The Institution of Engineers (India)

AN ISO 9001 : 2008 CERTIFIED ORGANISATION
(Established 1920, Incorporated by Royal Charter 1935)

"A Century of Service to the Nation"

e-Disha

VOLUME I : 25/27-1

JHARKHAND STATE CENTRE

IEI ENGINEER BHAWAN, NEPAL KOTHI CAMPUS, RANCHI- 834 002
Phone : 0651 - 3510412 | E-mail : jharkhandsc@ieindia.org | Website : www.ieijscjharkhand.org

January - March 2026





Dr. Vishal H Shah
Honorary Secretary
IEI, JSC



Er. Sandeep K Bhagat
Chairman
IEI, JSC

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e-Disha
VOLUME I : 25/27-1

Chairman's Message

The Institution of Engineers (India)
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JHARKHAND STATE CENTRE
IEI ENGINEER BHAWAN, NEPAL KOTHI CAMPUS, RANCHI- 834 002



Er. Sandeep K Bhagat, FIE
Chairman

Phone : 0651 - 3510412
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Website : www.ieijscjharkhand.org

"A Century of Service to the Nation"

Message

It gives me immense pleasure to note the subsequent issue of e-Disha, the official magazine of the Institution of Engineers (India), Jharkhand State Centre.

This publication marks a significant step towards fostering knowledge sharing, innovation and professional excellence among our members, engineers and the wider community. e-Disha aims to serve as a dynamic platform for exchanging ideas, showcasing technical advancements and highlighting the achievements and contributions of our IE(I) family.

In an era driven by rapid technological transformation, it is essential to stay informed, connected and inspired. Through this magazine, we aspire to encourage thought leadership, promote best practices, and create meaningful dialogue on emerging trends and challenges in the field of engineering.

I extend my sincere appreciation to the editorial team and all contributors whose dedication and efforts have made this initiative a reality. I am confident that e-Disha will grow into a valuable knowledge resource and a source of inspiration for all.

I invite all members to actively participate and contribute to the continued success of this publication.

With best wishes,

(Sandeep K Bhagat)

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Dr. Vishal H Shah, FIE
Hony. Secretary

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"A Century of Service to the Nation"

Message

I am delighted to note the present issue of e-Disha, the official magazine of the Institution of Engineers (India), Jharkhand State Centre.

The journal is a proud milestone for our Centre, reflecting our continued commitment to knowledge dissemination, professional growth, and intellectual engagement.

e-Disha is envisioned as a vibrant platform that brings together innovative ideas, technical insights and achievements of engineers, academicians, and industry professionals.

In today's rapidly evolving technological landscape, the exchange of knowledge and experiences is vital. This publication will not only document our activities but also inspire meaningful discussions and encourage contributions that advance the engineering profession.

I sincerely appreciate the efforts of the editorial team and all contributors who have worked tirelessly to bring out the issue. Their dedication has made this initiative possible.

I encourage all members to actively participate by sharing their knowledge, experiences, and perspectives, making e-Disha a truly enriching and collaborative endeavours.

(Vishal H Shah)
Hony. Secretary

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Hony. Secretary's Message

e-Disha
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The Institution of Engineers (India)

JHARKHAND STATE CENTRE

Editorial Board

E-Disha Committee comprises of following Engineers:

Chairman: **Dr. Manoj Kumar**
Convenor: **Er. Kunal Sinha**
Members: **Er. Niranjan Prasad, Er. Umesh Prasad Sah, Er. Ashish Kumar Gupta, Er. Pankaj Kumar**

Foreword.....



It is a matter of great pride and satisfaction to present the issue of e-Disha, the official magazine of the Institution of Engineers (India), Jharkhand State Centre.

As the Chairman of the e-Disha Committee, I see this publication as a meaningful step towards creating a vibrant knowledge-sharing platform for engineers, professionals, and students alike. Our vision is to make e-Disha a medium that captures the spirit of innovation, technical excellence and collaborative learning within our engineering community.

This magazine has been conceptualized to showcase insightful articles, emerging technologies, research contributions, and the diverse activities of our Centre. It is our endeavor to ensure that e-Disha not only informs but also inspires readers to think critically, innovate responsibly, and contribute actively to the advancement of society through engineering.

