WATTS UP Quarterly

TAURUS POWERTRONICS P.VT. LTD.

YEAR: 6 ISSUE: 16 15th August 2026

Dear Team Members, Customers, Business Associates, and Well-Wishers,

Celebrating 80 Years of India's Independence

As India proudly celebrates its 80th Independence Day, I extend my heartfelt wishes to every member of the Taurus family and to our fellow citizens. This historic occasion is a powerful reminder of our nation's remarkable journey — from the dreams of freedom to becoming a rapidly advancing, self-reliant, and innovation-driven India.

The spirit of "Azadi" inspires us not only to celebrate our freedom but also to take responsibility for building a stronger, safer, and more prosperous nation. At Taurus Powertronics, we are proud to contribute to this journey by developing advanced technologies for Power Generation, Transmission, Distribution, Railways, Industries, and critical infrastructure, strengthening the reliability and safety of India's energy ecosystem.

As we step forward into FY 2026–27, we remain committed to innovation, predictive testing, condition monitoring, electrical safety, and smart diagnostic solutions that support the modernization of our nation's power infrastructure. Our progress is powered by the trust of our customers, the dedication of our employees, and the continued support of our partners and associates. Let us carry the spirit of independence into everything we do — thinking independently, innovating fearlessly, working with integrity, and contributing meaningfully to India's growth story. Together, let us build not just a stronger Taurus, but a stronger, smarter, safer, and more self-reliant India.

Wishing you and your families a proud, inspiring, and memorable 80th Independence Day. Jai Hind

With Warm Regards,
Suraj M R
Managing Director

BHARAT SWATANTRA DIVAS CELEBRATION
FREEDOM TO INNOVATE. POWER TO PROGRESS

As India celebrates its 80th Independence Day, we proudly celebrate the spirit of freedom, progress, innovation, and self-reliance that continues to shape our nation's journey.

Independence is not only the freedom to dream-it is the responsibility to build, innovate, contribute, and create a stronger India.

At Taurus Powertronics, we are proud to contribute to the nation's infrastructure by enabling safer electrical systems, smarter asset management, reliable power networks, and advanced testing and diagnostic solutions.

As India moves confidently toward a stronger and more self-reliant future, we remain committed to supporting the nation's energy ecosystem through technology, innovation, safety, and excellence.

Let us honour the spirit of freedom by powering progress, embracing innovation, and building a stronger tomorrow-together.

Jai Hind

Wishing you all a successful, prosperous, innovative, and inspiring FY 2026–27.

Happy Independence Day

A PROUD MILESTONE IN OUR SUSTAINABILITY JOURNEY

We are proud and overwhelmed to announce that Taurus Powertronics Pvt. Ltd. has been certified to ISO 14001:2015 – Environmental Management Systems, recognizing our commitment to responsible environmental practices and sustainable growth. This achievement strengthens our resolve to innovate responsibly, operate sustainably, and build a greener future.

NEUTRAL VERITAS TRANSPARENT ®

Certificate of Registration

This is to certify that the Environmental Management Systems of

TAURUS POWERTRONICS PRIVATE LIMITED

1) No.26, Mahadimane, 12th main, 1st Block, Rajajinagar, Bengaluru, Karnataka -560010
2) No. 648/ 54, "ANUGRAHA" Opp. Canara Bank, KLE College Road, 2nd Block, Rajajinagar, Bengaluru, Karnataka - 560010
3) 3B - 06, Block No.3, M.S Industrial Complex,14th Cross, 4th Phase, Peenya Industrial Area, Bengaluru, Karnataka, 560058

has been assessed and registered by TNV as conforming to the requirements of:

ISO 14001:2015

(Environmental Management Systems)

For the following Scope

MANUFACTURE, SUPPLY, INSTALLATION, REPAIR, MAINTENANCE, SERVICE OF DIAGNOSTIC AND MATERIAL HANDLING EQUIPMENTS AND TOOLS FOR POWER SECTOR

MANAGEMENT SYSTEM CERTIFICATE

TNV is accredited by United Accreditation Foundation (UAF), Status of Certificate can be verified on www.tnv.com & www.iafcertsearch.org

Certificate Number	HNVC6TCU20260617INDEV13H	Initial Registration Date	17/06/2026
Current Issue Date	17/06/2026	Validity of this Certificate	16/06/2029
1st Surveillance Date	17/05/2027	Recertification due on	16/06/2029
2nd Surveillance Date	17/05/2028	Revision No./Date	00
Issue No.	01	IAF Code	18

