CEEAMA™
Consulting Electrical Engineers Association of Maharashtra

CEEAMA *LiveWire*

E-NEWSLETTER

Published by Consulting Electrical Engineers Association of Maharashtra



Topic for October 2026

ELECTRICAL ENGINEERING IN FMCG SECTOR

Turn the Pages… Then Take the Challenge! Explore this month's theme and check your knowledge skills by solving the quiz inside.

CEEAMA is gearing up for

CEEAMATECH 2026

Saturday 24th October 2026, The Fern, Lonavala

Details for Delegate Registration given inside

Electrical Consultants Newsletter
Volume No. 4 Issue #64
October 2026

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Mr. Ulhas Vajre
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Mr. Subhash L. Bahulekar
Chief Editor - CEEAMA LIVEWIRE

From the Editors Desk,

Engineering the Intelligent Energy Future

As we welcome the festive month of October, we also enter a period of remarkable transformation for the global electrical engineering profession. Across the world, economies are navigating geopolitical uncertainties, evolving energy markets, supply chain realignments, and rapid digitalization. Yet amidst these challenges, one trend stands above all others: the accelerating shift toward an electrified, intelligent, and sustainable future. Global electricity demand continues to rise, driven by electrification of industry, transportation, data centres, artificial intelligence, and advanced manufacturing. International energy reports indicate that renewables, energy storage systems, digital grids, and AI-enabled operations are now becoming central pillars of the modern power ecosystem.

For electrical consultants, these developments represent far more than technological progress. They redefine the way we plan, design, operate, and maintain electrical systems. Artificial Intelligence is moving beyond experimentation and becoming an engineering tool for predictive maintenance, load forecasting, asset management, power quality analysis, energy optimization, safety monitoring, and renewable integration. The convergence of AI, digital twins, IoT devices, smart grids, and distributed energy resources is creating unprecedented opportunities for innovation and efficiency.

Closer home, CEEAMA continues to play its role as a catalyst for technical excellence and professional development. September witnessed active engagement from members through technical discussions, knowledge-sharing initiatives, and preparations for the upcoming CEEAMATECH 2026.

We also appreciate the enthusiasm shown by members towards our forthcoming technical programs. The flagship **CEEAMATECH 2026** scheduled on 2**4 October 2026 at The Fern, Lonavala** will focus on **"AI in Power Systems",** addressing topics such as AI in Energy Management Systems, Intelligence in Transmission & Distribution, Electrical Safety, Renewable Energy Integration, and evolving regulatory requirements. These sessions promise valuable insights into technologies that are already reshaping our profession.

(Continued on next page)



Subhash L. Bahulekar
Chief Editor – CEEAMA

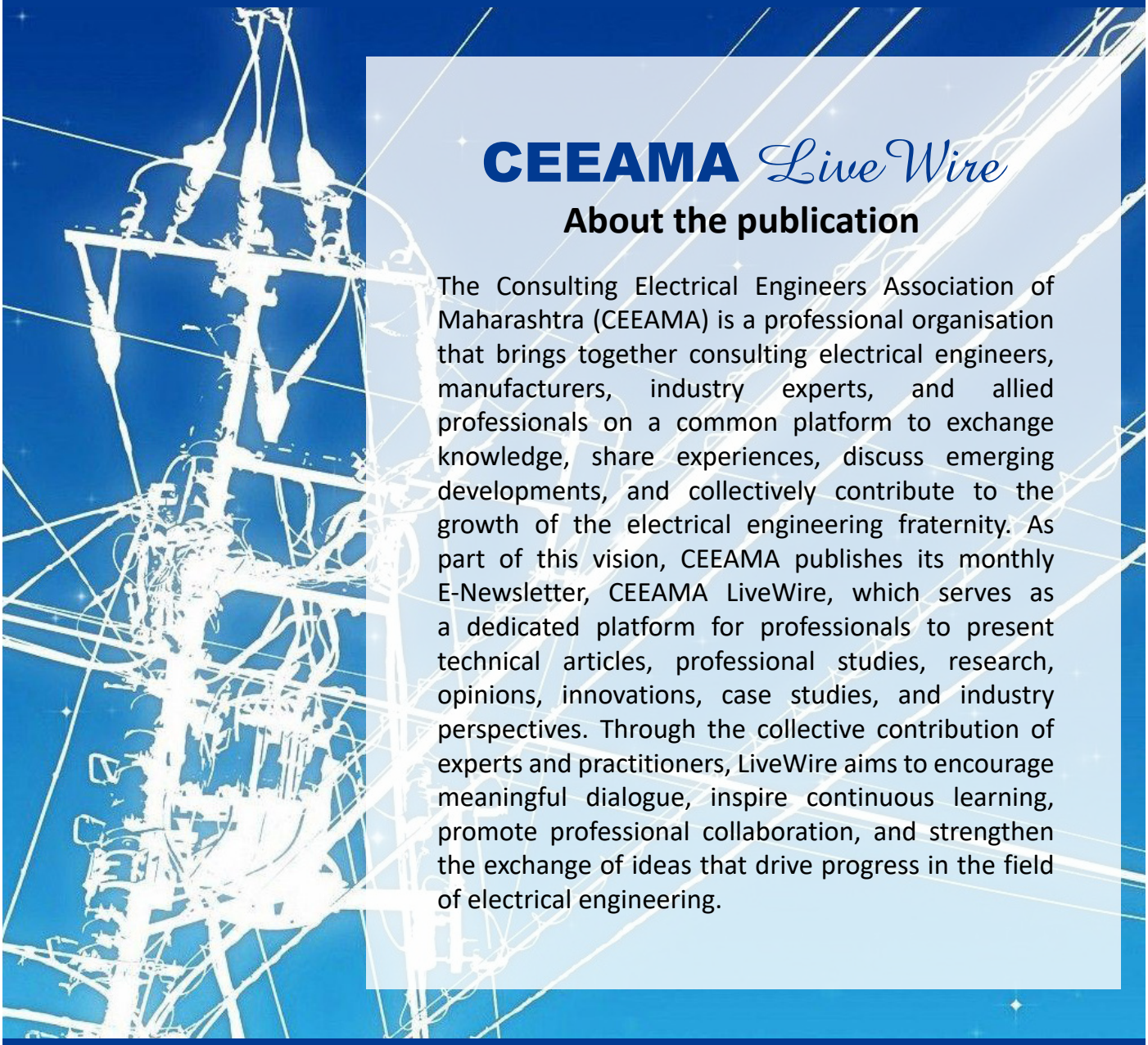
Looking ahead, CEEAMA has also announced technical programs on **Modern Trends in Electrical Distribution Systems** in January 2027 and **Electrical Standards and Practices** in March 2027, ensuring continuous learning opportunities for our members.

As consulting engineers, we must embrace lifelong learning and remain agile in adapting to these changes. The future electrical engineer will not only be a designer of systems but also an integrator of energy, data, automation, safety, sustainability, and digital intelligence. Success will belong to professionals who combine strong engineering fundamentals with emerging technological capabilities.

October is also a month of celebration and gratitude. On behalf of the CEEAMA LiveWire Editorial Team, I extend warm greetings to all our members and their families on the occasions of **Navratri, Dussehra, Sharad Purnima, Karwa Chauth, and Diwali preparations.** May these festivals bring happiness, prosperity, good health, and renewed energy for professional and personal success.

Let us continue working together to strengthen our profession, share knowledge generously, mentor the next generation of engineers, and contribute toward building safer, smarter, greener, and more resilient electrical infrastructure.

"The future of electrical engineering will not be defined merely by the energy we generate, but by the intelligence with which we manage, distribute, and utilize it."



CEEAMA *LiveWire*

About the publication

The Consulting Electrical Engineers Association of Maharashtra (CEEAMA) is a professional organisation that brings together consulting electrical engineers, manufacturers, industry experts, and allied professionals on a common platform to exchange knowledge, share experiences, discuss emerging developments, and collectively contribute to the growth of the electrical engineering fraternity. As part of this vision, CEEAMA publishes its monthly E-Newsletter, CEEAMA LiveWire, which serves as a dedicated platform for professionals to present technical articles, professional studies, research, opinions, innovations, case studies, and industry perspectives. Through the collective contribution of experts and practitioners, LiveWire aims to encourage meaningful dialogue, inspire continuous learning, promote professional collaboration, and strengthen the exchange of ideas that drive progress in the field of electrical engineering.

