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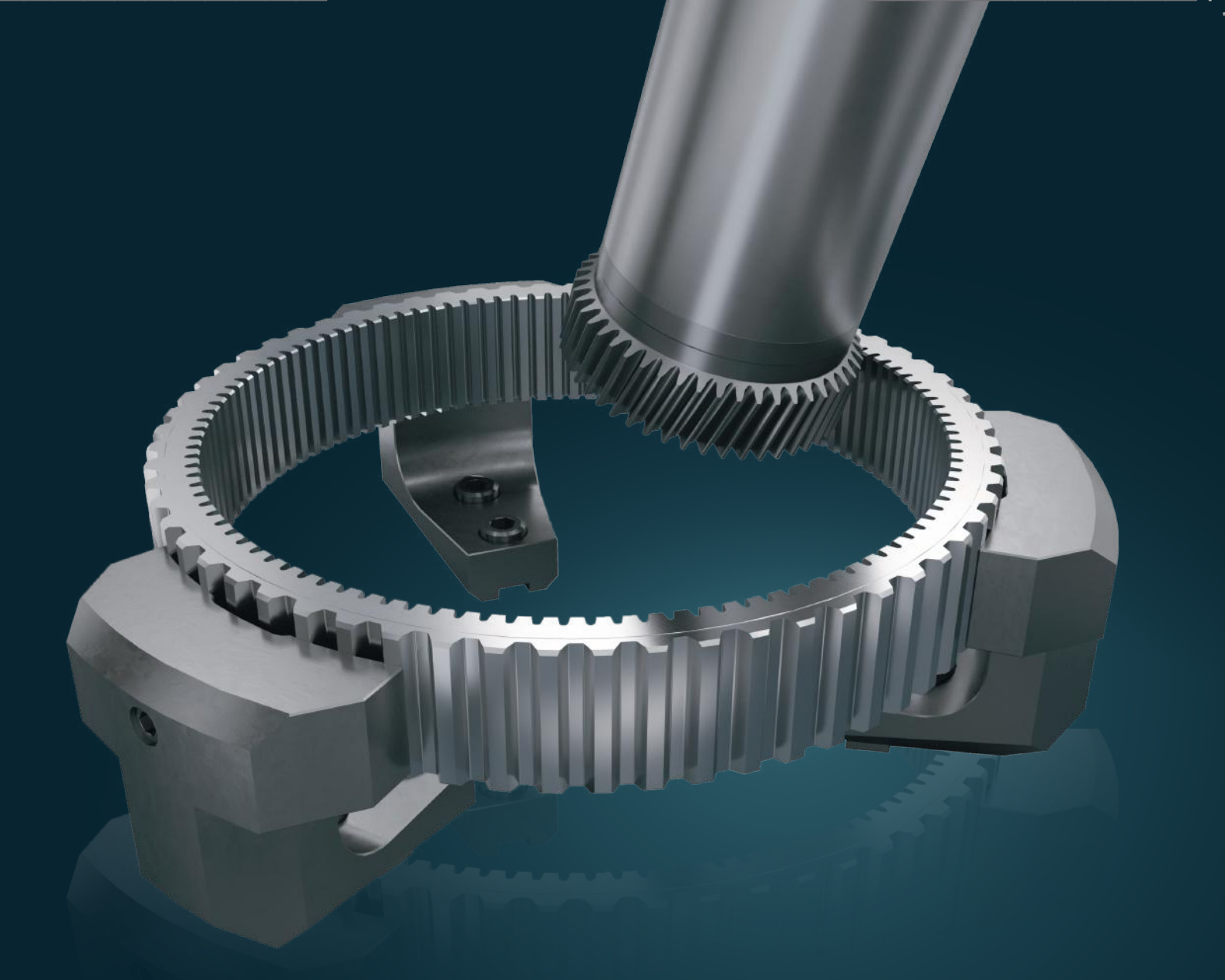
COVER STORY
Strengthening Global Synergies: India Aligns with the New MPMA Era

AUTOMATION
Reinventing Precision: ARK MachTek's CNC Upgradation & Mechanical Reconditioning of Gear Grinding Machines

INTERVIEW
Honouring 50 Years of Excellence: The Legacy of Mr R. Chandrakant Gunaji Nemade

In Association
AGMA
AMERICAN GEAR MANUFACTURERS ASSOCIATION



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Janis Thalau, Technology Development

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KAPP NILES

Anitha Raghunath
Director
Virgo Communications and Exhibitions Pvt.Ltd

Dear Readers,

It is with great enthusiasm that we present to you **Gear Technology India Vol. 3 Issue 6 (2025)**—a special edition dedicated to **Automation and Industry 4.0**, the forces that are redefining the future of gears, power transmission, and advanced manufacturing. As Indian industry accelerates toward smarter, interconnected, and digitally enabled production, this issue brings together insights, innovations, and perspectives that reflect this transformative journey. From intelligent machines to sustainable solutions and global collaborations, we have curated stories that highlight both the technological advancements and the people driving them forward.