UNITED ACCREDITATION FOUNDATION UAF — MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

CB-MS-2206

Director
TNV Global Limited
(LEI No: 335800HPF7ZH8AORCF93)

Certification Body Add. H.O.: Abichi House, 5 Wadsworth Road, Perivale, Greenford, England, UB6 7JD
Accreditation Board.: United Accreditation Foundation Inc, 1060 Laskin Road, Suite 12B/ 13B, Virginia Beach VA 23451, USA

*Validity of this certificate is subject to continued compliance with the management system standard and successful completion of audits as planned by TNV from time to time. Further clarification regarding the scope of this certificate and the applicability of the standard may be obtained by consulting the organization. The India office address of TNV is B-1/19-69, Sector K, Aliganj, Lucknow, Uttar Pradesh – 226024, India. This certificate remains the property of TNV and must be returned on request. For surveillance details, please visit www.tnv.com or write to info@isoindia.org. CIN Number of TNV Global Limited is U74900UP2011PLC046719.

When the breaker opens and the lock is applied, the equipment is dead, right? Not exactly. For high-voltage transmission lines, transformers, and industrial capacitors, residual stored energy remains a lethal, invisible threat.

While Indian utilities and plant managers strictly adhere to the Central Electricity Authority (CEA) regulations for permanent earthing, the manual procedures for temporary discharging and portable grounding often lack the rigid, fail-safe protocols seen in international frameworks. As India's grid modernizes and industrial power demands surge, adopting global best practices for electrical discharging is no longer just an option—it is a life-saving necessity.

The Global Standard: Zero Trust, Total Verification

International frameworks-most notably the **NFPA 70E** in the United States and **IEC 61230** globally-treat de-energization not as a single action, but as a heavily documented procedural state known as an "Electrically Safe Work Condition."

In these jurisdictions, discharging stored energy relies on a few non-negotiable principles:

1. **The "Live-Dead-Live" Test:** Before any discharge rod touches a conductor, the absence of voltage must be verified using a properly rated non contact voltage detector (NCVD). Crucially, the NCVD itself must be tested on a known live source before and after the measurement to ensure it hasn't failed.
2. **Capacitance and Induced Voltage Protocols:** NFPA 70E specifically mandates that any capacitor storing 10 Joules or more (example long cables, capacitor banks), or operating at 100 Volts or higher, must be properly discharged before work begins. Furthermore, adjacent live lines can induce dangerous voltages in de-energized lines, making temporary grounding mandatory, not just recommended.
3. **Certified Portable Earthing Equipment:** Under IEC 61230, portable discharge rods and earthing cables are subjected to rigorous short-circuit testing. If a feeder is accidentally switched on while technicians are working, the discharge rod's aluminum alloy clamps and flexible copper/aluminum cables (often rated for fault levels up to 40KA) must safely route the short-circuit current to the ground without disintegrating.
4. **Bracket Grounding (Equipotential Zones):** When working on a de-energized line, applying temporary grounds on both sides of the immediate work zone is a strict requirement. This practice creates an equipotential zone. If the line is accidentally re-energized or if dangerous induction occurs from parallel active lines, the current is routed harmlessly to earth around the workers, keeping the voltage across their bodies at a safe zero level.

Key Insight: International standards focus heavily on the Hierarchy of Risk Controls. The primary goal is always elimination of the hazard at the source, moving down to engineering controls, and only relying on PPE as a last line of defense.

The Current Landscape in India

India's CEA (Measures Relating to Safety and Electric Supply) Regulations, alongside standard **IS 3043:2018,** provide a robust foundation for permanent earthing systems. Plant managers are required to ensure strict earth resistance limits, periodic testing, and comprehensive earth fault protection on high-voltage (HV) installations.

However, a critical gap often emerges in field execution. While permanent substations are well-regulated, the use of portable discharging equipment during temporary shutdowns or hotline maintenance is occasionally compromised by:

- Makeshift Equipment: The use of non-standardized grounding cables or low-quality clamps that would melt instantly under high fault currents.
- Procedural Shortcuts: Skipping the formal "Live-Dead-Live" voltage verification before applying the discharge rod.
- Single-Point Grounding Risks: Placing only one discharge rod on the line, leaving workers exposed to induced voltages or reverse-feed hazards from the unguarded side.
- Lack of Documented Risk Assessments: Unlike the NFPA 70E Section 110.5(H) requirement, task-specific risk assessments detailing exact discharging procedures for unique equipment are not universally documented across all Indian utilities.