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From the President's desk:

Dear friends,

Thank you all for a fruitful AGM held last month. As we usher into October, we have a wonderful program coming up this month at Lonavala. Let me explain …

Everybody uses some form of AI (Artificial Intelligence) these days. From asking basic questions on 'what to eat while visiting Kolhapur' to the 'side effects of a specific medicine', AI has been providing answers to quite a few queries. Some of the answers have to be rechecked again for correctness, as artificial intelligence can still not beat natural intelligence. The big question is 'why should engineers need to know AI?' The answer is "Engineers need to know about AI because it fundamentally changes how systems are designed, optimized and deployed across all technical disciplines. Going further, Electrical engineers need to understand artificial intelligence (AI) because AI is reshaping hardware design, grid management and career demands."

AI is presently helping electrical consultants in many day-to-day activities and simplifying workload, although checks on the outputs are required from time to time. With proper 'prompts' provided, one can use AI very creatively to help in the design activities such as drawings checks, creating tables, specifications reviews, bids comparison etc. Going beyond normal office work, AI helps in generation forecasting, demand side management, predictive maintenance, rapid fault detection etc. On the other hand, critical safety actions such as Lockout/ Tagout (LOTO), permit-to-work approvals, and emergency isolation must remain under the control of competent human professionals rather than automated AI triggers. Increased grid connectivity and smart-meter integration expand the cyber-attack threat bringing AI dangers to the common man's doorstep. AI models and communication pathways must be hardened against adversarial attacks and unauthorized tampering. Your laptop may become your biggest enemy if an AI virus infects it creating havoc. An AI-driven virus can transform your laptop into a highly adaptable, autonomous adversary capable of causing severe damage to your digital and physical life. Unlike traditional malware that follows a rigid, predictable script, an AI virus functions like a hostile digital brain operating right on your desk. Friends, AI brings challenges, but fear isn't the answer, preparation is. By understanding the technology and taking precautions, we can safely navigate the future.

The month of October is full of festivals, this year. CEEAMA too has planned its technical festivities in the form of **CEEAMATECH 2026 on 24th October at The Fern,** Lonavala featuring **AI in Power Systems.** The CEEAMATECH 2026 will attempt to bring all this AI expertise to help gain insights into the latest in the world of technology. Do register and attend in large numbers to know more about its applications in day-to-day work as well as in Power Systems.

Let us meet at **CEEAMATECH 2026 at The Fern, Lonavala on 24th October (Saturday).** Let us enjoy the beauty of technological advances and the pitfalls that we may encounter in our journey.

Friends, Ravana could not be defeated by just cutting off his heads; Lord Rama had to strike his core (the navel). The core weakness of all malicious AI is that it cannot truly think; it only predicts. Strike at this weakness by practicing relentless skepticism. Just as Dasara celebrates the triumph of good over evil, the rise of AI presents a modern battlefield; while it poses significant benefits as well as risks to humanity. Individuals must not succumb to fear, but proactively prepare to conquer these challenges through knowledge and vigilance.

Friends, AI may not solve all the problems and if we are not careful, it may exacerbate to a great extent. My friend had once joked "AI is like a hyper-efficient trainee engineer who has memorised the entire internet but still needs to ask how to use the office coffee machine, while Natural Intelligence is knowing exactly how to use the coffee machine but forgetting why you walked into the pantry in the first place."



Enjoy Dasara with verve.

Mr. Chidambar Joshi
Hon. President

From the Secretary's desk:

Dear Members, Colleagues, and Industry Associates,

As we step into October 2026, the energy ecosystem of Maharashtra is undergoing one of the most defining transformations in recent history. The transition from traditional power systems to green energy is no longer a futuristic goal—it is our current operational reality.

Nationally, India's non-fossil fuel capacity has successfully crossed **52% of the total energy mix,** driven by a monumental push in renewable infrastructure.

Closer to home, the focus for electrical consultants across Maharashtra has completely shifted toward implementing the landmark **Maharashtra Renewable Energy & Energy Storage Policy (2025–36).** This policy is proving to be a game-changer, particularly for Commercial & Industrial (C&I) consumers. The elimination of the Cross-Subsidy Surcharge (CSS) for stored solar energy, alongside the waiving of wheeling and transmission charges, offers our clients unprecedented tariff advantages. However, this policy also brings stringent engineering responsibilities: any new Renewable Energy (RE) project requiring a Battery Energy Storage System (BESS) must now be **commissioned simultaneously with its storage infrastructure.** As consulting engineers, the mantle falls on us to master the integration of these co-located BESS setups, ensuring seamless compliance via the single-window regulatory portals.

This massive influx of Distributed Energy Resources (DER)—ranging from high-capacity rooftop solar and windmills to grid-scale BESS and widespread EV charging infrastructure—is putting immense pressure on modern network design. Traditional layouts are rapidly becoming obsolete.

The modern consultant must excel in advanced distribution automation, grid thermal mapping (especially for overhead-to-underground cable conversions), and sophisticated network planning tools to manage bidirectional power flows effectively.

Amidst these macro changes, our fundamental priorities remain steadfast: **Electrical Safety and Power Quality.** We must continue to champion comprehensive energy and kVAh tariff audits to shield industries from escalating penalties. More importantly, there remains a critical gap in electrical safety awareness within mid-to-low scale commercial spaces and housing societies. I urge our members to look beyond major industrial assignments and actively provide safety expertise to these underserved sectors to mitigate hazards.

CEEAMA thrives on active participation and the collective wisdom of its engineers. I invite each of you to contribute technical whitepapers, case studies, or field experiences on DER integrations and BESS safety for our upcoming publications.

Let us use this period of regulatory and technological disruption to elevate our standards, optimize national resources, and lead Maharashtra's green grid transition with technical excellence.

Warm regards,



Ulhas Vajre
Honorary Secretary

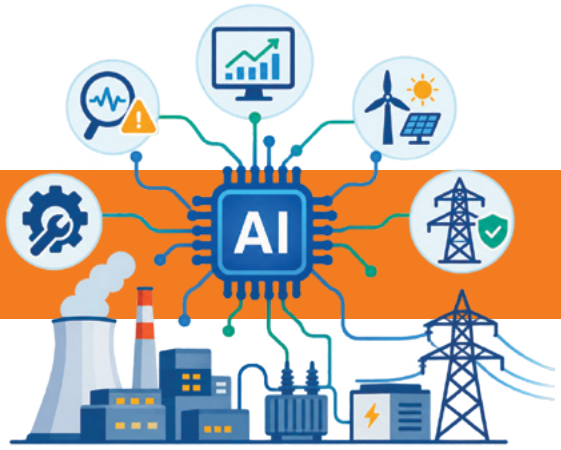
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Consulting Electrical Engineers Association of Maharashtra

(REGISTERED UNDER SECTION 25 OF THE COMPANIES ACT, 1956) - CIN: U91990MH2011NPL212166

Understanding need of hour to create awareness about electrical safety and ensuring the same at all levels of project execution - design, manufacturing, installation, and operation, CEEAMA is taking training sessions on various subjects.



CEEAMATECH 2026

AI IN POWER SYSTEMS

24th October 2026

VENUE THE FERN, LONAVALA

ABOUT THE CONFERENCE

The power system of today already has elements of AI and tomorrow will be more complex with higher analysis of data, prediction of events, detection of faults and optimisation of operations. From load forecasting and predictive maintenance to renewable integration and smart grids, AI is transforming conventional power system planning, electricity distribution philosophies and operation. For electrical consultants and designers, understanding these developments is becoming essential to harness AI effectively while ensuring reliability, safety and seamless integration with existing systems.

CEEAMATECH 2026, in this October, will focus on:

- AI in energy management systems
- Intelligence in Transmission and Distribution and cost of energy
- Intelligence in Electrical Safety
- Advances in Renewables and AI
- CEA Regulations on Renewables

CEEAMA is proud to announce 2 more events in the coming future:

Saturday 9th Jan 2027 : 'Modern Trends in Electrical Distribution Systems'
Saturday 6th March 2027 : 'Electrical Standards and Practices'

CEEAMATECH 2026 DELEGATE FEES AND PAYMENT

Membership type	Fees amount INR
Life Fellow / Patron Member	1500/- + 18%GST
Associate Members	2500/- + 18%GST
Non Members	3000/- + 18%GST

Scan or open the link to register

https://ceeama.org/CeeamaTech_2026.aspx

Limited seats only to be alloted on early registration basis. The sessions will also be accompanied by a small exhibition of relevant products with presence of technical staff from respective exhibitors to answer your queries.

CEEAMA is organising Pick-up and Drop service from Pune and Mumbai for all delegates who register 15 days before the events.

