to electrical energy sector, IT and computer science branches along with the traditional 'electro technology' branches. It received an overwhelming response and widespread participation from all over the country with more than 1,800 entries + a highly filtered 74 were selected for final display and demonstration during ELECRAMA-2014. The Innovation Day event ended with the prize distribution for the Best Student Projects of Engineer Infinite 2014 competition. A Jury of eminent persons from diverse engineering backgrounds did a thorough evaluation of the projects on display and decided the winners.

Awards to Exhibitors at Exhibitors Nite- JOSH 2014

IEEMA awards the efforts and entrepreneurship of the exhibitors who participate in the show. The exhibitors participated under different categories with different space allotments for the Best Stall and Best Product categories. The Jury was selected based on their strong technical expertise and long industry experience. About 75 entries were received for the Best Product category and the assessment was made based on parameters like innovation, usability of product in long run, energy saving criteria, etc.

The following products were chosen as the winners for Best Product under various categories:

- Overall Product developed by an Indian or Foreign Exhibitor: Omicron Energy Solutions Pvt. Ltd. for CIBANO 500 & OMS 605
- Best Product developed by an Indian Exhibitor: Larsen & Toubro Ltd. for AU series of Final Distribution Products – A Complete Solution
- Certificate of Appreciation: Sterlite Technologies Ltd. for ULTRAEFF Low Loss Cable
- Best Product developed by an Indian Exhibitor in Small Scale Sector: Jognics for Mpp Capacitor Winding Machine.

The Best Stall contest had a separate Jury under each category that included eminent Architects and Planners, Corporate Communications Consultants, Industry Counsellors, etc. The assessment was made taking into consideration various parameters which included overall appeal, optimum use of space, branding and brand projection, use of green materials / technology, innovation in products, behaviour of stand staff towards visitors etc.

On January 11, 2014, over 2,300 participants enjoyed the scintillating musical evening with dinner by Chairman ELECRAMA-2014. ■

Importance of Halogen Free Wires & Cables

Fire Safety is a crucial factor that consumers need to consider while choosing electrical installations. With the growth of high rise buildings, multiplexes, modern offices, malls, retail outlets, basement parking, underground metro stations, electrical installations in such locations play an important role in providing more comfort to the community at large. It is an imperative need of the hour to educate the electricians and the customers on the important safety standards, components of the cables and the selection of proper cable system to avoid fire accidents which have become rampant today.

Electricity is an essential part of our daily life but most of the times people tend to overlook the consequences or threats associated with electrical hazards until it is too late. The growing infrastructure requirements and increased usage of electrical equipment in our personal and professional life call for a higher level of awareness about electrical installations. Of late, there have been several instances of fire accidents, most of them attributed to electrical short circuit and usage of improper cable systems. In today's connected society wires and cables have become integral part of our homes, offices, public place and industries and are extensively used in electrical and electronic equipment for power supply, control/signal, internal connections and communication from one device to another.

A lot of buildings have been using wires that are predominantly insulated by PVC, which contain chlorine. In the case of a short circuit, the cable catches fire to emit chlorine and reacts with oxygen present giving out dense toxic smoke and also emits corrosive acids. This toxic smoke emitted, numbs the brain activity, causes irritation, impairs vision and prevents a person from locating a safe exit thereby creating panic during emergency situations. According to research, around 15% of fire accidents occur due to the poor quality of wiring. Adoption of poor wiring solutions can lead to damaging lives and property and hence there arises a need for safe cabling solutions.

The most effective way to minimise the fire incidents is using Halogen free wire and cables. Halogen free wire and cables have an insulation which are free from halogens. (namely chlorine, bromine, fluorine, iodine) which are the main cause for releasing huge amount of toxic smoke and corrosive acids when the wires burn. Sustained exposure to toxic smokes when inhaled leads to serious damage or even fatality. The effect of emission of toxic gases is largely heightened within enclosed spaces where people have limited means of escape.

The prime benefit of HFFR wires and cables is that they stop flame propagation through the sockets in which they are laid. They do not emit acidic gases, in-turn reducing the fatality because of smoke.