In this edition, you will find **in-depth automation features**, including ARK MachTek's breakthrough in CNC upgradation and reconditioning solutions, next-generation cylindrical grinding automation, and the evolving landscape of tool and process monitoring systems. We also explore how global events like **EMO 2025** are shaping competitiveness with AI-driven manufacturing.

Our **Industry Updates** spotlight CTI's expansion in the USA, while the **Sustainability** section showcases Lubeco Green Fluids' SUPERCOOL NEAT 260 X—an innovation aligned with India's commitment to greener production. We are honoured to feature a **special interview** celebrating 50 years of engineering excellence with Mr. R. Chandrakant Gunaji Nemade—a remarkable journey of passion, leadership, and contribution to the machine tool sector.

Through Make in India, we bring you ZF's newly introduced rail gearbox developed specifically in India for Indian railways, a proud milestone reinforcing our domestic manufacturing strength.

Our Design and Product Profile segments look toward the future, with additive manufacturing for gears and Flender's revolutionary REVO drive concept for wind turbines.

We also bring exclusive coverage of the 14th VDMA Mechanical Engineering Summit, along with a preview of IMTEX Forming 2026, where the global metal forming community will converge in Bengaluru.

Rounding off the issue is a powerful Cover Story on India's growing alignment with the new MPMA era, illuminating the facts on how global synergies are shaping the next chapter of the gear industry.

As we continue our commitment to delivering meaningful, high-quality content, I invite you to explore this edition and join us in embracing the era of intelligent, sustainable, and globally connected manufacturing.

Thank you for your constant support and engagement.

Warm regards,

gear TECHNOLOGY INDIA

Gear Technology India is a quarterly publication created in collaboration between the American Gear Manufacturers Association (AGMA) and Virgo Communications & Exhibitions. It serves as the premier platform in the industry, offering latest innovations, information, interviews and technical articles related to gears.

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Michael Goldstein founded Gear Technology in 1984 and served as Publisher and Editor-in-Chief from 1984 through 2019.
Thanks to his efforts, the Michael Goldstein Gear Technology Library, the largest collection of gear knowledge available anywhere will remain a free and open resources for the gear industry.
More than 38 years' worth of technical articles can be found online at geartechnology.com. Michael continues working with the magazine in a consulting role and can be reached via e-mail at michael@geartechnology.com.

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Table Of CONTENTS

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Strengthening Global Synergies: India Aligns with the New MPMA Era

- By Sushmita Das

Industries evolve through pivotal moments that foster new connections and widen possibilities. For Gear Technology India, such a moment occurred in Detroit this year, from 21 to 23 October, where we, alongside IPTEXGRINDEX, exhibited at the Motion and Power Technology Expo 2025.

It was a pleasure to witness India's strong and confident representation through the presence of Mr Raghu, Director at Virgo Communication and Exhibitions, and Mr Dev, Vice President at Virgo Communication and Exhibitions Pvt Ltd. Their involvement emphasised our nation's growing commitment to strengthening its place in the global gear and power transmission ecosystem.

Over thousands of professionals filled the halls of the Huntington Place Convention Centre. The atmosphere was immediate and unmistakable: a collective enthusiasm to learn, collaborate and explore the technological advances shaping our industry. Walking through the hallways, one could sense how deeply interconnected and globally driven the motion and power transmission landscape has become.

A Transformative Partnership: Understanding the MPMA

One of the most transformative developments highlighted during the expo was the creation of the Motion and Power Manufacturers Alliance. This newly formed alliance is not simply an administrative merger. It is an evolution born from thoughtful consideration, strategic alignment and a strong, continued commitment to where the industry is headed.

The American Gear Manufacturers Association and the American Bearing Manufacturers Association, both with more than a century of history, heritage and influence, voted to combine their strengths during the Annual Meeting in Austin. From the first of May 2025, the Motion and Power Manufacturers Alliance came into operation.

Even as AGMA and ABMA continue to retain their strong identities and market presence, the MPMA now stands as a unified entity guiding the sector with enhanced capabilities. With this new structure, members and industry professionals can expect:

- Better coordinated and more impactful standards development
- Stronger, more accessible education and workforce development programmes
- A tightly connected supply chain enabled by meaningful in-person events
- Two respected industry publications that support knowledge sharing
- Unified advocacy and representation at the federal government level

This merger is an important milestone. It reflects the increasing need for collaboration between gears, bearings

and associated technologies, especially as industries move towards electrification, automation and advanced manufacturing.

For us in India, witnessing this transition signalled a future where global alliances will play a vital role in shaping knowledge, progress and competitiveness.