Bridging the Gap: What India Should Adopt

To elevate safety standards and eliminate discharging-related fatalities, Indian utilities and industrial plants should consider integrating these international techniques:

International Practice	Current Indian Context	Recommended Action
Mandatory "Live-Dead-Live"	Often reliant on visual breaker status or unverified by NCVD.	Standardize voltage verification protocols using NCVD, prior to grounding.
Equipotential Zone Grounding	Often relies on single-point grounding near the work site.	Mandate the practice of "bracket grounding" placing discharge rods on both sides of the work zone to isolate workers from accidental re-energization or induced currents completely.
IEC-Certified Discharge Rods	Mixed use of certified equipment and locally fabricated, unrated earthing sticks.	Mandate the exclusive use of Type-Tested portable earthing equipment (IEC 61230 /IEC 61235) rated for the specific system's fault level (e.g., 40KA).
Formalized Risk Assessments	General safety manuals; task-specific assessments are sometimes bypassed.	Adopt a framework similar to NFPA 70E, requiring documented hazard identification and control implementation before discharging begins.

By Vishal Patil, Manager - Product

IMPORTANCE OF MONITORING LEAKAGE CURRENT IN ELECTRICAL ASSETS

Introduction

The reliability and safety of electrical power systems are critical for ensuring uninterrupted electricity supply to industries, commercial establishments, and residential consumers. Electrical assets such as power transformers, switchgear, circuit breakers, generators, transmission lines, cables, insulators, surge arresters, and rotating machines are continuously exposed to electrical, thermal, environmental, and mechanical stresses throughout their operational life. These stresses gradually deteriorate the insulation systems of electrical equipment, resulting in the flow of unwanted electrical current known as leakage current.

Leakage current refers to the small amount of electrical current that flows through or across an insulating material instead of the intended conductive path. Although the magnitude of leakage current is generally low during healthy operating conditions, an increase in leakage current is considered one of the earliest indicators of insulation degradation. If left undetected, it can lead to equipment failure, electrical fire, flashover, short circuits, power outages, and safety hazards.

With the increasing adoption of condition-based maintenance (CBM), predictive maintenance (PdM), and Industry 4.0 technologies, continuous leakage current monitoring has become an essential diagnostic technique for assessing the health of electrical assets. Researchers and utilities worldwide have demonstrated that monitoring leakage current significantly improves equipment reliability, reduces maintenance costs, and extends asset life.

Leakage Current and Insulation Health

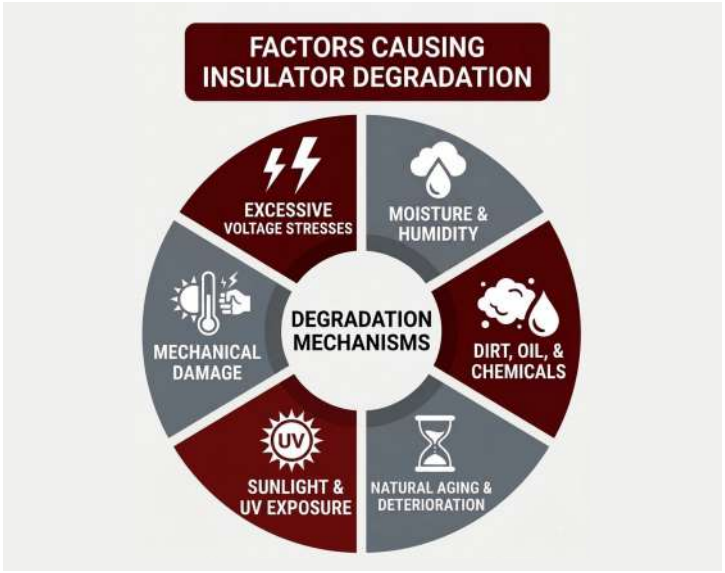
Insulation serves as the primary barrier that prevents current from flowing between conductors and grounded components. Ideally, insulation possesses infinite resistance, allowing no current to pass. However, in practical systems, insulation always exhibits a finite resistance due to material imperfections, moisture absorption, contamination, aging, and thermal degradation.