The success of this issue is the result of the collective efforts of a dedicated editorial team and enthusiastic contributors. I extend my heartfelt gratitude to everyone involved in bringing this vision to life.

I warmly invite members and readers to share their ideas, experiences, and expertise in future editions, so that e-Disha continues to evolve as a valuable and engaging platform for all.

Sd/-
(Dr. Manoj Kumar)
Chairman, e-Disha and Websites Committee
Institution of Engineers (India), Jharkhand State Centre, Ranchi

The Institution of Engineers (India)

JHARKHAND STATE CENTRE

Executive Committee 2025-27

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The Institution of Engineers (India)

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Sub Committee 2025-27

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The Institution of Engineers (India)

JHARKHAND STATE CENTRE

Welcome to the family of IEI, JSC

Application No.	Name	Date of Membership	Place
AM3186388	NADEEM AHMAD	02-01-2026	JHARKHAND
AM3186604	RAVI SHANKAR	02-01-2026	JHARKHAND
AM3186728	MD ARIF EQUBAL	02-01-2026	JHARKHAND
AM3186957	BIPIN KUMAR	13-01-2026	JHARKHAND
AM3187023	TANVIR GHAUS	15-01-2026	JHARKHAND
AM3187023	TANVIR GHAUS	15-01-2026	JHARKHAND
AM3187252	SUJIB BARMAN	15-01-2026	JHARKHAND
AM3190275	BIPIN CHANDRA RAI	22-01-2026	JHARKHAND
AM3190652	TAUQEER ALAM	22-01-2026	JHARKHAND
AM3190717	MD FAISAL	22-01-2026	JHARKHAND
AM3190865	VIVEK RAJ	22-01-2026	JHARKHAND
AM3190946	SNIGDH KUMAR	28-01-2026	JHARKHAND
AM3191098	FAROOQUE ANSARI	28-01-2026	JHARKHAND
AM3191565	MD NAJEEBUL HAQUE	30-01-2026	JHARKHAND
AM3191675	CHANDRASHEKHAR PRASAD	30-01-2026	JHARKHAND
AM3192507	PRASHANT KUMAR MAHAPATRA	09-02-2026	JHARKHAND
AM3192817	DEEPAK KUMAR TIWARY	20-02-2026	JHARKHAND
AM3193139	MUKESH TUDU	20-02-2026	JHARKHAND
AM3193236	MD ALIMUZ ZAMAN	20-02-2026	JHARKHAND
F-1324345	MUNNA LAL	14-01-2026	JHARKHAND
F-1324450	ALOK KUMAR	14-01-2026	JHARKHAND
F-1324728	MOHAMMAD ISRAIL MANSURI	14-01-2026	JHARKHAND
M-1839602	RAMSWAROOP KHILERI	08-01-2026	JHARKHAND
M-1840473	MD AZHAR IQBAL	14-01-2026	JHARKHAND

Engineers' Wives Association

The Institution of Engineers (India)

JHARKHAND STATE CENTRE

EWA Committee



Seema Bhagat
President



Sejal Shah
Hony. Secretary



Anju Kumari
Treasurer

Engineers Wife's Association (EWA) is a socio cultural organization, catering to the needs of the depressed and socially handicapped people, as well as fulfilling the cultural tastes of the Indian community.

EWA cordially INVITES YOU to join as a member to the ever-growing and active Association. The Secretary is always available to give any information and answer any enquiry.

Eligibility: Wives of those Engineers, who are member of The Institution of Engineers (India). A lady, who herself is a member of The Institution of Engineers (India).

Subscription: Annual Subscription of ₹ 900/- only.

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JHARKHAND STATE CENTRE

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Engineers' Wives Association







IEI, JSC 63rd AGM Report

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Er. M. K. Gupta, FIE
Chairman
Er. Harun Ansari, MIE
Honorary Secretary

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Website : www.ieijscjharkhand.org
GSTIN : 20AAATT3439Q2Z7

Ref. No: IEI /JSC/3782

"A Century of Service to the Nation"

Date: 12.10.2025

Notice for 65th Annual General Meeting (AGM)

To: All the Corporate Members,

This notice is hereby given that 65th Annual General Meeting of the Institution of Engineers (India), Jharkhand State Centre, will be held on 30th October 2025 from 06.30 PM at Engineer Bhawan, Nepal Kothi Campus, Doranda Ranchi, Jharkhand, as per the following Programme / business ;