Inside the Exhibition: Innovation, Dialogue and Discovery

The expo floor offered an impressive display of technological innovation. Spanning experts in gear manufacturing, bearing technology, motion control, heat treatment and system design, the one hundred and seventy exhibitors brought the event alive with running machinery, product demonstrations and interactive displays. Visitors from across more than a dozen countries engaged in deep technical conversations. Senior leaders, engineers, researchers, procurement teams, maintenance specialists and defence representatives explored practical solutions that can drive efficiency, accuracy and productivity in their respective sectors.

Matt Croson, President of the MPMA, expressed his gratitude for the support of the entire industry. He emphasised how Detroit has become a welcoming and reliable home for the event, offering a strong network and an environment conducive to serious business discussions.

The expo was not merely a display of equipment. It was a living, breathing platform for learning. Attendees enjoyed sessions such as the Power Breakfast Panels, where critical issues were explored through honest dialogue. The Ask the Expert tables welcomed targeted questions and offered practical guidance. The Solution Centre hosted technical presentations that broke down real-world challenges.

Every corner of the venue offered an opportunity for discovery. It was impossible to walk through without being drawn into discussions, demonstrations and moments of shared enthusiasm.

Leadership Reflections and the Beginning of a New Chapter

This edition of the expo marked the completion of Steve Janke's term as Chair of the MPT Expo Committee. Steve's leadership played an important role in shaping the event's quality and direction. His words echoed the spirit of the show when he said that the attendees who come to the expo arrive with real issues and leave with solutions that have a genuine impact.

As Steve concluded his term, the committee welcomed its new Chair, Mr Shane Hollingsworth, Vice President of Sales at Kapp Niles. Shane spoke with deep appreciation and humility as he reflected on his journey with the event. Having attended as a manufacturing engineer, a gear and gearbox supplier, and now as a machine tool exhibitor, he stated that the event has always delivered meaningful value to the North

American gear industry.

His insights suggest a future aligned with relevance, collaboration and consistent improvement.

Celebrating Excellence: Recognising Global Contributions

Among the most inspiring moments of the MPT EXPO week was the awards luncheon at the MPMA Fall Technical Meeting. Over one hundred and ten participants from around the world gathered for three days of detailed presentations covering design and rating, electric vehicles and emerging technologies, manufacturing and inspection, efficiency and noise reduction and materials and performance.

Over thirty members of MPMA's technical committees were honoured for their contributions to standards development. These recognitions highlight how critical collaborative technical work is in improving industry practices and supporting innovation globally.

For the Indian gear community, the proudest moment arrived when Mr Prakash Kadam, Managing Director of Pragati Transmission Pvt Ltd, received the Distinguished Service Award.

In the words of Matt Croson, the president of AGMA, the award is reserved for those who have selflessly advanced the gear industry through dedication and leadership. Seeing an Indian leader being recognised for such a significant contribution was both heartening and motivational.

Industry professionals with research contributions are encouraged to submit their abstracts and participate in this important technical forum.

India's Growing Global Presence: A Moment of Reflection

As I look back on our experience at the event, one thought remains constant. India is not merely present on the global stage. It is participating, influencing and helping shape the future of the motion and power transmission industry.

The presence of GTI and IPTEXGRINDEX at MPT Expo 2025 was not symbolic. It was purposeful. It reflected our industry's commitment to international engagement and our readiness to contribute meaningfully to global discussions.

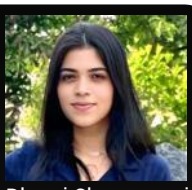
Through Gear Technology India, our aim remains the same: to bring global insights to our readers, to highlight opportunities for growth and innovation, and to ensure that India continues to rise as a respected and competitive contributor to the international gear community.

The journey ahead is bright. Collaborations are strengthening. Technology is advancing rapidly. And India is stepping forward with confidence, competence and ambition.

Sanjay Gupta
Director,
ESGI TOOLS PVT LTD

Participating in MPT EXPO 2025 was a truly enriching experience. The event brought together global industry leaders, practical innovations and insightful discussions that highlight where our sector is heading. For ESGI Tools India, it offered an excellent platform to connect with partners, discover new possibilities and understand emerging trends. I look forward to carrying this momentum forward.

Nidhi Champaneri
Director
Quality Gears



Dhruvi Champaneri
Director
Quality Gears

As part of the third generation carrying forward our family's gear-manufacturing business, the MPT Expo is a platform that has offered an incredible opportunity to connect with industry giants—names we grew up hearing about since the days my father was building this business. As an Indian exhibitor, bringing our home-grown expertise to Detroit—the true manufacturing hub alongside other industry giants, was deeply empowering. We engaged with international buyers, witnessed leading innovators pushing the boundaries of technology, and uncovered exciting new opportunities linking Indian manufacturing with global supply chains.

Prakash Kadam
Managing Director
Pragati Transmission Pvt Ltd.