As insulation deteriorates, its resistance decreases, allowing more current to leak through unintended paths. Consequently, leakage current becomes an effective indicator of insulation condition.

Numerous studies have shown that insulation deterioration follows a gradual process involving:

a. Thermal aging
b. Electrical stress
c. Moisture ingress
d. Surface contamination
e. Mechanical damage
f. Chemical degradation
g. Partial discharge activity.

Monitoring leakage current enables maintenance engineers to detect these problems before catastrophic insulation failure occurs.



By Shrivatsa V Kulkarni, Asst Manager - Technical

PREDICTIVE MAINTENANCE STRATEGY USING PARTIAL DISCHARGE DETECTION

1. Introduction

In modern power systems, the reliability and availability of electrical equipment are critical for uninterrupted supply. Traditional maintenance strategies, such as corrective (run-to-failure) and time-based preventive maintenance, often lead to unnecessary downtime or late detection of faults. To overcome these challenges, industries are increasingly adopting predictive maintenance (strategies, Predictive maintenance relies on real-time condition monitoring, diagnostics, and advanced analytics to anticipate failures before they occur, thereby improving asset availability, reducing costs, and extending equipment life.

One of the most effective techniques in predictive maintenance for high-voltage equipment is the use of Partial Discharge (PD) detection systems, which provides early indications of insulation degradation. International standards such as IEC 60270, IEEE 400.3, and ISO 55000 recommend PD monitoring as a core element of condition-based maintenance strategies.

2. Understanding Partial Discharge

Partial Discharge (PD) is defined by IEC 60270 as a localized electrical discharge that partially bridges the insulation between conductors and which may or may not occur adjacent to a conductor. PD activity is symptomatic of insulation defects, such

as voids, cracks, surface contamination, or sharp edges. If undetected, PD can progressively weaken insulation systems and result in catastrophic failures of:

- Power transformers
- Cables and Joints
- Switchgear
- Rotating machines (motors, generators)
- Insulators

PD activity is a leading indicator of insulation degradation. If left undetected, it can evolve into catastrophic failures, causing costly outages and equipment damage.

3. Standards Governing Partial Discharge Detection

PD measurement and monitoring are well documented in international standards, ensuring consistency and reliability of test results:

- IEC 60270: High-voltage test techniques – Partial discharge measurements.
- IEEE 400.3: Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment.
- IEC 62478: High-voltage test techniques – Measurement of partial discharges by electromagnetic and acoustic methods.
- ISO 55000: Asset Management – Overview, principles and terminology (provides framework for predictive maintenance integration).
- IEEE Std C57.127: Guide for the Detection and Location of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers.

These standards provide guidelines for measurement techniques, instrumentation, calibration, and interpretation of PD data.

4. Predictive Maintenance Framework with PD Detectors

A Partial Discharge Detector allows utilities and industries to continuously or periodically monitor insulation health, enabling condition-based maintenance.

Key Steps in Strategy:

4.1 Baseline Assessment

- Perform initial PD measurements during commissioning or routine inspections (per IEC 60270).
- Establish a healthy reference value for equipment.
- Establish reference PD levels for future comparison.

4.2 Online Monitoring

- Install permanent or portable PD detectors for real-time monitoring of critical equipment.
- Apply non-intrusive methods such as UHF, HFCT, TEV, and acoustic sensors depending on equipment type.
- Continuously track discharge magnitude, frequency, and location under normal operating conditions.
- Ensure compliance with IEC 62478 for electromagnetic and acoustic detection methods.

4.3 Data Acquisition and Analysis

- Collect PD data including magnitude, phase-resolved patterns, and frequency spectrum.
- Use advanced algorithms to analyze PD patterns.
- Apply IEEE 400.3 methodologies for noise filtering and field environment corrections.
- Use diagnostic algorithms to differentiate harmful PD from background noise.
- Differentiate between harmless noise and dangerous PD activity.
- Correlate PD signals with equipment load, temperature, and humidity.

4.4 Trending and Condition Assessment

- Track PD activity over time to identify progressive deterioration.
- Integrate PD data into asset management systems aligned with ISO 55000 principles.
- Establish risk indices for equipment prioritization.
- Rising trends indicate progressing insulation degradation.