Tel: +91 9765150066 / 9822916302 (Prabha Enterprises) | Email: admin@ceeama.org

www.ceeama.org

Electrical Engineering in the FMCG Sector: Salient Features, Challenges, and Opportunities

Introduction

The Fast-Moving Consumer Goods (FMCG) sector is one of the largest and most dynamic industries worldwide. It encompasses products with high consumption rates and short shelf lives, such as food and beverages, personal care products, household cleaners, dairy products, pharmaceuticals, and packaged goods. While marketing, supply chain management, and production efficiency often receive significant attention.



Modern FMCG plants are highly automated facilities where electrical systems form the backbone of production operations. From utility distribution and plant electrification to process automation and smart manufacturing, electrical engineers contribute significantly to productivity, operational reliability, and profitability. Electrical engineering plays a vital role in ensuring uninterrupted manufacturing, quality assurance, energy efficiency, safety, automation, and sustainability

1. Importance of Electrical Engineering in FMCG Plants

The primary objective of FMCG manufacturing is to produce large volumes of products consistently while maintaining quality, safety, and cost competitiveness.



Electrical engineering supports these objectives by ensuring:

- Reliable power supply
- Optimal energy utilization
- Continuous operation of production lines
- Automation and control systems
- Safety of personnel and equipment
- Compliance with statutory requirements
- Sustainability and carbon reduction initiatives

Even a few minutes of power interruption can result in:

- Production losses
- Material wastage
- Product contamination
- Packaging disruptions
- Significant financial losses

Therefore, electrical systems are treated as mission-critical infrastructure in FMCG facilities.

2. Characteristics of FMCG Manufacturing Facilities

Unlike heavy industries such as steel, cement, or petrochemicals, FMCG facilities possess distinctive electrical requirements:



High-Speed Production

Production lines operate continuously at high speeds.

Examples include:

- Beverage bottling lines
- Biscuit manufacturing plants
- Dairy processing units
- Detergent production facilities
- Pharmaceutical packaging lines

These processes demand highly reliable electrical systems.

Multiple Parallel Production Lines

Most FMCG plants operate:

- Several packaging lines
- Filling lines
- Blending systems
- Conveyors

Each production line requires independent electrical control and monitoring.

Hygiene Requirements

Food, beverage, and personal care industries demand:

- Clean environments
- Wash-down facilities
- Corrosion-resistant electrical equipment

Thus, electrical installations must meet IP65, IP66, or IP67 protection standards.

3. Power Distribution Systems

Power distribution is the foundation of every FMCG facility.

Typical Electrical Distribution Structure



The distribution system must ensure:

- Reliability
- Selectivity
- Safety
- Energy efficiency

Voltage Levels

Typical voltage levels include:

Application	Voltage
Utility Supply	11 kV / 22 kV / 33 kV
Distribution	415 V
Control Systems	24 V DC
Instrumentation	24 V DC

4. Electrical Loads in FMCG Plants

Electrical loads in FMCG facilities mainly consist of motors and process equipment.

Major Loads

Motors

Motors account for 60–80% of electrical consumption.



Applications include:

- Pumps
- Compressors
- Agitators
- Mixers
- Conveyors
- Fans
- Elevators

Refrigeration Systems

Particularly important in:

- Dairy plants
- Beverage facilities
- Frozen food production

Large refrigeration compressors consume significant power.

Air Compressors

Compressed air is widely used for:

- Packaging
- Pneumatic actuators
- Process equipment
- Instrumentation

Compressors are among the largest energy consumers.

Packaging Equipment

Includes:

- Filling machines
- Capping machines
- Labeling machines
- Cartoning machines
- Palletizers

5. Automation and Control Systems

Modern FMCG industries are driven by automation.

Electrical engineers closely collaborate with automation specialists to ensure process efficiency.



Key Automation Components

PLC Systems

Programmable Logic Controllers control:

- Motors
- Valves
- Sensors
- Production sequences

Benefits include:

- Faster response
- Repeatability
- Reduced human error

SCADA Systems

Supervisory Control and Data Acquisition provides:

- Real-time monitoring
- Process visualization
- Alarm management
- Data logging



Distributed Control Systems (DCS)

Used in larger facilities such as:

- Dairy plants
- Pharmaceutical plants
- Food processing units

6. Variable Frequency Drives (VFDs)

Variable Frequency Drives are extensively used in FMCG operations.

Applications include:

- Conveyor systems
- Pumps
- Fans
- Blowers
- Mixers

Benefits

Energy Savings

A 20% speed reduction can often produce 40–50% energy savings in centrifugal loads.

Process Optimization

VFDs permit precise control over:

- Flow rate
- Pressure
- Speed
- Product quality



Reduced Mechanical Stress

Benefits include:

- Longer equipment life
- Lower maintenance costs

7. Energy Management

Energy cost is a major component of manufacturing expenses.

Electrical engineers are increasingly responsible for achieving energy reduction targets.

Major Initiatives

Energy Monitoring Systems

Smart meters are installed on:

- Production lines
- Utilities
- Buildings

Power Quality Monitoring

Monitoring includes:

- Harmonics
- Voltage disturbances
- Power factor

Load Optimization

Engineers identify:

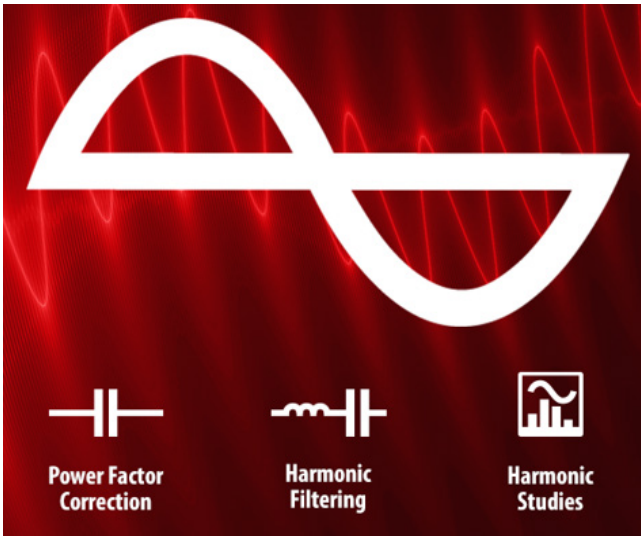
- Idle equipment
- Peak demand periods
- Energy-intensive processes

8. Power Quality Management

FMCG plants employ numerous electronic devices and variable-speed drives.

Consequently, power quality problems can arise.

Common Issues



Harmonics

Sources include:

- VFDs
- UPS systems
- Switch-mode power supplies

Effects:

- Transformer overheating
- Cable heating
- Capacitor failures

Voltage Sags

May cause:

- PLC shutdowns
- Production interruptions
- Quality issues

Poor Power Factor

Results in:

- Utility penalties
- Increased losses

Solutions include:

- Automatic Power Factor Correction (APFC)
- Active harmonic filters
- Multi-pulse VFDs

9. Utilities and Electrical Engineering

Utilities are essential for FMCG production.

Refrigeration Systems

Common in:

- Dairy
- Ice cream
- Beverage industries

Electrical engineers manage:

- Compressor motors
- Control systems
- Power distribution

Boiler Systems

Used for:

- Steam generation
- Sterilization
- Cleaning operations

Electrical scope includes:

- Boiler controls
- Feedwater pumps
- Combustion systems

Water Treatment Plants

Electrical systems support:

- Pumps
- Chemical dosing systems
- RO plants
- Effluent treatment units

10. Reliability and Maintenance

Downtime directly impacts production targets.

Electrical engineers implement strategies for:

- High availability
- Reliability improvement
- Predictive maintenance

Maintenance Approaches

Preventive Maintenance

Scheduled inspections of:

- Motors
- Transformers
- Switchgear



Predictive Maintenance

Using technologies such as:

- Infrared thermography
- Vibration monitoring
- Motor current analysis

Condition Monitoring

Continuous tracking of:

- Temperature
- Current
- Insulation health

11. Safety Systems

Safety is particularly critical in FMCG facilities due to:

- Human-machine interaction
- Food safety requirements
- Continuous operations

Essential Safety Features

Earthing Systems

Ensures:

- Personnel protection
- Equipment safety

Emergency Shutdown Systems

Provide rapid isolation during emergencies.