Exhibiting at MPT EXPO 2025 was a highly rewarding experience for Pragati Transmission. The event offered valuable interactions, meaningful business conversations and a clear view of the industry's evolving priorities. It was encouraging to see strong interest in our solutions and to connect with professionals from around the world. We are energised by the response and look forward to future collaborations. Some of the customers expressed their concerns about our competitiveness, considering the recent tariffs imposed by the US government. Hence, they would like to wait and watch before concluding the business.

MUSHTAQ JAMAL
Vice President of Engineering and Business Development at Bevel Gears (India) Private Limited.

MPT Expo 2025 was a very good show for BGI. Personally, I have been going to the show since 2003 and have seen it evolv,e and this is in no small part due to the MPMA team. They listen and take AGMA member feedback very seriously, and you can see the media reach of the show being extended with every show.

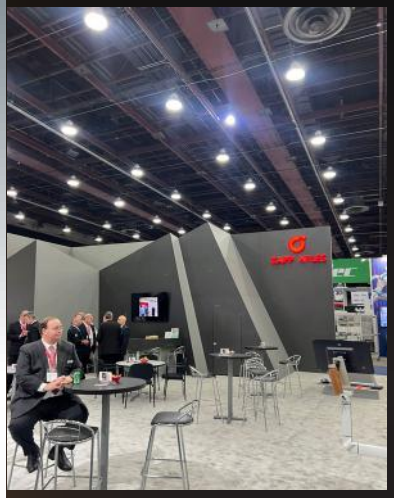
For BGI, there was a recognition of the specialised and unique CNC bevel gear capabilities that have been cultivated over decades for aero-engines, motorsport, robotics, mining and steel, to name a few. The reverse engineering and niche competencies reach the right audience at MPT, where the quality of the visitors is focused and at a very high level. We will certainly be returning for 2027.

Sushmita Das
Associate Editor
Gear Technology India

Editor's Note

As part of the global gear community, I welcome the formation of MPMA with great enthusiasm. The alliance represents not just organisational evolution, but a renewed dedication to excellence, collaboration, and industry leadership. Through Gear Technology India, I look forward to supporting this transition, amplifying the voices of both AGMA and ABMA, and showcasing the developments that will shape the next era of motion and power manufacturing.

Glimpses from MPT EXPO 2025



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Honouring 50 Years of Excellence: The Legacy of Mr. Chandrakant Gunaji Nemade

- By Sushmita Das

In celebration of an extraordinary 50-year journey, Gear Technology India presents a special conversation with Mr. Chandrakant Gunaji Nemade, the Founder Nemade Engineers Pvt. Ltd., a visionary whose contributions have shaped India's gear and machine tool landscape. Conducted by Sushmita Das, the Associate Editor of Gear Technology India. This interview honours a lifetime of dedication, innovation, and leadership, from his early inspirations and entrepreneurial beginnings to the legacy he now passes on to the next generation.

Through this dialogue, Mr Nemade reflects on the challenges, triumphs, and transformative technological shifts that have defined his path. He also shares timeless principles on leadership, integrity, and service, values that continue to steer Nemade Engineers Pvt. Ltd. toward a future of excellence.

This interview stands as a tribute not only to his achievements, but also to the enduring impact he has made on the industry and the people he has mentored along the way.

Let's steer through his valuable insights:

1. A Golden Journey of 50 Years

You have completed an extraordinary 50-year journey in the engineering and machine tool industry. Looking back, what inspired you to take that first step in this field, and what key moments defined your professional path?

My earliest inspiration came from my father, who nurtured my curiosity about the engineering field, and from my village schoolteacher, who encouraged me to think practically and technically. Their guidance sowed the seeds of passion for machines and problem-solving that eventually shaped my professional journey.

2. The Birth of Nemade Engineers

After gaining experience at Kirloskar Cummins and Chougule & Chougale, you took the bold step of starting your own company. What motivated you to become an entrepreneur, and how did Nemade Engineers Pvt. Ltd. come into being?

During my tenure at Kirloskar Cummins and Chougule & Co., I worked tirelessly—often for 14-16 hours a day—and learned every aspect of the trade. That hands-on experience gave me the confidence to build something of my own. I was particularly fascinated by gear grinding and gear inspection technology, especially the precision of German HÖFLER machines. With this knowledge and determination, Nemade Engineers was born—a dream to serve the gear industry with unmatched technical expertise.

3. Challenges & Turning Points

Every successful journey has its share of challenges. What were some of the major challenges you faced while establishing and growing your business, and how did you overcome them?

In the early days, communication technology was minimal—no mobile phones, no internet. Providing prompt service support to customers across India was extremely challenging. But we made it our identity to respond quickly and personally, no matter the distance or difficulty. That dedication to service became Nemade's hallmark and the reason our business grew steadily.

4. Building People, Not Just Machines

Your team describes you as a mentor who has built not only machines but also people, values, and systems. What leadership principles have guided you in nurturing teams and building a sustainable organization culture?