These cables are used in all locations where a high degree of protection against fire and fire damage has to be provided, including:

- Public buildings
- Residential buildings and Commercial buildings
- All kind of industries especially where safety is the main concern.

HFFR formulations are used in thermoplastic and cross-linked wire and cable applications, with the majority of compounds used in sheathing applications. Ethylene vinyl acetate (EVA) is an essential polymer in HFFR compounds, with higher VA levels improving filler loading, flame retardancy and flexibility.

Exact plastomers are an ideal blend partner for EVA to improve compound viscosity and thermal properties, while Exxelor polymer resins optimize the bonding between the polymer and the filler.

Furthermore, Fire Survival (FS) cables sustain their composition, thus providing protection against short circuit even while burning under fire.

The building developers need to keep in mind the following:

- Conductors for internal wiring should be of copper. Conductors for power and lighting circuits should be of adequate size to carry the design circuit load without exceeding the permissible thermal limits for the insulation.
- Do not use any aluminum conductor cable for internal wiring
- Use copper wire made of pure electrolytic copper for optimum current carrying capacity.
- Plan for adequate number of plug points for now and for the future to avoid over loading of circuits.
- Use low fire hazard cable for fire safety and damage of property as well as human being in fire situation.
- Ensure independent circuits for each room and keep higher load instruments like AC's, Geysers, Heaters, and Irons etc in separate circuits.
- Isolate each major circuit and connect to a MCB.
- Follow right earthing process to avoid electric shock. Use copper wires, plates and rods for earthing. ■

Courtesy: Sanjeev Kumar Lakhotia - Field Application Engineer, Lapp India

Southern Grid Connectivity is a Landmark Achievement for the Power Sector

Historical Power Generation Capacity Addition of 21 GW During 2012-13
Bids for Odisha & Cheyyur UMMP to be Opened on 26th February

An historical 21 GW of capacity addition took place during the financial year 2012-13 and more than 8700 MW of capacity addition has been achieved by December, 2013 for the financial year 2013-14. The total installed capacity in the country at present stands at 236 GW. This was stated by Jyotiraditya Scindia, Union Minister of State (I/C) of Power while addressing the media in New Delhi. The Minister disclosed that total installed capacity of 400 GW will be required by 2022 to meet the power demand, which is a huge challenge for the country.

Scindia opined that availability, adequacy, and affordability have to be the crux of power sector strategy in India. For this, the emphasis of power sector development should be on capacity addition, transmission and last mile connectivity. In a major achievement, the southern grid connectivity was achieved three months ahead of schedule with the commissioning of 765 Kv Raichur-Sholapur Transmission line on 31st December, 2013. With this the power system has stepped into a new era i.e., One Nation, One Grid, One Frequency, the minister added. He said that the country will have the largest transmission capacity in the world in the next four to five years. The RGGVY scheme has been extended to the 12th Plan and for the balance of the 13th Plan, covering habitations with the population of 100 and above. More than Rs. 35000 cr have been approved for the completion of the scheme in the 13th Plan.

Speaking about the supply of gas to the coal sector, the Minister said that after the latest decision of the Govt. to cap the supply of domestic gas to the fertilizer sector, nearly 9 MMSCMD of additional gas will be available to the power sector over the next three years. The Minister admitted that the shortage of gas supply has become a matter of concern since nearly 20 GW of capacity is tied up in gas based power projects.

With respect to the supply of coal to the power sector, the Minister said that a remarkable achievement has been signing of 157 FSAs with total capacity of 72 GW out of a total of stipulated 78 GW in a record time of 2 and half months. He disclosed that 9 applications have been received for Odisha UMPP and 8 for Cheyyur (Tamil Nadu), the bids for which will be opened on 26th February, 2014.

The Minister elaborated that several level of redundancies have been put in place and these mechanisms are now institutionalized to ensure grid security. Frequency band has been tightened which is now closer to international norms and congestion charges have been imposed to ensure that everybody follows the guidelines. Similarly, autonomy to POSOCO is also under process.