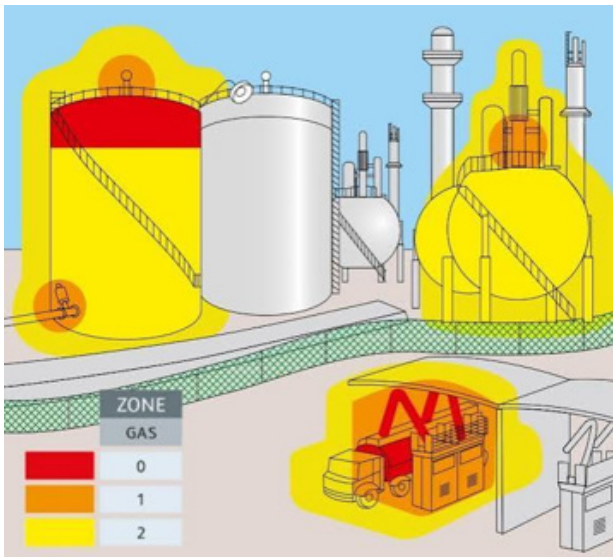
Electrical Fire Protection

Includes:

- Fire detection
- Fire suppression
- Arc protection systems

Lockout-Tagout (LOTO)

Ensures safe maintenance practices.



12. Hazardous Area Applications

Certain FMCG processes involve combustible materials.

Examples:

- Flour handling
- Sugar processing
- Solvent-based products
- Aerosol manufacturing

Electrical engineers must design systems compliant with:

- IEC standards
- ATEX requirements
- Hazardous area classifications

Equipment includes:

- Flameproof motors
- Explosion-proof lighting
- Intrinsically safe instrumentation

13. Digitalization and Industry 4.0

FMCG plants are rapidly adopting smart manufacturing principles.

Key Technologies

Industrial IoT

Connected sensors provide:

- Equipment status
- Energy consumption
- Maintenance alerts

Digital Twins

Support:

- Process optimization
- Asset management
- Maintenance planning

Artificial Intelligence

Applications include:

- Predictive maintenance
- Demand forecasting
- Energy optimization

14. Sustainability Initiatives

Sustainability has become a strategic priority for FMCG companies.

Electrical engineers contribute significantly to ESG objectives.

Key Focus Areas

Renewable Energy

Increasing use of:

- Solar PV systems
- Wind energy
- Battery storage

Energy Efficiency

Projects include:

- LED lighting
- Premium efficiency motors
- Waste heat recovery

Carbon Reduction

Electrical engineers support:

- Electrification of processes
- Green energy integration
- Smart energy management systems

15. Future Trends



The future FMCG facility will be:

- Fully automated
- Digitally connected
- Energy efficient
- Environmentally sustainable

Electrical engineering will increasingly focus on:

Smart Power Systems

- Intelligent switchgear
- Digital substations
- Smart protection systems

Advanced Analytics

- Real-time energy dashboards
- AI-based fault prediction

Electrification

- Electric boilers
- Electric process heating
- Green manufacturing

Cybersecurity

- Protection of industrial control systems
- Secure operational technology networks

Conclusion

Electrical engineering is a critical enabler of modern FMCG manufacturing. Unlike process-intensive heavy industries, FMCG facilities place exceptional emphasis on high-speed production, automation, product quality, hygiene, reliability, and energy efficiency. Electrical engineers are responsible for designing and maintaining robust power distribution systems, automation infrastructure, utility networks, safety systems, and sustainability initiatives.

As FMCG organizations navigate Industry 4.0, digital transformation, and carbon reduction targets, the role of electrical engineering is expanding beyond traditional power distribution. Today's electrical engineer in the FMCG sector is not only a custodian of reliability but also a key contributor to productivity, operational excellence, sustainability, and business competitiveness.

The future of FMCG manufacturing will be powered by intelligent electrical systems that combine automation, data analytics, renewable energy, and smart asset management to create highly efficient and sustainable production facilities.

Contributed by:



Subhash Bahulekar

Global Head – Electricals

L&T Technology Services





POWERING PROGRESS

SINCE THREE DECADES

V CABLES

BY VARSHA CABLES PRIVATE LMITED

MANUFACTURERS OF WIRES & CABLES

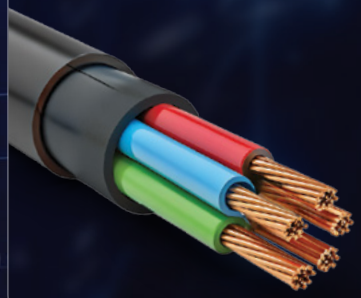
CUSTOMISED CABLE SOLUTIONS

PRODUCT RANGE

- BMS Cables
- Fire Survival Cables
- Flexible Cables
- Solar Cables
- Control Cables
- Panel Wiring
- Industrial Automation Cables
- Instrumentation Cables
- Submersible Flat Cables
- Power Cables
- House Wiring
- Special Application Cables

PRODUCT FEATURES

- Heavy Duty LV Cables
- PVC
- FRLS
- LSZH
- Copper
- XLPE
- HR
- TPE
- Aluminium
- XLPO
- ZHFR
- TPU



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APPLICATIONS

Metro Rail | Airports | Oil & Gas

Infrastructure | Data Centers | Industrial Automation

Solar | Wind | Smart Cities

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ISO 14001 CERTIFICATION INTERCERT

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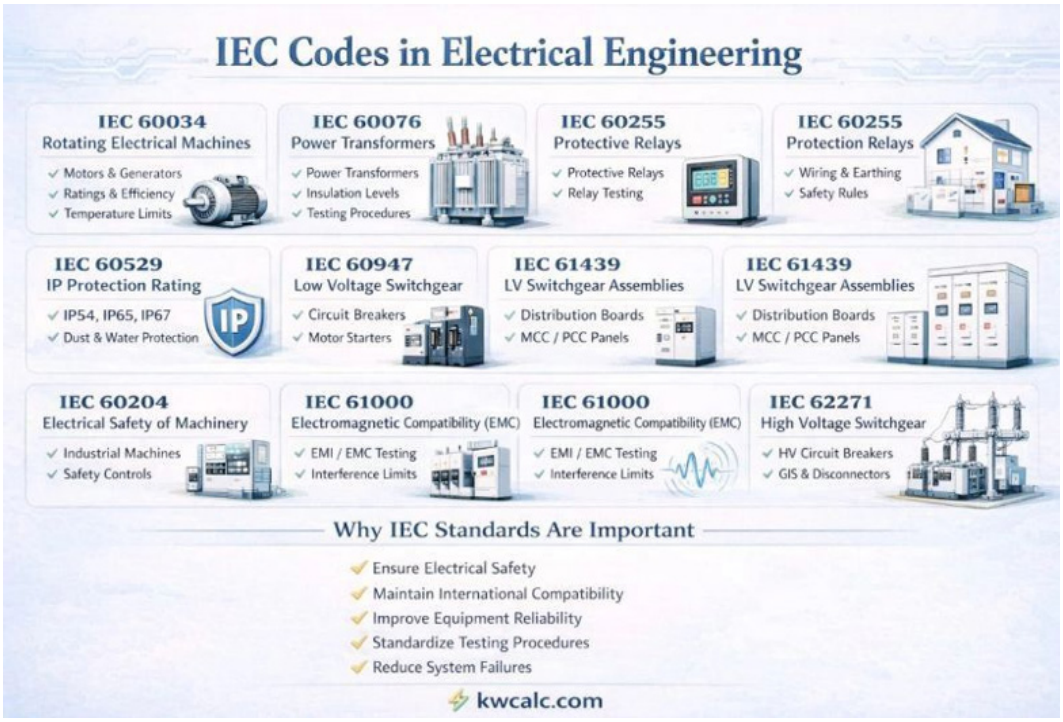
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Regulatory and Standards Framework

Electrical systems in FMCG manufacturing facilities must satisfy three simultaneous objectives:

- Production reliability
- Personnel and food safety
- Energy efficiency and sustainability

To achieve these objectives, electrical engineers must comply with recognized international standards as well as Indian statutory regulations.



Key International Standards

Electrical Installations

IEC 60364 Series

- Electrical Installations of Buildings
- Earthing systems
- Protection against electric shock
- Cable sizing and installation practices

This serves as the global reference for safe low-voltage electrical installations.

Low Voltage Switchgear Assemblies

IEC 61439 Series

- Low-voltage switchgear and controlgear assemblies
- Applicable to PCCs, MCCs, distribution boards, and intelligent motor control centers
- Defines requirements for design verification, temperature rise, dielectric performance, and short-circuit withstand capability.