I've always believed in sharing knowledge openly—with my team and with our customers. Every individual working with Nemade Engineers has been equally important. Training, trust, and teamwork are the foundation of our organisation. When people grow, the company grows automatically.

5. Evolution of Gear Technology

You have witnessed five decades of transformation in gear manufacturing, from conventional methods to CNC and now Industry 4.0. What key technological changes have impressed you the most, and how have they influenced your business direction?

In the early years, gear machines were primarily electro-mechanical and hydraulic. The evolution to CNC and the introduction of specialized gear software revolutionized the industry—making machines faster, smarter, and more accurate. This technological leap has

completely transformed gear manufacturing, bringing a big revolution to the engineering industry as a whole.

6. Partnership with Global Machine Tool Brands
Nemade Engineers has represented world-leading CNC machine tool manufacturers for gear production. How has this collaboration shaped your company's technical strength and customer trust over the years?

Our global partners recognized the depth of experience and technical expertise within our team and extended their full support to us. Over the years, we have earned their trust by providing exceptional service not only in India but also globally, whenever and wherever needed.

Additionally, we have established our own manufacturing unit equipped with the latest machines, serving as a demo and training center for our customers—further strengthening our technical foundation.

7. Transition & Legacy
Today, your sons, Mr Ashish Nemade and Mr Harshad Nemade, are carrying forward your legacy. How do you view this generational transition, and what advice have you passed on to them for leading the company into the future?

My wife, Late Mrs. Sandhya Nemade, my sons Ashish and Harshad, and our entire Nemade team—particularly Mr. Amar Banedar, our General Manager since the company's inception—have been the true pillars of this journey. Their unwavering commitment, loyalty, and shared vision have been the driving force behind our growth.

Both my sons continue to uphold our core motto—"Service First"—ensuring complete customer satisfaction. With their modern approach, technical expertise, and dedication, they have taken the company to new heights. My only advice to them has always been simple: stay grounded, stay customer-focused, and uphold integrity and commitment in every step forward.

8. Vision for the Future
As you celebrate this golden milestone, what is your vision for Nemade Engineers Pvt. Ltd. and for India's gear industry in the coming decade?

My vision is to see India—and Nemade Engineers—emerge as one of the most sought-after hubs for gear manufacturing in the world. With our nation's growing engineering capabilities and young talent, I believe this goal is well within reach.

9. Reflections on Leadership & Values
If you were to summarise your leadership philosophy in a few words, what core values do you believe are essential for building a lasting and respected organisation?

Networking, sharing knowledge, and gratitude. Always remember and value those who have helped you grow. Success is built on relationships, learning, and humility.

10. A Message to the Next Generation
What message would you like to share with young engineers and entrepreneurs entering the gear and machine tool industry today?

Learn by doing work with your hands, understand machines from the ground up, and never stop exploring the technical details. True expertise comes from practical experience, not just theory.

Equally important is to document what you learn—every observation, challenge, and solution. Written knowledge not only strengthens your understanding but also becomes a valuable guide for others who follow. Stay curious, stay dedicated, and the industry will reward you richly.

Mr. Chandrakant Gunaji Nemade
Founder - Nemade Engineers Pvt. Ltd.

Driving Indian Manufacturing Forward: SUPERCOOL NEAT 260 X from Lubeco Green Fluids

- By Pratap Tex-Chem Pvt. Ltd

Introduction: Pratap Tex-Chem Pvt. Ltd. – Raising the Bar for Metalworking Solutions

Based in Pune, Pratap Tex-Chem Pvt. Ltd. (PTCPL) has established itself as a frontrunner in the Indian metalworking and lubricant industry since its foray into this market. The company's journey, from textile manufacturing in 1979 to a leader in specialty chemicals, lubricants, and metalworking fluids, demonstrates a commitment to resilience, innovation, and quality. The transition into a multi-sectoral enterprise and incorporation in 1999 marked the beginning of a new era, propelling PTCPL into markets ranging from automotive to aerospace and general manufacturing.

Commitment to Excellence: Brands, Infrastructure, and Expertise

Pratap Tex-Chem Pvt. Ltd. operates a state-of-the-art manufacturing setup in Pune with advanced automated reactors and scalable packaging lines, supporting an annual production capacity of 6000 KL. The company's robust in-house laboratory, equipped with pilot reactors and advanced analytical tools, enables continuous R&D and quality assurance, ensuring each product offering meets evolving industrial needs. With a skilled workforce of 100+ and a growing logistics footprint, the company serves customers all over India and exports to diverse regions across Asia, Africa, Russia and beyond.

The Lubeco Green Fluids Brand: Innovation in Metalworking and Lubrication

Under its flagship brand, Lubeco Green Fluids, Pratap Tex-Chem Pvt. Ltd. offers a comprehensive suite of products. This portfolio includes water-soluble and neat cutting oils, EDM fluids, specialized industrial lubricants, rust preventives, and VCI packaging—solutions designed for optimum efficiency and environmental responsibility in modern manufacturing setups. Lubeco's success is underpinned by advanced formulation, application-specific approach, and a relentless focus on sustainability, performance, and customer partnership.