AGENDA (Business Session)

- Welcome address by Er. M. K. Gupta, Chairman, Jharkhand State Centre IE(I) JSC.
- To confirm the minutes of the 64th AGM held on 20th October 2024.
- Executive Committee Annual Report for the year ended 31st March, 2025.
- Presentation of Audited Report for the year ended 31st March, 2025.
- To approve the Appointment of Auditor Mr. OP Tulysan & Co. for the financial Year 2025-26 and fix the remuneration.
- To consider any other business that may be put forward with the prior permission of the Chair.
- Handing over and welcome to new committee for session 2025-27.
  Incoming Chairman - Er. S.K. Bhagat
  Incoming Honorary Secretary - Er. Vishal H. Shah.
- Welcome address by incoming Chairman Er. S.K. Bhagat.
- Member's observation.
- Vote of Thanks by Er. Vishal H. Shah, Honorary. Secretary- IE(I)JSC

You all are requested to kindly attend the meeting followed by dinner.

Distribution:
1. All Members of IE(I)JSC.
2. The Secretary & Director General, IE(I)
   8, Gokhale Road, Kolkata – 700020

(Er. Harun Ansari)
Honorary Secretary.

The Institution of Engineers (India)
JHARKHAND STATE CENTRE

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Glimpses of Programme during the month of January

Republic Day Celebration
26 January 2026

Like every year, this year also The Institution of Engineers (India), Jharkhand State Centre, Ranchi celebrated the 77th Republic Day at Engineer Bhawan, Doranda, on 26th January 2026.

Many members with their family and friends gathered at the Institution premises by 11:00 A.M for flag hoisting ceremony. The 77th Republic Day of the country was marked with a spectacular display by the Institution of Engineers (India), Jharkhand State Centre. Mr. S.K. Bhagat, the honorary chairman of the IE(I) Jharkhand State Centre, hosted the national flag to kick off the momentous occasion. After hoisting of National Flag the National Anthem was sung by all the members with their families & friends. Sweets and toffees were distributed to children and child participants.

After flag hoisting ceremony, all were invited to the auditorium for the cultural programs organized by Engineers Wives Association. The Chairman in his brief speech thanked all the members and their families and expressed his views on the importance to observe this day as our country was announced as Republic India in 1950. He also explained the progress of our country after it became Republic.

The program was convened by Mrs. Seema Bhagat The convener of the programme Er. Kunal Sinha and the co-convenor was Mrs. Sejal Shah also welcomed all the guests and dignitaries and delivered a short massage on Republic day. Then the co-convener called up stage a dance troupe to perform a song and dance based on national integration. Small scripts were also performed by the small children. Then various participants presented their dance, songs and recitations which were appreciated by the spectators and the atmosphere became very joyful and all spectators thanked the small participants for their performance.

More than 130 persons were enjoyed the programme and around 35 participants including children of different age group starting from 6 years participated.

After completion of the cultural programme the prizes were distributed to all participants by Chairman Er. Sandeep K Bhagat, Honorary. Secretary Dr. Vishal H Shah, Council Member Er. Sanjay Sen & Chairman (EWA) Mrs. Seema Bhagat. At last the Honorary. Secretary Dr. Vishal H Shah delivered vote of thanks and praised all for successfully celebrating the Republic Day and invited all to take light refreshment.





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Glimpses of Programme during the month of February