The Ladakh region of J&K will be connected with the National Grid soon since the Cabinet has approved the transmission project between Srinagar and Leh along with the associated transmission lines as well as sub stations. This will enable remote areas of Leh and Kargil to benefit from the much needed power supply during winter as well as allow evacuation of excess power in summer from NHPC Power Plants of Nimmo Bazgo, and Chutak recently commissioned in the Leh/Kargil area. Ministry has been working closely with the Ministry of Environment and Forests for speedy clearances. More than 4800 MW of Hydro Capacity received wildlife/ environment/forest clearances recently as a result of these efforts. Similarly, E-GoM has been set up to expedite Hydro Projects in Arunachal Pradesh.

Speaking on the issue of subsidy on power, the Minister said that if the states wish to give subsidy on electricity, then they must re-imburse the subsidy amount to the concerned DISCOM immediately to ensure revenue neutrality of the DISCOM.

The Financial Restructuring of DISCOMs is doing well in the four states of Tamil Nadu, Rajasthan, UP & Haryana with an FRP amount of Rs 95,247 cr finalized and bonds worth Rs 46,707 cr already issued. ■

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Parker Hannifin India is pleased to announce the launch their new series of AC variable frequency drive, the AC30V Drive. Engineered specifically for flexibility, simplicity and reliability, the AC30 series of variable frequency AC drives covering a range from 0.75 kW to 75 kW . AC30 drive has been designed to provide users with exceptional levels of control, from simple open-loop pumps and fans through to closed-loop process line applications. Its flexible and highly modular construction enables a wide range of communications and I/O modules to be easily added as required. The AC30 has been designed with simplicity in mind, but this doesn't compromise its functionality. Integrated macros for a range of applications and PLC functionality enable more capable users to create sophisticated control that would previously have required a separate PLC. Designed for operation in environment class 3C3 and 3C4 for Hydrogen Sulphide (H2S) as standard (tested at 25 ppm for 1200 hours), temperatures up to 50 °C with optional integrated EMC filter to C2 1st environment and DC link choke to reduce line harmonics. AC30V also complies with RoHS substance restrictions in accordance with EC Directive 2011/65/EU. AC30 variable speed drives give comprehensive and cost effective control of either AC induction or permanent magnet (PMAC) servo motors and are suitable for the Open- and Closed-Loop Control of Pump, Fan and many other General Purpose Applications. Availability : The new AC 30V Drive will be available from the state of the art Parker India modern Manufacturing facility at Mahindra World City near Chennai, well equipped to cater to sophisticated industrial automation systems and solutions. The factory comprising of a manufacturing

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Jyoti Ltd. introduces **'Jyoti Ring ™ '** a SF6 gas insulated Ring Main Unit. This product has been type tested at CESI, Italy, one of the most reputed European Laboratories. The total International certification has been done as per IEC 62271-100/200/103/102.

Design of the Jyoti Ring is modular & any combination is possible as per customer's requirement. There are three basic modules :

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- ❖ Direct Link (Type - D) - 15.5kV, 21kA, 630A

The Type tested ratings of the Jyoti Ring are as follow

Rated Voltage	15.5kV
Power Frequency Withstand Voltage	38/45kV
Impulse Withstand Voltage	75/85kV
Rated Frequency	50Hz
Operating temperature range	-5°C to +55°C
Rated continuous current	630A
Rated Short-time withstand Current	21kA rms, 3sec
Rated peak withstand current	52.5kA
Rated symmetrical interrupting current for VCB	21kA
Rated asymmetrical making current	52.5kA
Rated operating sequence of Circuit Breaker	O-3min-CO-3min-CO
Rated cable charging interrupting current	25A
Mechanical operating sequence CB(C-O) M2	10000
Mechanical operating sequence LBS(C-O) M2	5000
Minimum operating Gas Pressure	0.3 bar G

CESI

TEST REPORT APPROVED 82037155

Client: JYOTI Ltd.