Lubeco®
GREEN FLUIDS

Unlocking Value in Modern Machining: Introducing SUPERCOOL NEAT 260 X

Product Overview

SUPERCOOL NEAT 260 X is Lubeco's cutting-edge synthetic-based neat cutting fluid, developed for demanding metalworking environments. It reflects the company's commitment to bringing next-generation products to Indian and global manufacturers by combining the latest advances in base oil and additive technology.

- The clear liquid appearance ensures straightforward visibility in operation and contributes to a clean, mist-free working environment.
- Its mineral oil-free, synthetic formulation delivers enhanced oxidation stability, helping maintain fluid integrity throughout extended use.
- Formulated with advanced, customized ester chemistry and anti-staining agents, it provides superior lubricity and helps prevent built-up edge, resulting in smoother machining and improved surface quality.
- With moderate viscosity and a high viscosity index, the product enables efficient flushing and evacuation of metal chips and dust, supporting uninterrupted process reliability.
- The elevated flash point delivers robust thermal stability and safer handling, supporting a secure

work environment and compliance with rigorous EHS standards.

Unique Features and Technical Superiority

SUPERCOOL NEAT 260 X stands out in multiple ways:

- Mineral oil-free design ensures lower stickiness, reduced carry-over, and improved workplace cleanliness.
- High viscosity index delivers consistent lubricity even at elevated temperatures, without needing hazardous extreme pressure (EP) additives such as sulphur, chlorine, or phosphorus.
- The innovative ester-based formula ensures excellent cooling, wetting, and deposit control, vital for high-precision and long-cycle machining operations.

Key Technical Advantages:

- Superior Heat Transfer: Rapid cooling minimizes thermal loads on workpieces and tools, ensuring dimensional stability and better finishes.
- Enhanced Lubricity: Light viscosity enables effective chip evacuation, minimizes friction, and reduces power consumption.
- Minimal Smoke & Mist Formation: Ensures operator comfort and health, keeps plant air quality high.
- High Flash Point: Boosts fire safety and operational peace of mind.

Eco-Conscious: No mineral oil or heavy metals, free from organic nitrogen and aromatics; helps end-users meet environmental and regulatory standards.

Typical Applications Across Industries

SUPERCOOL NEAT 260 X is designed for a wide spectrum of advanced manufacturing operations, including:

- Gear cutting, shaping, and shaving
- Gear hobbing
- Bar cutting and sliding head machines
- Other neat cutting operations

Its application flexibility makes it particularly valuable for automotive, precision engineering, gear manufacturing, and urgent OEM production lines targeting efficiency and process reliability.

Real-World Validation: Case Study at a Leading Tractor Manufacturer

To demonstrate the tangible benefits of SUPERCOOL NEAT 260 X, a comprehensive field trial was conducted at a major tractor manufacturing plant in Punjab, India. The trial compared SUPERCOOL NEAT 260 X with a prominent mineral oil-based neat cutting fluid from a well-known global brand, focusing on gear hobbing operations using HSS tools on automated lines.

Key Observations and Results

Observation Points	Market Leader	SUPERCOOL NEAT 260 X	Verdict
Oil consumption	700 pcs with 70 L	1055 pcs with 100 L	Low carry over
Regular tool life	780 pcs	1055 pcs	35% higher tool life
Highspeed tool life	1200 pcs	1622 pcs	35% higher tool life
Chips appearance	Burning black chips	Clear shiny chips	Less oxidation
Mist/smoke	High	Low	Eco-friendly, low evaporation

- Tool life: Lubeco's SUPERCOOL NEAT 260 X displayed a 35% improvement in both regular and high-speed tool life, enabling the production of more components per tool change and reducing downtime.
- Chip appearance: The use of Lubeco fluid resulted in clear, shiny chips, an indicator of high-quality cutting and improved surface finish, as opposed to the burning black chips observed with the conventional product.
- Oil consumption: Oil usage per number of parts produced was better, despite higher component output. Upto 10% consumption saving can be achieved.
- Shop environment: The Lubeco product generated noticeably less mist and smoke, leading to improved

shop floor air quality and operator comfort.

This case study underscores SUPERCOOL NEAT 260 X's ability to deliver superior tool life, cleaner machining, and a more sustainable working environment—making it a preferred choice for precision gear manufacturing at high-volume, quality-focused plants.

Product Management and Safety

Proper handling of advanced lubricants is essential:

- Store under cover, away from sunlight and rain.
- Use recommended PPE during transfer, handling, and maintenance.
- Refer to the product's MSDS for hazard identification, first aid, and disposal protocols. SUPERCOOL NEAT 260 X has been classified as causing mild skin and serious eye irritation; contact should be minimized, with immediate washing and consultation recommended if exposure occurs.