The Institution of Engineers (India)
JHARKHAND STATE CENTRE

EEHVACR 2025-26

08th & 9th February 2026

ISHRAE Ranchi Chapter jointly with The Institution of Engineers(I)JSC, Ranchi organized seminar on the theme "Energy Efficiency in HVAC & R Industries and Indoor Air Quality" at Engineer Bhawan, Nepal Kothi Campus, Doranda, RANCHI on 08th& 9th February 2026 titled as "EEHVACR 2025-26".
This seminar witnessed eminent speakers from industries, Consultants and Manufacturers who came and shared their experiences/ research findings. Table Partners showcased their products at the venue. The program was attended by about 150 attendees, which was consisted of Members of ISHRAE, IEI, Company Delegates, Invitees, Manufacturers, Presenters, and Students etc.
The programme was co-ordinated by Er. Rakesh Roshan, President ISHRAE Ranchi Chapter & Er. Manoj Kumar Singh, Convenor, EEHVACR. Thereafter dignitaries were invited to the dais and presented with Plant Saplings. The program started with national Anthem.
Welcome Address was delivered by Er. Sandeep K Bhagat, Chairman, IEI, JSC. In his welcome address he stressed on the need of organising of many such knowledge sharing programs in joint association with ISHRAE Ranchi Chapter. He welcomed the speakers, delegates, consultants and manufacturers who who attended and welcomed them to share their experiences/ research findings.
Welcome address was followed by lighting of lamp by the dignitaries on the dais.
Er. Er. Manoj Kumar Singh, Convenor, EEHVACR set the ball rolling by giving a brief introduction on the program. He also stressed about the successful carrying out of the flagship program EEHVACR 2025-26 by ISHRAE Ranchi Chapter.
Er. Rakesh Roshan, President, ISHRAE Ranchi Chapter explained the various activities of ISHRAE. He detailed about the various programs that are being organized by ISHRAE Ranchi Chapter starting from students to the professional engineers with special emphasis on ACREX 2026. He informed that ACREX will be conducted at BEC, Mumbai from 12th to 14th March, 2026. He invited all the dignitaries present to visit ACREX 2026 and also to become member of IE(I) for which membership forms and various publications were on display in the registration counter.
Souvenir on this occasion was released by the dignitaries on the dais.
VIP guest, Er. N. Hari Babu, Principal, RTC Institute of Technology, Ranchi, Guest of Honour, Er. Sanjay Sen, Council Member, IE(I), JSC, Er. KK Mishra, ED, Vigilance, MECON Limited and Er. S. K. Das, Chief General Manager (Mechanical, C&S, U&S and Refractory) CET, SAIL, Ranchi deliberated that HVAC industry is passing through a transformation phase. Today industry is migrating to environment friendly refrigerants. Energy efficient products are entering the market.
The chief guest Er. JK Jha, Director (Commercial), MECON Ltd., Ranchi discussed about the energy consumption in Buildings. He further stressed about the designing the residential buildings to use the sun light and minimising energy consumption, use of AI in control of lights, ventilation system, etc. He wished that seminar would discuss in detail about efficient system and ways & means for clean environment.
The inaugural program ended with vote of thanks by Dr. Vishal H. Shah, Honorary Secretary, IE(I), JSC.
There after stalls of table partners were inaugurated by the chief guest, Er. JK Jha, Director (Commercial), MECON Ltd., Ranchi





The Institution of Engineers (India)
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World Water Day
22nd March 2026

The Institution of Engineers (India), Jharkhand State Centre, organised World Water Day 2026 at Engineer Bhawan, Doranda, Ranchi on **22nd March 2026, from 3:00 PM to 6:00 PM.** The event was held on the globally recognised occasion of World Water Day with the theme **"Water and Gender"**, focusing on the critical intersection of water access, governance, and gender equity.

Er. Onkar Nath, Convenor, welcomed the dignitaries on the dais and presented their brief introductions to the gathering. Er. Sandeep K. Bhagat, Chairman, IEI Jharkhand State Centre, extended a formal welcome to the Chief Guest, Dr. D.K. Singh, Head of the Department of Civil Engineering, CIT Tatisilway, Ranchi, and the distinguished guests — Er. Nagesh Mishra, Retired Engineer-in-Chief, Water Resources Department; and the engineers from various departments and fields present in the audience.

Er. Nipoon Gupta, Assistant Engineer, Water Resources Department, delivered the Keynote Address. In his address, he stressed the urgent need for coordination between all water sector departments, educational institutions, and stakeholders to bring about a meaningful change in the water scenario of the region. He highlighted that inter-departmental collaboration is the cornerstone of sustainable water management and called upon the engineering community to take a proactive role.

Distinguished guest Er. Nagesh Mishra, Retired Engineer-in-Chief, and Chief Guest Dr. D.K. Singh shared their vast and valuable experience with the gathering, guiding the engineers and professionals towards constructive action for the betterment of water resource management in Jharkhand.

Mementoes were presented to the honourable guests as a token of appreciation. Chairman proposed the Vote of Thanks, expressing gratitude to all speakers, guests, and participants. The celebration concluded with the National Anthem, reinforcing the spirit of collective responsibility towards water conservation and equitable access.