Degree of Protection

IEC 60529

- IP Ratings
- IP55, IP65, IP66 and IP67 frequently used in FMCG facilities

Food and beverage plants often utilize:

- IP65 stainless steel control panels
- IP66 field junction boxes
- Wash-down rated motor enclosures



Rotating Machinery and Drives

Motors

IEC 60034 Series

- Rotating electrical machines
- Motor performance
- Temperature rise limits
- Efficiency classifications

Modern FMCG facilities increasingly adopt:

- IE3 motors (Premium Efficiency)
- IE4 motors (Super Premium Efficiency)

Variable Frequency Drives

IEC 61800 Series

- Adjustable speed drive systems

Applications include:

- Bottling conveyors
- Mixing systems
- Chilled water pumps
- Process fans
- Refrigeration compressors

VFD implementation typically produces energy savings of 15-40% depending upon process characteristics.

Power Quality Standards

Modern FMCG facilities contain large numbers of:

- VFDs
- UPS systems
- Servo drives
- Switch mode power supplies

Consequently, harmonic management has become a critical design consideration.

IEEE 519-2022

- Harmonic control in electric power systems
- Defines voltage and current distortion limits at the Point of Common Coupling (PCC).

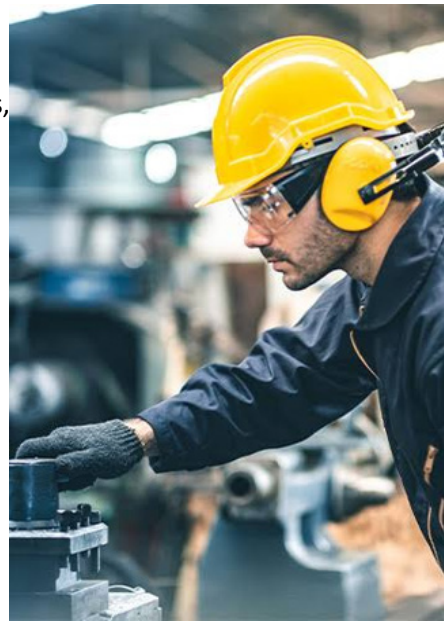
IEC 61000 Series

Addresses:

- Electromagnetic compatibility
- Harmonic emissions

- Voltage fluctuations
- Flicker
- Immunity requirements

These standards are particularly important in highly automated packaging facilities where PLCs and sensitive electronics can be affected by power disturbances.



Machinery Safety Standards

A typical FMCG production line contains hundreds of sensors, drives, motors,

IEC 60204-1

Safety of Machinery – Electrical Equipment of Machines

This is one of the most important standards for:

- Packaging equipment
- Filling machines
- Conveyor systems
- Palletizers
- Robotic packaging lines

Electrical engineers must ensure compliance with requirements related to:

- Emergency stop circuits
- Protective bonding
- Motor protection
- Control circuit design

Functional Safety Standards

IEC 61508

Functional Safety of Electrical/Electronic Systems.

IEC 62061

Functional Safety of Machinery.

ISO 13849

Safety-related parts of control systems.

These standards are increasingly applied in:

- Robotic palletizing cells
- Automated packaging plants
- High-speed bottling facilities

Hazardous Area Requirements

Although most FMCG facilities are non-hazardous, certain processes involve combustible dusts or flammable solvents.

Examples include:

- Flour handling plants
- Sugar factories
- Spray drying units
- Aerosol packaging facilities
- Perfume and cosmetic manufacturing

IEC 60079 Series

Provides requirements for:

- Hazardous area classification
- Flameproof equipment
- Intrinsically safe systems
- Explosion-proof installations.

Typical equipment includes:

- Ex-d motors
- Ex-proof lighting fixtures
- Intrinsically safe barriers
- Hazardous-area control panels

Energy Management and Sustainability

Energy represents one of the largest manufacturing costs in FMCG operations.

ISO 50001:2018

Energy Management Systems (EnMS).

Benefits include:

- Continuous improvement in energy performance
- Reduction in specific energy consumption
- Carbon emission reduction
- Structured energy monitoring and reporting.

Many multinational FMCG organizations including Nestlé, Unilever, PepsiCo, and Coca-Cola have adopted structured energy management programs based on ISO 50001 principles.

ISO 55001

Asset Management Systems.

Provides a framework for:

- Reliability improvement
- Lifecycle cost optimization
- Asset health monitoring
- Maintenance planning

Electrical Safety Requirements

NFPA 70E

Provides internationally recognized best practices for:

- Arc flash analysis
- Electrical safe work practices
- Electrical PPE requirements
- Risk assessment procedures.

Many multinational FMCG facilities use NFPA 70E to supplement local regulations and establish corporate electrical safety programs.



Indian Regulatory Requirements

For facilities located in India, compliance with statutory regulations is mandatory.

Central Electricity Authority (CEA) Regulations

Electrical installations must comply with:

CEA (Measures Relating to Safety and Electric Supply) Regulations

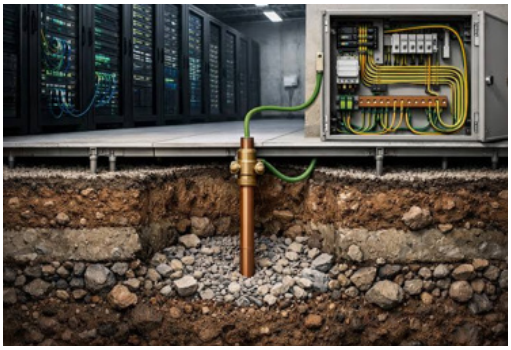
Requirements include:

- Earthing systems
- Protection schemes
- Electrical clearances
- Testing and commissioning
- Maintenance procedures

National Electrical Code of India (NEC)

The National Electrical Code provides guidance for:

- Plant electrification
- Cable routing
- Equipment selection
- Hazardous areas
- Electrical safety practices



IS 3043

Code of Practice for Earthing.

Widely used for:

- Transformer earthing
- Equipment bonding
- Lightning protection integration
- Safety grounding systems



IS 732

Code of Practice for Electrical Wiring Installations.

Provides guidance on:

- Wiring systems
- Installation practices
- Selection of equipment
- Safety requirements

BIS Adoption of IEC Standards

Many international standards are adopted in India as:

- IS/IEC 60364
- IS/IEC 61439
- IS/IEC 60079
- IS/IEC 61800

This harmonization simplifies specification preparation for multinational FMCG projects.

Indian FMCG Industry Examples

Food Processing

Britannia Industries

Modern biscuit manufacturing facilities utilize:

- Automated baking lines
- High-speed packaging systems
- Intelligent motor control centers
- Energy monitoring systems

Electrical reliability directly influences overall equipment effectiveness (OEE).

ITC Foods

Integrated food manufacturing facilities employ:

- SCADA systems
- Energy management systems
- Condition-based maintenance
- Solar power integration

Dairy Sector

Amul

Large dairy plants depend heavily upon:

- Refrigeration systems
- Process automation
- Continuous utility operation

Electrical engineers are responsible for ensuring uninterrupted operation of refrigeration systems because product quality is temperature sensitive.

Mother Dairy

Advanced facilities employ:

- PLC-controlled processing
- Smart power distribution
- Variable speed pumping systems
- Utility optimization programs

Beverage Industry

Coca-Cola and PepsiCo Bottling Plants

Typical facilities contain:

- Hundreds of motors
- Extensive VFD installations
- Automated bottling lines
- Centralized SCADA systems

Power quality and harmonic control are major design considerations.

Personal Care Products

Hindustan Unilever (HUL)

Manufacturing facilities incorporate:

- Automated batching systems
- Intelligent MCCs
- Predictive maintenance tools
- Energy monitoring platforms

Godrej Consumer Products

Facilities frequently require:

- Hazardous area compliance
- Automated material handling
- Smart process control systems

Future Outlook

The FMCG manufacturing plant of the future will increasingly adopt:

- Industry 4.0
- Industrial Internet of Things (IIoT)
- AI-based predictive maintenance
- Digital substations
- Smart MCCs
- Renewable energy integration
- Battery Energy Storage Systems (BESS)

Electrical engineers will evolve from traditional maintenance and power-distribution roles to become key contributors to digital transformation, energy transition, sustainability, and operational excellence.

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Lighting Installation solutions in FMCG
Cold Storage (-25 Deg and below) and Check List

For **lighting installation at -25°C ambient temperature**, selection of **XLPE cable alone is not sufficient**. The entire lighting system should be evaluated for low-temperature operation.



Key Items Requiring Special Attention

1. Lighting Fixture Temperature Rating

- Ensure luminaires are certified for **-25°C or lower ambient temperature**.
- Check manufacturer's datasheet for:
  - Minimum operating temperature
  - Driver operating temperature range
  - LED lumen output at low temperature

2. LED Drivers / Control Gear

- Often the most critical component.
- Standard LED drivers may be rated only up to **-10°C or -20°C**.
- Specify drivers rated for **-30°C or -40°C**.
- Prefer drivers with cold-start capability.