4.5 Maintenance Decision

- Schedule maintenance only when PD trends indicate critical insulation degradation.
- Schedule repair or replacement before failure.
- Prioritize assets with critical PD activity for maintenance shutdowns.
- Reduce unnecessary preventive maintenance on healthy equipment.
- Avoid unnecessary interventions on healthy equipment, optimizing OPEX and CAPEX.

5. Benefits of PD-based Predictive Maintenance

5.1 Proactive Fault Identification

- Detects insulation defects at an early stage, well before they escalate into critical failures.
- Provides actionable diagnostic insights that enable timely interventions.
- Provides valuable lead time for corrective action.

5.2 Enhanced Asset Reliability and Availability

- Reduces unplanned outages in critical power equipment.
- Reduces the likelihood of unexpected equipment outages.
- Ensures stable operation of substations, cables, transformers, and switchgear.
- Improves overall system stability and ensures continuity of power supply.

5.3 Optimized Maintenance Strategies

- Facilitates a shift from schedule-driven to condition-based maintenance.
- Minimizes unnecessary inspections, testing, and downtime.

5.4 Extended Equipment Service Life

- Prevents progressive insulation degradation, thereby delaying major or replacements.
- Delays costly refurbishment or replacements by maintaining insulation integrity.
- Supports sustainable utilization of capital-intensive assets.

5.5 Cost-Effectiveness

- Reduces unplanned repair expenses and the financial impact of outages.
- Enhances long-term return on investment through efficient resource allocation.
- Improves return on investment (ROI) through proactive asset management.

5.6 Improved Safety Performance

- Mitigates risks of arc flash, fire, and catastrophic failures.

- Reduces risk to maintenance personnel and surrounding infrastructure.

5.7 Compliance with International Standards

- Aligns with IEC 60270, IEC 62478, and IEEE 400.3 for reliable PD measurement and interpretation.
- Supports ISO 55000 principles of structured and risk-based asset management.

5.8 Readiness for Digital Transformation

- Integrates seamlessly with digital substations, online monitoring systems, and smart grid applications.
- Enables predictive analytics, data-driven decision-making, and remote diagnostics.

6. Industrial Applications

6.1 Power Transformers

- Continuous PD monitoring helps detect insulation defects in windings, bushings, and tap changers.
- Acoustic, electrical, and UHF PD sensors are commonly applied in accordance with IEC 60270 and IEEE C57.127.

6.2 High-Voltage Cables and Joints

- PD detection (per IEEE 400.3) identifies voids, cracks, or poor terminations in shielded power cables.
- Prevents sudden breakdowns in underground transmission and distribution networks.

6.3 Gas-Insulated Switchgear (GIS)

- UHF and acoustic PD sensors detect defects in spacers, conductor surfaces, or gas contamination.
- Online monitoring supports condition-based maintenance in critical substations.

6.4 Rotating Electrical Machines (Motors & Generators)

- PD monitoring of stator windings detects partial discharge activity caused by insulation aging, thermal stress, or contamination.
- Reduces unexpected downtime in industrial plants, steel mills, and power generation facilities.

6.5 Outdoor Insulators and Bushings

- Surface PD detection identifies contamination, cracks, or tracking on porcelain, glass, and composite insulators.
- Supports grid reliability in harsh environmental conditions.

6.6 Renewable Energy Systems

- Wind turbine generators and solar inverter transformers benefit from online PD monitoring.
- Ensures reliability of renewable assets integrated into smart grids.

7. Comparative table showing Corrective Maintenance vs Preventive Maintenance vs PD-based Predictive Maintenance

Aspect	Corrective Maintenance (Run-to-Failure)	Preventive Maintenance (Time-Based)	PD-based Predictive Maintenance (Condition-Based)
Approach	Repair/replace after failure occurs	Scheduled interventions at fixed intervals	Real-time monitoring with PD detection and diagnostics
Risk of Failure	Very high – failure occurs before action	Moderate – failure may occur between intervals	Low – incipient defects detected before failure
Cost Efficiency	High unplanned repair and downtime costs	Moderate – unnecessary maintenance adds cost	High – maintenance only when condition demands
System Reliability	Poor – frequent unexpected outages	Fair – reliability depends on schedule	Excellent – faults addressed proactively
Asset Lifespan	Reduced due to repeated breakdowns	Improved, but affected by over/under-maintenance	Maximized through early defect detection
Safety	Low – high risk of catastrophic events	Medium – failures may still occur unexpectedly	High – prevents arc flash, fire, and major hazards
Standards Compliance	Not aligned with structured frameworks	Partially aligned with general maintenance practices	Fully aligned with IEC 60270, IEEE 400.3, ISO 55000
Suitability	Emergency or low-criticality assets	Moderate-criticality assets with predictable aging	High-criticality assets in utilities and industries
Integration with Digital Systems	None	Limited	Seamless – compatible with smart grids and online monitoring