Glimpses of Programme World Water Day 2026

The Institution of Engineers (India)

JHARKHAND STATE CENTRE

Glimpses of Programme World Water Day 2026

PARTICULARS	DETAILS
Organising Centre	Jharkhand State Centre, IEI
Title of Activity	World Water Day 2026 — Theme: "Water and Gender"
Date	22nd March 2026
Venue	IEI, Jharkhand State Centre, Engineer Bhawan, Doranda, Ranchi
Chief Guest	Dr. D.K. Singh, HOD, Dept. of Civil Engineering, CIT Tatisilway, Ranchi
Distinguished Guests	Er. Nagesh Mishra (Retd. Engineer-in-Chief, WRD, Govt. of Jharkhand);
Chairman	Er. Sandeep K. Bhagat
Convenor	Er. Onkar Nath, Superintending Engineer, Water Resources Dept.
Keynote Address	Er. Nipoon Gupta, Assistant Engineer, Water Resources Dept.

KEY TAKEAWAYS

1	Strong inter-departmental coordination is essential to effectively manage and augment water resources in Jharkhand.
2	Water must be used judiciously, and all engineering communities must promote water efficient practices across sectors.
3	Innovative engineering solutions exist for augmenting water supply in urban centres like Ranchi — these must be pursued urgently.
4	The intersection of water governance and gender equity is critical; the role of women in water management must be strengthened.
5	Education institutions and professional bodies like IEI have a vital role in driving awareness and technical capacity on water issues.

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e-Disha
VOLUME I : 25/27-1

Advancement in Steel Sector for Vikshit Bharat with Net Zero Carbon Emission & Technological Development









Glimpses of Programme during the month of March

e-Disha
VOLUME I : 25/27-1

Technical Papers/Article/Presentation

The Institution of Engineers (India)
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The Transition of Engineers into Managerial Roles: Challenges, Opportunities and the Path Forward

Nitesh Kumar

Engineering as a profession has always been associated with precision, problem-solving, and innovation. Engineers are trained to think systematically, diagnose complex problems, and design effective solutions. However, as organizations evolve in an increasingly competitive and technology-driven environment, engineers are frequently called upon to assume managerial responsibilities. The transition from a purely technical role to a managerial one is both a natural progression and a profound transformation. It requires not only new skills but also a shift in mindset, behaviors, and expectations.

1. The Changing Landscape of the Engineering Profession

In today's dynamic industrial ecosystem, engineers are no longer limited to designing systems, optimizing processes, or working on the shop floor. Digital transformation, automation, and global competition have redefined what organizations expect from engineering professionals.

Modern industries seek leaders who can:

- Integrate technical knowledge with strategic thinking
- Drive cross-functional collaboration
- Coordinate teams across diverse domains
- Influence organizational culture
- Manage resources, risks, and change effectively

Thus, the journey toward managerial responsibility is not an optional career path anymore but an essential requirement for engineers aspiring to contribute meaningfully at an organizational level.

2. Why Engineers Make Strong Managers

Engineers inherently possess several qualities that make them suitable for leadership roles:

a. Structured Problem-Solving Ability

Engineering education trains individuals in analytical thinking and systematic planning, The skill that are essential for managerial decision-making.

b. Data-Driven Decision Making

Managers increasingly rely on data for decisions related to productivity, efficiency, quality, and investments. Engineers are naturally aligned to this approach.

c. Technical Credibility

Teams tend to respect leaders who understand the technical complexities of work. This credibility strengthens trust and communication.

d. Continuous Improvement Mindset

Engineers are habituated to identifying inefficiencies and finding better ways of doing

things, this mindset is invaluable in managerial roles.

3. The Challenges Engineers Face During Transition

Despite their strengths, engineers often encounter several challenges when moving into management:

a. Moving from "Doer" to "Leader"

In technical roles, engineers focus on solving problems themselves (Individual Contributors) In managerial roles, they must enable others to solve problems, which requires delegation and trust - both difficult shifts for many.

b. Developing Soft Skills

Communication, negotiation, conflict resolution, and emotional intelligence are not always emphasized in engineering education but are essential for leadership. Engineers coming from rural areas often lacks the confidence to take lead in boardroom meetings.

c. Managing People, Not Machines

Unlike machines or equations, human behavior is unpredictable. Understanding team dynamics, motivation, and behavior becomes crucial.

d. Balancing Technical and Administrative Work

Managers must shift from technical depth to broader operational responsibilities like budgeting, planning, performance management, and stakeholder communication.

e. Adapting to Organizational Politics

Many engineers initially resist politics within organizations. But navigating relationships and influencing stakeholders is a practical necessity in leadership roles. Politics in organization are fact of life and one who refuge to participate in politics is being governed by their inferiors.