3. Cable Glands

- Use glands with:
  - Low-temperature elastomer seals
  - IP66/IP67 minimum
- Standard NBR seals may become brittle.
- Prefer **silicone or neoprene seals**.

4. Junction Boxes

- Use polycarbonate, GRP, or stainless-steel boxes certified for low temperatures.
- Standard plastic enclosures may crack at -25°C.

5. Cable Outer Sheath

Even if XLPE insulation is suitable:

- Verify outer sheath material.
- Prefer:
  - PE/HDPE sheath
  - Low-temperature LSZH sheath
- Standard PVC sheath can harden and become brittle.

6. Cable Installation

- Avoid cable installation at very low temperatures unless manufacturer permits.
- Increase bending radius.
- Prevent impact loading on cables during installation.

7. Mounting Hardware

- Use:
  - SS316 hardware
  - Hot-dip galvanized structures
- Avoid brittle plastic clips and nylon ties not rated for cold climates.

8. Condensation Control

At -25°C, temperature cycling can cause condensation inside fixtures.

- Use breather drains where recommended.
- Ensure IP66/IP67 sealing integrity.
- Consider anti-condensation heaters for critical outdoor panels.

9. Emergency Lighting Batteries

Very important.

- Battery capacity decreases significantly at low temperatures.
- Use:
  - Low-temperature Ni-Cd batteries
  - Heated battery enclosures (if required)
  - Manufacturer-certified cold-weather emergency lighting systems

10. Control Devices

Check rating of:

- Photocells
- Motion sensors
- Push buttons
- Local control stations
- Smart lighting controllers

All should have minimum ambient temperature ratings of **-25°C or below**.

Typical Specification for -25°C Outdoor Lighting

- LED Luminaire Ambient Rating: **-40°C to +50°C**
- Driver Ambient Rating: **-40°C to +50°C**
- Cable: XLPE insulated, PE/LSZH sheath
- Cable Glands: Nickel-plated brass, IP66/IP67, cold climate rated
- Junction Boxes: GRP/SS316, -40°C rated
- Fasteners: SS316
- Emergency Batteries: Low-temperature type
- Enclosure Protection: IP66 minimum

For your EPCM projects (Europe, Kazakhstan, Netherlands cold-storage areas, etc.), generally recommend specifying **all lighting equipment for -40°C operation** even when the design ambient is only **-25°C**, to provide adequate margin during cold spells and start-up conditions.

Outdoor Lighting Installation Checklist for -25°C Ambient Temperature

A. Cable System

- XLPE insulated cable suitable for low-temperature operation selected
- Outer sheath material verified for -25°C service (PE/HDPE/LSZH preferred)
- Cable minimum bending radius increased for cold weather installation
- Cable manufacturer confirms suitability for -25°C ambient
- Cable glands rated for low-temperature application
- Spare cable loops provided to account for thermal contraction

B. Lighting Fixtures (Luminaires)

- Luminaire operating temperature range includes -25°C or below
- LED module certified for low-temperature operation
- Luminaire housing material suitable for cold climates
- Impact rating (IK rating) verified for brittle condition at low temperatures
- Fixture ingress protection minimum IP66 for outdoor exposure
- Corrosion protection suitable for outdoor environment

C. LED Drivers / Ballasts

- Driver minimum operating temperature ≤ -25°C
- Cold-start capability confirmed by manufacturer
- Driver enclosure adequately protected against moisture ingress
- Driver replacement accessibility considered

D. Junction Boxes & Accessories

- Junction box material suitable for -25°C operation (SS316 / GRP / Polycarbonate)
- Enclosure gasket material suitable for low temperatures
- Breather drain provided where condensation risk exists
- IP66/IP67 protection maintained after cable entry

E. Cable Glands & Sealing

- Low-temperature certified cable glands selected
- Silicone/Neoprene sealing elements used
- Double compression glands for exposed outdoor installations
- Spare plugged entries properly sealed

F. Mounting Structure & Hardware

- Stainless Steel 316 fasteners used
- Hot Dip Galvanized support structures inspected
- Plastic clips and cable ties certified for cold weather use
- Wind load and ice load considered

G. Earthing & Bonding

- Earthing continuity verified at low-temperature conditions
- Corrosion-resistant earthing connections provided
- Protective earth conductor sized as per project requirements
- Bonding of poles, structures, JB and fixtures completed

H. Control System

- Photocells rated for -25°C operation
- Motion detectors/sensors rated for outdoor cold service
- Lighting control panel heaters considered if located outdoors
- Control relays and timers verified for low-temperature operation

I. Emergency Lighting

□ Battery type suitable for low-temperature operation □ Emergency duration verified at -25°C □ Heated battery enclosure provided where required □ Battery capacity de-rating considered

J. Installation & Construction

□ No cable pulling below manufacturer's installation temperature limit □ Cables stored in heated area before installation □ Visual inspection for insulation cracking after installation □ Gland torque checked after temperature stabilization □ All enclosure covers properly fitted and sealed

K. Inspection & Testing

□ Cable insulation resistance (IR) test completed □ Earth continuity test completed □ Lux level measurement completed □ Functional testing of all fixtures completed □ Photocell operation verified □ Emergency lighting discharge test completed □ Thermal imaging performed after energization (recommended)

L. Recommended Project Specification for -25°C Outdoor Areas

Item	Recommended Rating
Ambient Temperature	-25°C (Design)
Luminaire Rating	-40°C to +50°C
Driver Rating	-40°C to +50°C
Cable	XLPE + PE/LSZH Sheath
Junction Box	-40°C Rated
Glands	Low Temperature Certified
Fasteners	SS316
Enclosure Protection	IP66 Minimum
Structure	HDG / SS316

EPCM Design Review Approval Checklist

Before approval, obtain:

- Luminaire datasheet showing minimum ambient temperature rating
- Driver datasheet showing minimum operating temperature
- Cable manufacturer's compliance certificate for -25°C service
- Junction box and gland certification
- Vendor confirmation for complete lighting system operation at -25°C ambient

This checklist is suitable for industrial outdoor facilities, oil & gas plants, chemical plants, terminals, and utility installations with a design ambient temperature of **-25°C**

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Behind Every Product: The Instrumentation Systems Powering FMCG Manufacturing

Abstract

In the world of fast-moving consumer goods, consumers rarely see the technology that ensures every bottle, packet, tube, or container reaches the shelf with the same quality as the one before it. Behind this consistency lies a sophisticated network of instruments, sensors, analyzers, controllers, and automation platforms. From measuring the temperature of pasteurized beverages to verifying the weight of packaged products and monitoring utility consumption, instrumentation has become an indispensable pillar of modern FMCG manufacturing. This article explores how instrumentation supports process reliability, hygienic production, packaging excellence, digital transformation, and sustainability while helping manufacturers meet growing expectations for quality, safety, and operational efficiency.

Introduction

The FMCG sector is characterized by high production volumes, stringent quality requirements, rapid product turnover, and intense market competition. Whether producing dairy products, beverages, cosmetics, household cleaners, or packaged foods, manufacturers must maintain remarkable consistency across millions of units. Instrumentation provides the visibility required to achieve this objective. Real-time measurements enable operators to understand exactly what is happening inside a process at any given moment. Instead of relying on manual inspection, plants use accurate measurements and automated control strategies to regulate production, reduce variability, and improve product traceability.



Figure 1: Instrumentation and Automation Infrastructure in an FMCG Facility

Instrumentation in FMCG Processes

At the heart of every FMCG manufacturing facility lies a robust instrumentation system that transforms physical processes into measurable and controllable operations. Unlike industries where final product inspection alone may be sufficient, FMCG plants require continuous monitoring throughout production to ensure uniformity across thousands or even millions of units. Critical process variables such as temperature, pressure, flow, and level are continuously measured to maintain product consistency, optimize resource utilization, and prevent deviations that could affect quality. In beverage manufacturing, for instance, flow measurement ensures the correct proportioning of water, sweeteners, and flavor concentrates, while level monitoring prevents storage tank overflows and supports accurate inventory management.

Temperature control remains one of the most significant instrumentation applications in FMCG operations because it directly influences both product quality and consumer safety. Processes such as pasteurization, sterilization, cooking, drying, and emulsification depend on maintaining precise thermal conditions throughout the production cycle. Hygienic RTDs and temperature transmitters are commonly integrated with PID control loops to regulate steam and heating media, ensuring that process temperatures remain within specified limits. Equally important are analytical instruments such as pH, conductivity, dissolved oxygen, and Brix analyzers, which provide direct insight into product characteristics that cannot be determined from conventional process variables alone.