Address of the client: J/44-59, B.I.D.C., Gorwa390 016 Vadodara - India

Manufacturer: JYOTI Ltd

Tested samples/items: Three-pole AC Medium-Voltage SF6 gas-insulated metal-enclosed switchgear (RMU) consisting of three functional units (two ring units with a load-break switch and one feeder unit with earthing switches and a vacuum circuit breaker for grounded and ungrounded neutral system for indoor application

Tests carried out: Basic short-circuit test-duties
Single-phase fault test
Single-phase double earth fault tests
Three-phase mainly active load current switching tests
Three-phase closed-loop distribution circuit current switching tests
Three-phase cable-charging current switching tests
Three-phase line-charging current switching tests
Three-phase short-circuit making tests
Earth fault breaking current tests
Cable-charging breaking current tests under earth fault conditions
Short circuit making tests

Standards/Specifications: IEC 62271-200 (2011)
IEC 62271-100 (2012)
IEC 62271-103 (2011)
IEC 62271-102 (2003)

Tests date: from November 28, 2012 to December 13,2012

The results reported in this document relate only to the tested samples/items.
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DAT-PL-284/08-00

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No. of pages: 58 No. of pages annexed: 251

Issue date: December 13,2012

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Approved: PMI - Arcidiaco Lorenzo

CESI S.p.A.
Testing & Certification Division
Testing Operations Area
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ElMeasure's new product, 'Gen Duos' is set to give a fillip to the Generator Industry

The Generator set market is a well-organized and highly competitive. The market can be broadly divided into three segments namely the small generators (15 – 75 kVA), medium generators (75.1 – 375 kVA), and large generators (375.1 – 2000 kVA). Chronic power shortages and prolific growth in certain industrial sectors beating the general slowdown are infrastructure; telecommunication, information technology (IT), and IT enabled services which are the current drivers for the generator industry. Although market prospects look upbeat, there are some challenges clouding the landscape. Import of low cost generators and price competition from the unorganized generator suppliers are some of the key restraints that are expected to curtail growth. Low-cost imports have impacted the pricing trends of domestic manufacturers, causing erosion of profit margins. The rising input cost for the DG industry such as measuring instruments, electrical cables, switches, steel and engine components has negatively impacted the growth of this sector. In order to help this industry ElMeasure had collated the requirements and customer inputs from the industry which has led them to innovate. ElMeasure's R&D engineers have burnt the midnight oil to successfully launch an innovative product, Gen Duos'. This once again reinforces the adage of ElMeasure being a trend setter. The product is unique and a first in the industry. This powerful product has been designed to replace multiple meters in the generator panel. In other words, this product will perform the functions of two or more products single handedly. Gen Duos has been designed with a unique dual display system. The kWh display is counter based and 3phase VAF display in bright red LED. This innovative feature practically nullifies

the need for multiple meters. The old version of counter meters commonly used in DG will have DIP switches for programming CT, PT ratios. Programming through DIP switches was cumbersome and prone to errors. CT, PT programming in Gen Duos is through front panel keys which eliminate DIP switches thus improving simplicity and accuracy. Gen Duos solves the problems faced by the Generator Industry in the generator control panel space. This product replaces multiple meters, reduces panel space, and simplifies electrical panel wiring thereby reducing cost significantly. ■

For further details contact:
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Transformer Winding Resistance Meter XWRM-10

Motwane have designed and developed Transformer Winding Resistance Meter XWRM-10, after extensive research on the challenges & requirements of transformer winding testing. This gives fast stability of readings of transformer winding resistance measurement within approx. one minute, for any rating and type of Transformer.

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dual channel winding resistance meter designed to carry out winding resistance measurement of two windings simultaneously. The XWRM 10 meter is intended to replace complex bridge set up with a single compact instrument. The instrument is based on four wire measurement method to measure the low resistances accurately by eliminating error of lead resistance. XWRM-10 is well protected against inductive kickback offered by transformer winding and to give stable readings on medium rating transformers. It has an auto selectable test current from 10mA to 10A as per the selection of the resistance range. The resistance range is from 2mΩ to 2000Ω with minimum resolution of 0.1μΩ. XWRM10 has got a unique feature of HEAT RUN TEST to carry out heat run tests on transformers as per IS 2026. The instrument can be operated from remote location through software. XWRM-10 has a large LCD screen with backlit and a user friendly keypad for easy operations. The newly designed XWRM – 10, comes in an easy to carry case which is IP 54 certified. The XWRM-10 is provided with heavy duty crocodile clips which are industrial grade rugged clips specially designed for durable performance in harsh industrial condition, with test lead length of 15 meters Transformer Winding Resistance Meter XWRM-10 is perfectly suitable for measurement of cold &hot winding resistances of any rating and type of Transformer. ■