4. Competencies Required for a Successful Transition

To excel in managerial responsibilities, engineers must supplement their technical foundation with new competencies like management courses (MBAs), soft skills and new-age capabilities like digital tools, AI, ML, and sustainability to succeed as managers.

a. Communication and Interpersonal Skills

The ability to articulate ideas clearly, listen actively, and engage teams productively.

b. Strategic Thinking

Understanding organizational objectives, long-term planning, and aligning team efforts with business goals.

c. Financial Literacy

Managers must read budgets, assess investments, and justify expenditures. Basic financial understanding is non-negotiable.

d. People Management

Managing conflict, building team cohesion, mentoring younger engineers, and conducting performance evaluations.

e. Change Management

As industries rapidly evolve, managers must lead teams through technological, structural, and cultural changes.

f. Emotional Intelligence (EI)
Empathy, self-awareness, and relationship management play a major role in leadership success.

5. How Organizations Can Support Engineers in Managerial Transitions
Forward-thinking organizations recognize that simply promoting engineers is not enough but they need structured support.
a. Leadership Development Programs
Workshops, training modules, and mentorship programs help build managerial competence.
b. Cross-Functional Exposure
Engineers benefit greatly from exposure to procurement, finance, HR, and operations to understand the larger business ecosystem.
c. Formal Education
Encouraging engineers to pursue management certifications, diplomas, or an MBA enhances strategic thinking and business acumen.
d. Coaching and Mentoring
Experienced leaders can provide invaluable guidance during the transition phase.

6. The Advantages of Engineer-Managers for Organizations
Organizations that successfully integrate engineers into management roles enjoy several benefits:
- High-quality decision-making due to technical understanding
- Improved productivity through continuous improvement initiatives
- Effective communication between technical teams and top leadership
- Better implementation of digital and Industry 4.0 initiatives
- Stronger innovation culture driven by analytical thinking

Thus, the blend of engineering expertise and managerial capability creates leaders who can drive sustainable growth.

7. Conclusion
The transition of engineers into managerial roles represents more than a career shift—it signifies a strategic evolution in modern industrial leadership. Engineers bring a unique combination of analytical skills, problem-solving ability, and process-oriented thinking. When enriched with managerial competence, they emerge as highly effective leaders capable of guiding organizations through complex technical and business challenges.
The journey may be demanding, but it is also deeply rewarding. With the right mindset, continuous learning, and organizational support, engineers can excel as managers who inspire teams, drive innovation, and contribute to long-term organizational excellence.

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e-Disha
VOLUME I : 25/27-1

Technical Papers/Article/Presentation

Optimizing Electrical Reliability through Integrated Process and Workplace Safety: A Technical Guide for Maintenance Professionals

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Area Manager (Technical Audit)
Industry expert in Integrated Electrical Maintenance

Abstract
In modern industrial environments, the distinction between Workplace Safety and Process Safety is fundamental to operational resilience. Workplace safety focuses on high-frequency, behaviour-related incidents with relatively straightforward root causes. In contrast, process safety addresses low-frequency, high-consequence events—such as catastrophic releases or explosions—that involve complex technological failures and major material damage. By integrating the Central Electricity Authority (CEA) Regulations, 2023 and OSHA Process Safety Management (PSM) standards, electrical maintenance professionals can implement engineering and administrative controls that effectively mitigate these risks. This article explores critical frameworks, including Pre-Startup Safety Reviews (PSSR), Positive Isolation, and Failsafe Design, to ensure compliance and safety in complex industrial electrical systems.

1. The Regulatory Framework: Harmonizing CEA and OSHA Standards
Effective electrical maintenance requires a proactive approach, moving beyond routine "break-fix" cycles toward comprehensive regulatory adherence.