8. Conclusion

PD-based predictive maintenance represents a major advancement over conventional preventive and corrective strategies by transitioning from schedule-driven or failure-based approaches to condition-based asset management. Unlike corrective maintenance, which risks catastrophic equipment failure, or preventive maintenance, which often incurs unnecessary cost and downtime, PD-based strategies deliver actionable insights into insulation health at an incipient stage, enabling timely and effective interventions.

This approach is firmly supported by international standards, including IEC 60270 for partial discharge measurement, IEEE 400.3 for cable testing in field environments, and ISO 55000 for asset management principles. These frameworks ensure diagnostic reliability, structured implementation, and integration with broader maintenance strategies.

By combining early fault detection with standards-driven practices, PD-based predictive maintenance enhances reliability, extends asset life, and reduces operational expenditure. Its alignment with digital monitoring systems and smart grid technologies further establishes it as a cornerstone of sustainable, safe, and future-ready power system management.

MD Zeeshanullah Ansari, Engineer - Technical

EL ASIA 2026 EXHIBITION

Taurus Powertronics proudly participated in EL ASIA 2026, one of India's leading exhibitions for the electrical and power industry. The event provided an excellent platform to showcase our innovative electrical testing, diagnostic, and safety solutions to a diverse audience of utilities, EPC companies, consultants, OEMs, and industry professionals. We demonstrated our latest technologies, including the newly launched TAVION product range, while engaging in meaningful technical discussions with prospective customers and partners. The exhibition generated valuable business enquiries, strengthened existing relationships, and opened new opportunities for future collaborations. Our participation reaffirmed Taurus Powertronics' commitment to innovation, quality, and delivering reliable solutions that support the evolving needs of the global power sector. We sincerely thank everyone who visited our booth and contributed to making EL ASIA 2026 a successful and memorable event.

TAURUS POWERTRONICS AT MIDDLE EAST ENERGY DUBAI 2026

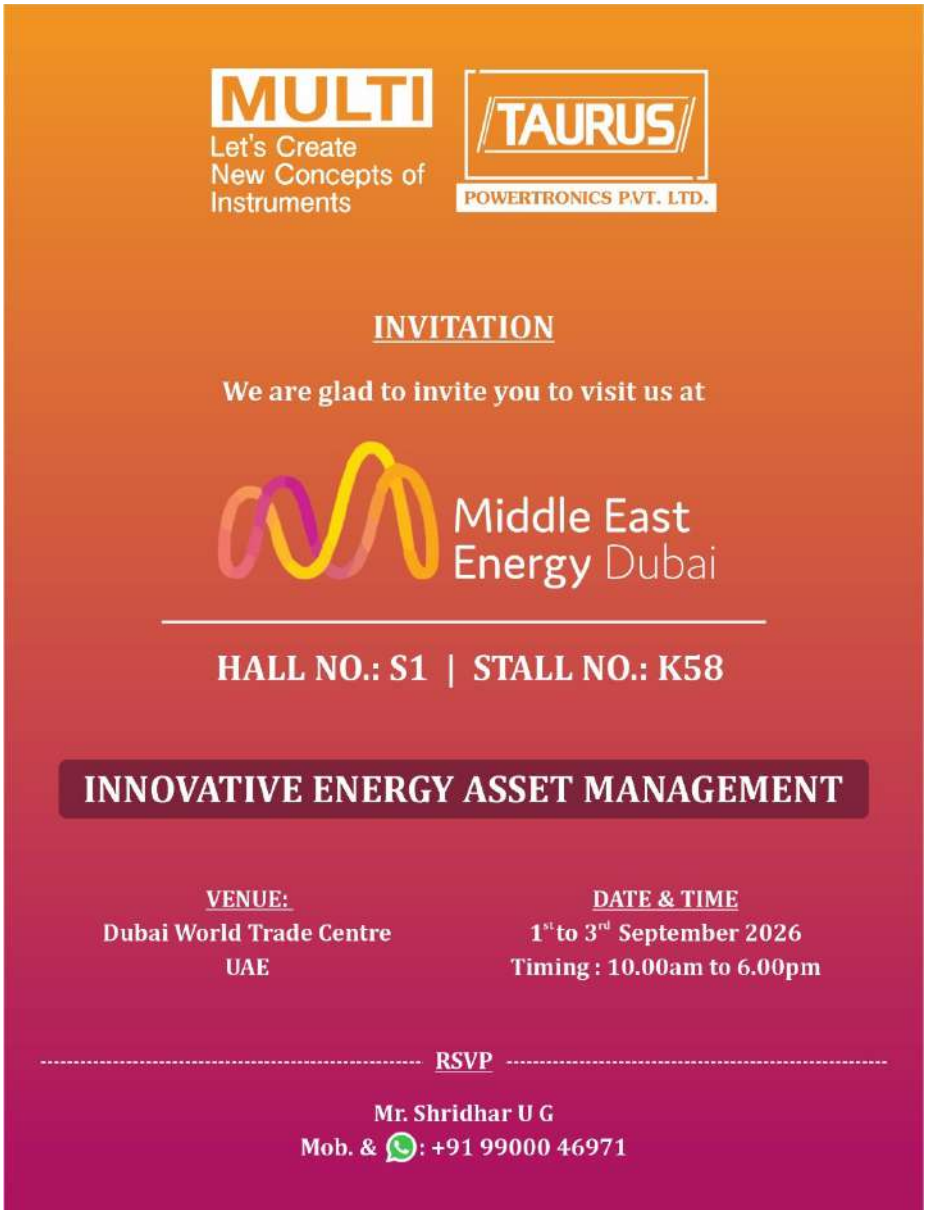
Innovative Energy Asset Management Goes Global