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Company Profile

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Skippers were established in 1986 and in 1987 started manufacturing low voltage motor control and power control centres. The Skippers are into manufacturing of Transformers, Substation Equipments & EPC in Generation, Transmission & Distribution sectors for over couple of years. In 1996 they started a new plant at Bhiwadi for manufacturing power and gradually 1 more manufacturing units were set up in Bhiwadi (INDIA). Skipper exports its products to over 50 countries around the globe, including Middle East, South-East Asia, Europe, and Africa & America. A strategic combination of design, innovation, quality and dedicated customer service has allowed Skipper to consistently exceed customer expectations. Apart from this the company had received awards and certificates such as," Regional Trophy for the Highest Exporters award, the Star Export House Award from Ministry of Commerce, Government of India. Some of the valued customers of the company are as follows ABB India Ltd, Bharat Heavy Electricals Ltd, National Thermal Power Corporation, Greaves Cotton, Jindal Stainless, Ranbaxy, Voltas Limited and others. Therefore the company's vision is to be an International power and Infrastructure Enterprise most admired for its people, performance, and partnerships. ■

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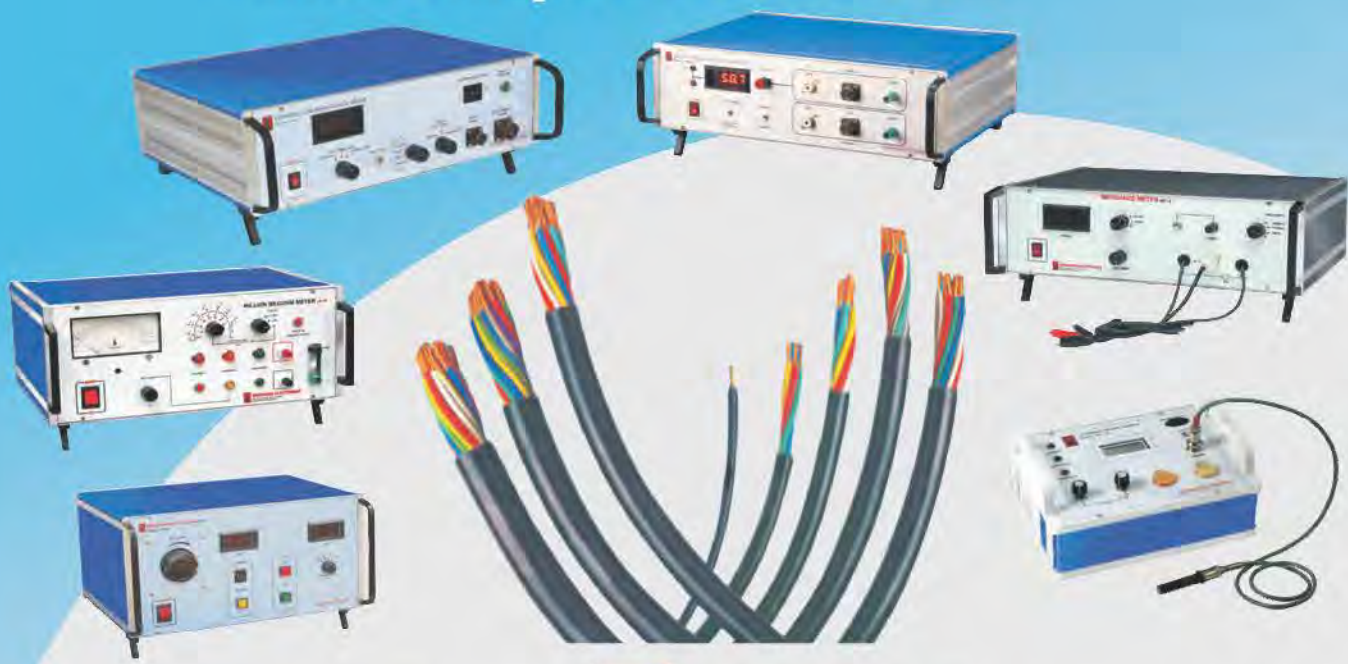

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