- CEA Regulations 2023: Mandate strict safety measures for the construction, operation, and maintenance of electrical systems. A designated Electrical Safety Officer must ensure that all apparatus have sufficient ratings, insulation, and mechanical strength for their intended duty cycles.
- OSHA 1910.119 (PSM): Focuses on preventing catastrophic releases of highly hazardous chemicals through systematic Process Hazard Analysis (PHA) and the maintenance of Mechanical Integrity. Mechanical integrity requires written maintenance procedures, employee training, and rigorous equipment testing.

2. Pre-Startup Safety Review (PSSR): The Maintenance Gatekeeper
Before any newly installed or significantly modified electrical system is energized, a PSSR must confirm the installation meets rigid design and safety requirements.

- Design Compliance: Maintenance teams must verify that construction and equipment align with original design specifications to prevent premature failure.
- Safety Documentation: Written safety, operating, and emergency procedures must be documented, tested, and verified as adequate before startup.
- PHA Integration: For new facilities, a Process Hazard Analysis must be completed, and all recommendations implemented before equipment is brought into use.
- Competency: Operating and maintenance personnel must be certified as having the required knowledge and skills to safely handle the specific process.

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3. Electrical Isolation: Risk Categorization ad Compliance

A primary industrial hazard is the mis categorization of isolation work, which can lead to fatalities from static charge or back-feed.

Here's a clear comparison of Category I vs. Category II isolation requirements:

Job Type	Requirement	Technical
Category I Isolation	Basic power cutting through physical/visible isolation for low-voltage or standard driven equipment.	CEA: Sub-regulation (3)
Category II	Requires discharging, grounding, and	

- Safe Work Practices: OSHA PSM requires documented Lockout/Tagout (LOTO) procedures to control hazards during equipment servicing.

4. Electrical Engineering Innovations for Operational Safety

Engineering innovations reduce risks at the source by embedding safety directly into system design.

- Shrouded Busbars: Prevent short circuits and ground faults caused by foreign objects or rainwater.



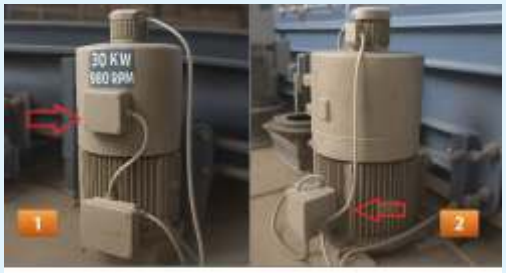
1. **Conventional MS angle type busbar in low rise factory sheds: potential hazard of electric shock, short circuit or ground fault**
2. **New shrouded type busbar: short circuit & ground proof arrangement from foreign metallic objects or rainwater**

Applicability: ***It is cost effective for pendent / remote operated smaller capacity cranes***

- Anti-Collision Systems: Laser-based transceivers and reflectors prevent mechanical impacts for cranes operating in the same bay, supporting efficient control requirements.



- Human-Machine Interface (HMI) and Ergonomics: Poorly designed interfaces often create difficulties for maintenance teams. For example, encoder terminal boxes positioned awkwardly can force technicians into inefficient positions when replacing components. Relocating or redesigning such components improves accessibility, reduces repetitive strain, and minimizes downtime.



1. Ergonomics issue / repetitive work: while replacing motor cooling blower, encoder connection needs to be removed
2. Corrected Encoder terminal box position

5. Advanced Process Control and Failsafe Maintenance

Process control and failsafe design are critical for high-risk systems where failure could lead to catastrophic incidents.

Incident Example:

During a power outage, a rotating component of an industrial machine continued to spin for several minutes due to residual inertia. With the rotation no longer under control, material being processed became entangled, eventually snapping and releasing stored tension.

This created a serious hazard for anyone working nearby, with potential for significant injury. Restoring the equipment to a safe operating condition required considerable time.

Root Cause:

The braking mechanism was of a design that required external power or air pressure to engage. When electrical power failed, the air supply also dropped, leaving the brake in a disengaged state. As a result, the rotating component was not brought to a controlled stop and continued spinning freely.

- Failsafe Design Principles: Systems must default to a predetermined safe state during failure. Examples include: "Power-fail-to-engage" brakes in crane hoists to prevent dangerous rotation during blackouts.

Bleeder valves designed to open automatically after power failure, preventing pressure buildup.

Hardwired logic panels and interlocks that enforce safe states for actuators and valves.