Figure 2: Critical Process Instrumentation in FMCG Manufacturing

Modern FMCG facilities extend beyond measurement by integrating field instruments with advanced automation platforms. PLCs execute process sequences, machine interlocks, and control algorithms, while SCADA systems provide centralized monitoring, alarm management, historical trending, and performance reporting. Batch control systems automate recipe execution by managing ingredient dosing, mixing durations, heating profiles, and production sequences with a high degree of accuracy and repeatability. Together, instrumentation and automation create a highly responsive manufacturing environment that delivers reliable product quality, complete traceability, reduced operator intervention, and the operational agility needed to meet the rapidly changing demands of the FMCG market.

Packaging Automation and Quality Assurance

Packaging is often the most visible demonstration of instrumentation within the FMCG industry. High-speed packaging lines employ photoelectric sensors, vision systems, barcode readers, checkweighers, and metal detectors to ensure every product satisfies quality requirements before shipment. Vision inspection systems verify labels, dates, packaging integrity, and print quality. Checkweighers confirm that products meet declared weight requirements, helping prevent customer complaints and regulatory concerns. Sensors installed throughout conveyors provide product tracking and synchronization, enabling machines to operate efficiently even at extremely high production rates.



Figure 3: High-Speed Packaging Line for beverage packing

Industry 4.0 and Sustainability

Walk through a modern FMCG plant today, and one quickly realizes that production equipment is no longer working in isolation. A flowmeter is not merely measuring flow, and a pressure transmitter is not just displaying value on

a screen. Every instrument has become a storyteller, continuously revealing how efficiently a process is running. From blending vessels and packaging lines to utility networks, data flows seamlessly across the plant, enabling engineers to spot bottlenecks, understand process behaviour, and make informed decisions in real time. The result is a manufacturing environment where visibility replaces guesswork and operational excellence is built on facts rather than assumptions.

Equally significant is the role instrumentation plays in the industry's pursuit of sustainability. In many facilities, the greatest savings are not achieved through large investments but through understanding where resources are being consumed unnecessarily. Steam losses, compressed air leakages, excessive water usage, and energy-intensive operations often remain hidden until reliable measurement exposes them. By converting plant data into meaningful actions, instrumentation helps engineering teams optimize utilities, improve equipment reliability, and reduce waste without affecting production targets. In this way, every sensor installed in a plant contributes not only to productivity and profitability, but also to building a smarter and more sustainable manufacturing future.



Figure 4: Industry 4.0 Enabled FMCG Manufacturing Environment

Challenges and Future Outlook

Behind every successful FMCG production line lies a complex set of challenges that demand far more than routine instrument maintenance. Instrumentation engineers operate in environments where production schedules are aggressive, product recipes change frequently, and hygiene standards leave little room for error. Sensors are continuously exposed to moisture, product buildup, vibration, temperature fluctuations, and harsh cleaning chemicals during CIP and SIP cycles, all of which can gradually affect measurement accuracy and reliability. Looking ahead, technologies such as artificial intelligence, advanced analytics, wireless instrumentation, edge computing, and digital twins are expected to redefine manufacturing operations. Future FMCG facilities will increasingly rely on self-diagnostic systems, predictive maintenance strategies, and intelligent control platforms capable of identifying process deviations before they impact production. In this evolving landscape, the role of instrumentation engineers will extend far beyond measurement and control, positioning them as key enablers of reliability, efficiency, sustainability, and the intelligent factories of the future.

Conclusion

In the fast-paced world of FMCG manufacturing, instrumentation acts as the silent force that ensures consistency, quality, and reliability across every stage of production. From monitoring critical process parameters to supporting automation, traceability, and quality assurance, its impact extends far beyond measurement. The ability to transform real-time process information into actionable decisions allows manufacturers to achieve higher efficiency, minimize waste, and consistently deliver products that meet both consumer expectations and regulatory requirements.

As factories continue to embrace digital technologies and smarter manufacturing practices, the importance of accurate and reliable instrumentation will only increase. While automation platforms and advanced analytics continue to evolve, they remain fundamentally dependent on trustworthy process data. For instrumentation engineers, this creates an opportunity to drive innovation, improve sustainability, and strengthen operational performance, making instrumentation a key pillar in the future of intelligent and competitive FMCG manufacturing.

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ECSBC 2024 and Eco Niwas Samhita 2024

Following the landmark 2022 amendment to the Energy Conservation Act, 2001, the Bureau of Energy Efficiency (BEE) and the Ministry of Power introduced a restructured regulatory framework for India's built environment. By transitioning from purely operational energy mandates to a holistic lifecycle sustainability approach, the government rolled out two distinct instruments: the **Energy Conservation and Sustainable Building Code (ECSBC) 2024** for commercial spaces and the **Eco Niwas Samhita (ENS) 2024** for residential projects. Together, they represent a unified strategy to lower the emissions intensity of India's GDP, balance skyrocketing cooling demands, and integrate clean energy directly into the design phase of modern real estate.

1. Energy Conservation and Sustainable Building Code (ECSBC) 2024

Overview and Scope

The **ECSBC 2024** serves as the updated successor to the Energy Conservation Building Code (ECBC 2017). While its predecessor focused heavily on reducing operational electrical consumption, ECSBC 2024 structurally shifts the goalposts by weaving green building parameters—such as water conservation, waste mitigation, low-carbon materials, and indoor environmental quality (IEQ)—into building law. The code applies to **commercial buildings or complexes** with a minimum connected load of **100 kW** or a contract demand of **120 kVA** or more.

The Three-Tier Performance Framework

The code retains and tightens a progressive performance structure, rewarding developers who surpass baseline expectations:

- **ECSBC Compliant Buildings:** The mandatory minimum baseline that all new commercial developments within the scope must achieve. Energy thresholds have been marginally tightened to account for market advancements in high-efficiency building products.
- **ECSBC Plus Buildings:** An aspirational, voluntary tier representing advanced energy conservation, typically reducing energy use by roughly 35% compared to conventional construction.
- **Super ECSBC Buildings:** The highest voluntary tier, targeting net-zero readiness or a minimum of 50% energy savings, designed to eventually become the future regulatory baseline as the domestic supply chain matures.

Key Pillars of Substance

1. **Passive Design & Climate Architecture:** Stricter standards govern the thermal transmittance (U-factors) of walls and roofs to minimize heat gain in cooling-dominated regions and trap heat in alpine climate zones.
2. **Solar-Ready & Renewable Integration:** Rather than treating solar power as an afterthought, ECSBC 2024 mandates structural and electrical allowances for **rooftop solar photovoltaics (PV)** during the architectural design phase.
3. **Flexible Compliance Pathways:** Developers can prove adherence using either the **Standardized**

Compliance Method (SCM), which provides prescriptive minimum thresholds for individual components, or the **Integrative Compliance Method (ICM)**, which grants architectural freedom through whole-building energy simulation modeling.

2. Eco Niwas Samhita (ENS) 2024

Overview and Scope

The **Eco Niwas Samhita 2024** functions as the unified **ECSBC-Residential** code. It synthesizes earlier piecemeal frameworks—specifically ENS 2018 (Part I: Building Envelope) and ENS 2021 (Part II: Electro-Mechanical and Renewable Energy Systems)—into a single, robust code enhanced with resource sustainability parameters. Crucially, ENS 2024 shifts its primary regulatory trigger to electrical capacity, capturing large apartment complexes, group housing societies, and mixed-use buildings with a minimum connected load of **100 kW** or a contract demand of **120 kVA**.

Point-Based Compliance System

Unlike the three-tier system used for commercial spaces, ENS 2024 employs a **point-based evaluation matrix** across mandatory and incremental tracks. To achieve premium green designations (**ENS+** or **Super ENS**), a residential block must secure 30% or 50% of the available sustainability points in each technical category respectively.

Key Pillars of Substance

- **Thermal Comfort & Building Envelope:** The code mandates a maximum permissible **Residential Envelope Transmittance Value (RETV)** alongside a minimum Openable Window-to-Floor Area Ratio (WFR). This relies on passive principles to guarantee adequate natural ventilation and daylighting, driving down artificial cooling needs.
- **Water Management & Conservation:** Addressing India's severe urban water stress, the code outlines strict mandatory benchmarks. It requires **rainwater harvesting systems** to capture 80% of roof runoff, stipulates that at least 40% of irrigation must rely on recycled wastewater, and mandates the use of water-efficient (minimum 1-star rated) sanitary fixtures.
- **Construction Waste & Low-VOC Materials:** Residential developers are legally required to divert construction waste away from landfills via recycling or municipal salvage. To protect occupant health, it also dictates strict limits on volatile organic compounds (VOCs) in internal paints and finishes.