We are proud to announce our participation in **Middle East Energy 2026,** one of the leading **international platforms for the global energy and power industry.** This prestigious event will provide **Taurus Powertronics** with an opportunity to showcase our **innovative electrical testing, measurement, safety, predictive maintenance, and energy asset management solutions** to industry leaders from across the world.

We warmly **invite our customers, partners, consultants, utilities, EPC companies, distributors, and industry professionals** to visit us and experience our latest technologies.

Discover. Connect. Innovate.

Visit us at Hall S1, Stall K58 to explore our advanced solutions, discuss your specific application requirements, and discover new possibilities for safer, smarter, and more reliable energy infrastructure.



PLANTING HOPE TODAY, GROWING A GREENER TOMORROW

On **12th August 2026**, Taurus Powertronics proudly conducted a tree plantation drive and planted nearly 650 Plus saplings in a single day, reaffirming our commitment to environmental responsibility and sustainability. We believe that our Earth is our Mother, and protecting her is a shared responsibility. As we continue to drive innovation and technological excellence, we remain equally committed to preserving nature, creating a healthier environment, and building a greener future for generations to come.








FROM EDITOR'S DESK

Dear Readers,

As India proudly celebrates its 80th Independence Day, we salute the spirit of freedom, resilience, innovation, and nation-building that has shaped our incredible journey. This historic occasion reminds us that the strength of a nation lies not only in its freedom, but in its ability to continuously innovate, progress, and build a stronger tomorrow.

At Taurus Powertronics Pvt. Ltd., we are proud to contribute to this journey by developing reliable, advanced, and indigenous solutions for electrical testing, predictive diagnostics, safety, and intelligent asset management. As the power sector moves towards smarter, safer, and more resilient networks, our commitment remains unwavering—to support India's energy infrastructure through technology, excellence, and continuous innovation.

This edition of WATTS UP brings together our latest innovations, achievements, field applications, and insights that reflect our passion for creating meaningful impact in the power sector. On this special Independence Day, I extend my heartfelt wishes to our employees, customers, partners, and stakeholders. Let us honour the legacy of our freedom by powering progress, embracing innovation, and working together to build a stronger, safer, self-reliant, and brighter India. Jai Hind!

Warm Regards,

Shridhar U G, Chief General Manager

TAURUS POWERTRONICS PVT LIMITED

No. 26, "Mahadimane", 12th Main, 1st Block, Rajajinagar, Bengaluru - 560 010. INDIA.

Tel : + 91 80 23012301**, WhatsApp :** +91 73496 44344**, Email :** info@tauruspowertronics.com