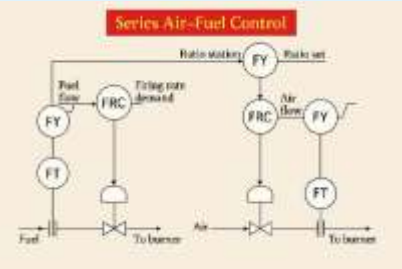
Maintenance teams should confirm that failsafe states are clearly defined, tested, and documented for all critical equipment.

Uninterrupted Power Supply (UPS): Safety interlocks and Process Safety Critical Equipment (PSCE) must remain functional during power interruptions. Tagging these items in management systems ensures they receive prioritized maintenance and testing.

Double Crossover Limit (DCL) Control Explained

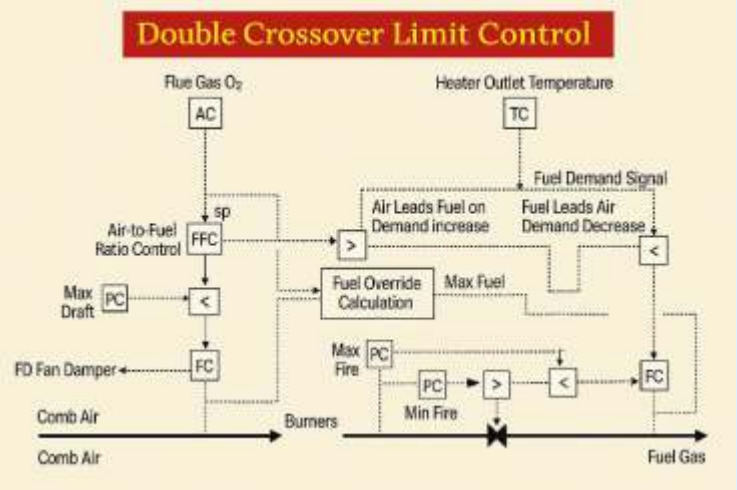
In gas-fired reheating furnaces, maintaining optimal air-to-fuel ratios is essential for efficiency and environmental compliance.

- The principle: Unlike "Series Control" (where one variable blindly follows another), DCL control ensures that air leads fuel during demand increases and fuel leads air during demand decreases. This cross-limiting approach prevents unsafe imbalances.
- Advantages: Prevents incomplete combustion and elevated stack emissions.



Reduces the risk of explosive mixtures by ensuring oxygen is always adequate for combustion.

Provides smoother transitions during load changes, avoiding spikes in furnace temperature or emissions.



Maintenance Perspective: Technicians should verify that DCL or parallel ratio control is implemented instead of series control, check emission trends for anomalies, and confirm that sensors and control valves are calibrated to maintain reliable operation.

Conclusion

The integration of CEA 2023 regulations and OSHA PSM standards establishes a robust defence against industrial electrical accidents. By prioritizing Mechanical Integrity, Design Compliance, and Failsafe Engineering, maintenance professionals move beyond reactive cycles toward a culture of reliability. The ultimate goal is ensuring every system—from a simple motor to a complex furnace—is designed, operated, and maintained in a state free from danger.

Key Takeaways for Maintenance Teams:

- Think beyond compliance: Regulations are the baseline; engineering design choices determine real-world safety.
- PSSR discipline: Always confirm design specifications, procedures, and personnel competency before energizing new systems.
- Isolation accuracy: Properly categorize work into Category I or II to prevent accidental energization.
- Innovation focus: Use shrouded busbars and anti-collision sensors to eliminate hazards at the source.
- Failsafe logic: Ensure critical equipment defaults to a safe state during power loss.
- Advanced control: Adopt DCL combustion strategies to maintain furnace safety and environmental compliance.
- Reliability culture: Maintenance is not just repair — it is proactive risk elimination and system resilience building.

Disclaimer: All images used in the above article have been generated using AI (Microsoft Copilot). References to the Central Electricity Authority (CEA) regulations are based on The Gazette of India: Extraordinary [Part III—Section 4] dated 8 June 2023. Extracts related to the OSHA framework have been referred from publications of the U.S. Department of Labor (year 2000).

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Facilities

1) Venue for Convention/ Seminars/Conference
2) Technical Information Centre
3) Engineering Hall Cum auditorium
4) Rest Rooms for Members
5) Technical Classes