Environment, Compliance, and Corporate Responsibility

As industrial customers adopt more sustainable and responsible production models, SUPERCOOL NEAT 260 X aligns with modern compliance:

- Biodegradable base formulation
- Recommended for industries seeking lower environmental impact and safer, greener workspaces
- Supports responsible disposal and waste management practices

Customer Value and Economic Benefits

By switching to SUPERCOOL NEAT 260 X, users experience:

- Improved productivity from less downtime and longer tool intervals
- Cleaner workspace with less smoke, mist, and carryover loss
- Lower process costs due to reduced volume usage and disposal needs
- Enhanced worker safety from absence of hazardous EP additives and lower irritant potential

Not only does the product offer superior technical performance but it also helps manufacturers achieve their sustainability and compliance targets more easily.

Conclusion: SUPERCOOL NEAT 260 X as the Future of Advanced Machining Fluids

SUPERCOOL NEAT 260 X from Lubeco Green Fluids embodies Pratap Tex-Chem's progressive approach—uniting chemistry, innovation, and deep customer understanding to deliver breakthrough performance in metalworking fluids. Its adoption helps industries address tougher workloads, more stringent quality demands, and the shifting landscape of environmental regulations, while maintaining cost competitiveness and operational reliability.

In summary, SUPERCOOL NEAT 260 X is more than just a cutting fluid—it is a strategic asset for forward-focused manufacturers and a testament to Lubeco's drive for technical and environmental leadership in the lubrication sector. For detailed specifications, safety, and partnership inquiries, reach out at info@lubecogreenfluids.com or www.lubecogreenfluids.com.

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Reinventing Precision: ARK MachTek's CNC Upgradation & Mechanical Reconditioning of Gear Grinding Machines

- By ARK MachTek Pvt. Ltd.

"At ARK MachTek, our gear grinding machine upgradation program delivers the performance of a new machine — at significantly lower investment."

A Legacy of Precision and Innovation

For over 25 years, ARK MachTek Pvt. Ltd. has been synonymous with engineering excellence in gear processing automation. Founded with a vision to modernise India's gear manufacturing landscape, the company has successfully reconditioned and upgraded hundreds of gear hobbing, shaping, and shaving machines—each tailored with Fanuc CNC systems to meet the diverse specifications of its customers.

As one of India's most experienced automation specialists, ARK MachTek continues to evolve with market needs, integrating new technologies and sustainable engineering practices into its solutions.

Expanding Horizons: Introducing Gear Grinding Machine Reconditioning

In 2025, as the company celebrates its silver jubilee, ARK MachTek proudly adds Gear Grinding machines to its product portfolio. This strategic expansion follows extensive in-house R&D and successful pilot projects in the retrofitting and mechanical rebuilding of gear grinding machines, reaffirming ARK's commitment to delivering cost-effective, high-precision manufacturing solutions.

This move strengthens ARK MachTek's position as a one-stop partner for the complete spectrum of gear processing equipment—from hobbing and shaping to the most advanced finishing stage: grinding.
Additionally, ARK MachTek is capable and offering gear tooth profile grinding upgradation, and worm thread grinding machine upgradation.

Why Gear Grinding Matters More Than Ever

The demand for precision gear grinding has accelerated rapidly across industries. In the automotive sector, especially with the rise of electric vehicles, stringent noise, efficiency, and surface finish requirements make gear grinding indispensable. Beyond automotive, aerospace, robotics, wind energy, and industrial automation are also driving the need for superior gear finishing technologies.

However, the capital cost of new gear grinding machines—often exceeding several crores—can be prohibitive. For many manufacturers, particularly MSMEs and Tier-2 suppliers, this presents a significant barrier to competitiveness.

ARK MachTek bridges this gap by offering CNC retro-fitment and mechanical reconditioning—transforming conventional gear grinders into state-of-the-art, high-productivity generating gear grinding machines, at a fraction of the cost of new equipment.

Engineering the Upgrade: From Legacy to Modern Precision

Each reconditioned gear grinding machine is equipped with a FANUC CNC Controller, featuring up to 13-axis control for enhanced precision and process flexibility:

- Rotary Axes: A (swivelling), B (grinding wheel), and C (workpiece)
- Linear Axes: X (grinding slide infeed), Y (Grinding Wheel shifting), Z (work slide stroke)
- Profiling Axes: U and V (infeed and stroke)
- Auxiliary Axes: W (tailstock sleeve), P (coolant nozzle positioning), and dedicated dresser control axes

This advanced configuration allows ARK's rebuilt machines to deliver cutting speeds up to 63 m/s, with customizable performance tailored to customer needs.