Direct Structural Comparison

Feature / Metric	ECSBC 2024 (Commercial)	Eco Niwas Samhita 2024 (Residential)
Primary Target	Non-residential, office spaces, retail complexes.	Multi-family housing, apartments, dormitories, hotels.
Applicability Limit	$\geq$ 100 kW connected load or $\geq$ 120 kVA contract demand.	$\geq$ 100 kW connected load or $\geq$ 120 kVA contract demand.
Evaluation Method	Tiered levels (Baseline, Plus, Super).	Sectional Point-Based System (ENS, ENS+, Super ENS).
Compliance Proof	Prescriptive (SCM) or Simulation (ICM).	Simple calculation tools based on architectural drawings.
Core Sustainability Focus	Peak cooling load reduction, commercial HVAC efficiency, and solar PV readiness.	RETV metrics, rainwater harvesting, local recycling, and occupant indoor air quality.

Conclusion

The **ECSBC 2024** and **Eco Niwas Samhita 2024** form a coordinated policy mechanism designed by the Bureau of Energy Efficiency (BEE) to future-proof India's urbanization. By moving past simple calculations of energy efficiency to enforce strict regulations on water usage, circular waste management, and passive thermal comfort, these codes lay down a legally binding path toward a net-zero built environment.

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*The author of the above article had an opportunity to attend the Master Trainer Program on **Energy Conservation and Sustainable Building Code**, ECSBC, for Energy Auditors and Managers, sponsored by Bureau of Energy Efficiency, Ministry of Power, Govt of India and conducted by the Administrative Staff College of India, at their CPC--Campus Banjara Hills, Hyderabad campus between 07th and 11th September 2026.*

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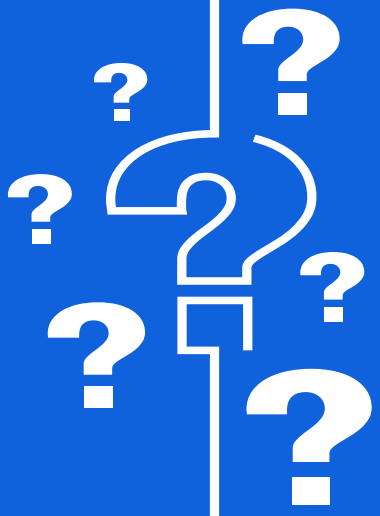
Congratulations

QUIZ - OCTOBER 2026

1. What is Artificial Intelligence (AI)?
A. A type of electrical transformer
B. The simulation of human intelligence by machines
C. A communication protocol
D. A programming language

2. What is Machine Learning?
A. Automatic operation of machines
B. Machines learning from data without explicit programming
C. A mechanical training process
D. Automated maintenance

3. Digital Twins are:
A. Duplicate electrical panels
B. Virtual models of physical systems
C. Backup generators
D. Secondary transformers



4. Which AI technique mimics the structure of the human brain?
A. PLC Logic
B. Neural Networks
C. Relay Logic
D. Ladder Diagrams

5. Which of the following is NOT a benefit of AI in industry?
A. Higher operational efficiency
B. Better decision-making
C. Increased unplanned downtime
D. Improved asset utilization

6. Generative AI can assist engineers by:
A. Drafting reports and specifications
B. Generating design concepts
C. Summarizing technical documents
D. All of the above

7. Which challenge must be addressed for successful AI implementation?
A. Data Quality
B. Cybersecurity
C. Skilled Workforce
D. All of the above

8. AI is particularly useful in renewable energy systems for:
A. Weather forecasting
B. Generation prediction
C. Grid balancing
D. All of the above

9. The future role of engineers in an AI-driven industry will be:
A. Fully replaced by machines
B. Limited to manual tasks
C. Enhanced through collaboration with AI tools
D. Unaffected by AI

10. Which upcoming CEEAMATECH 2026 theme focuses on the growing influence of intelligent technologies in electrical engineering?
A. Conventional Wiring Methods
B. AI in Power Systems
C. Historical Power Plants
D. Steam Engineering

- The quiz will be open for the following month.
- Each question carries 10 marks.
- Please use following google form link to participate in this month's QUIZ - https://forms.gle/GsSGYfJ9cHsNxtui8

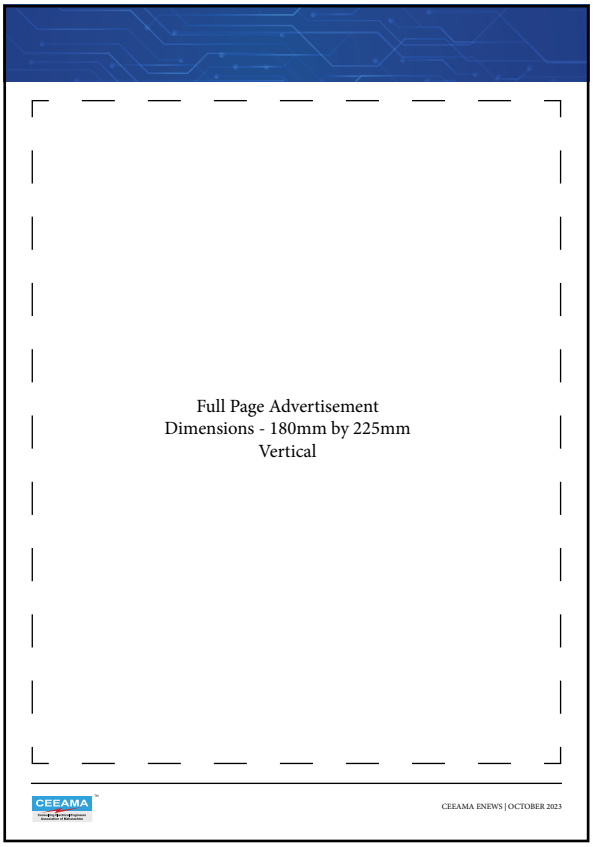
Thank you for the overwhelming response to the E-NEWS, especially the E-Quiz. MCQ-based quizzes often challenge our understanding and encourage us to think more deeply about technical concepts. Our aim is to spark curiosity, help you assess your technical awareness, and identify topics that deserve greater discussion and learning.

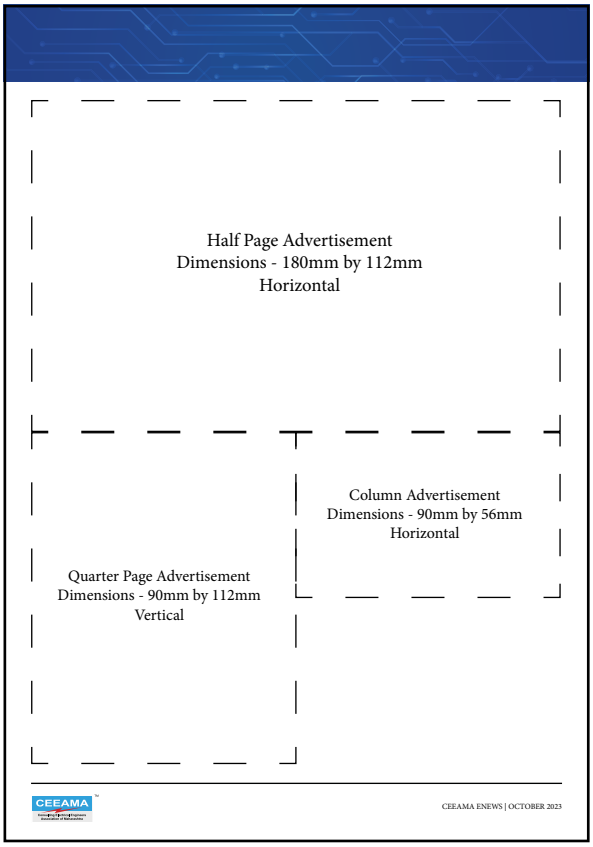
Wishing you the very best for this round — keep participating and spread the word!

September 2026 Quiz Answers

1. B. Technical Specification
2. B. Fault level withstand capability
3. C. Power Transformer
4. B. IECEx/ATEX
5. B. Conductor Cross-Sectional Area
6. B. Assess technical compliance with specifications
7. C. Substation Automation Systems
8. B. Specify engineering documents to be submitted
9. B. Ratio Test
10. B. Degree of Internal Separation

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E-NEWSLETTER

Published by Consulting Electrical Engineers Association of Maharashtra

Electrical Consultants Newsletter
Volume No. 4 Issue #64
OCTOBER 2026

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