Precision Meets Productivity

Reconditioned gear grinders from ARK MachTek incorporate a host of enhanced automation and control features designed for reliability, accuracy, and user-friendliness:

- Automatic dynamic wheel balancing and process monitoring
- Integrated 3,500 rpm grinding wheel spindle motor
- High-torque rotary table drive (up to 400 rpm)
- Variable-speed single disc dresser and OD dresser
- Manual and automatic dressing touch points
- Automatic stock dividing
- User-friendly, menu-driven CNC screens for simplified operation
- Automatic wheel shifting and multi-thread dressing cycles
- Total machine enclosure and guarding
- Automatic axis retraction in emergencies
- Overload protection for grinding and dressing tools
- Hydraulic work-holding actuation
- High-pressure coolant filtration system

"Our reconditioned machines deliver consistent accuracy, improved uptime, and exceptional safety — meeting the precision benchmarks of brand-new machines."

Performance You Can Trust

Each ARK MachTek rebuild undergoes comprehensive testing and calibration, ensuring gear quality that meets international standards. The company's process supports profile and lead corrections for spur and helical gears, taper and crowning cycles, and even point-to-point grinding for complex lead graphs.

With these capabilities, ARK's machines deliver the precision required for automotive transmission gears, EV drivetrains, aerospace actuators, and high-speed industrial gearboxes.

Empowering Indian Manufacturing

By providing cost-effective, high-performance reconditioning solutions, ARK MachTek empowers Indian manufacturers to compete globally—without the financial burden of new capital investment. The company's expertise in automation, motion control, and mechanical engineering ensures every retrofitment delivers long-term reliability and measurable ROI.

"Our mission is to modernise legacy machines into intelligent, high-productivity systems — supporting the growth of India's manufacturing ecosystem."

Looking Ahead

As ARK MachTek continues to advance its reconditioning technologies, the company remains committed to innovation, sustainability, and customer partnership. Its successful entry into gear grinding marks a major leap toward becoming India's leading provider of complete gear manufacturing automation solutions.

For more information, visit www.arkmpl.com

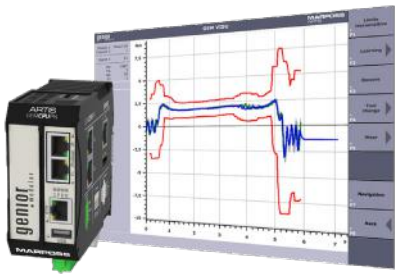
Mohan Bhagwat

Director @ ARK MachTek Pvt. Ltd.

Established in 2000, ARK MachTek Pvt. Ltd. is one of India's oldest and most experienced players in gear processing automation. Headquartered in Pune, the company specialises in CNC retro-fitment, automation, and reconditioning of gear hobbing, shaping, shaving, and grinding machines, offering world-class performance at optimal cost. Additionally, ARK MachTek is equipped to offer gear tooth profile grinding upgradation and the upgradation of a worm thread grinding machine.

TOOL AND PROCESS MONITORING SYSTEM: GEMCPU

- By Marposs Group



GEMCPU is an autonomous intelligent tool and process monitoring system providing an automatic real-time image of the current production process. Safe and reliable metal cutting processes are essential for economically efficient production.

GEMCPU's multi-criteria monitoring strategy adapts automatically to machining processes. This means that the system records all relevant signals and sets the limits based on special algorithms. During the following cutting cycles, GEMCPU adjusts the automatic limits. Experts can change and manually fix the limits. The modular system can be easily integrated into machine and network structures. Via fieldbus interfaces, data is exchanged with CNC controls.

Description

The modular system makes use of all relevant process signals and data from machine tools. It reacts in real-time after an event occurs. The system captures the measurement data digitally via a fieldbus interface or via sensors and then evaluates the data based on multiple criteria and visualises the processes in a transparent way. Trend or alarm reports support the users to optimise processes and allow them to produce much more efficiently.

In addition to the described functions, data (BIG DATA) is collected and converted into information (SMART DATA), which can be stored locally or on network devices for further evaluations like analysis, trend curves, statistics and reports.

The option Adaptive Control adjusts the set feed rate of the cutting cycle, so that the effective force of the tool is as stable as possible. A reduction of cycle time can be the result of this feed rate optimisation.
GEMCPU is also capable of detecting the wear of a brushing tool and thus automatically adjusting the feed axis.

The modularity of the system is one of the characteristic features needed to adapt the monitoring system to dedicated systems and machines. It is easy to integrate additional function modules, for example, GEMTP, GEMGP and GEMVM.

The MultiView process visualisation gives an overview of all parallel monitoring processes. Additionally, zooming, back tracing and filtering of different cycles is possible as well. Via Plug-ins (APPs), additional and/or customised functions can be activated, like CSV-export, trend curves or statistics.

The option „FINGERPRINT" (condition monitoring) shows variations in vibration and torque. An alarm will be given when these changes are still marginal and reach set limits to enable status-oriented maintenance.

Benefits

- Modular/scalable: Economical solution, even for simple applications
- Efficient: Parallel to the process, up to 16 real-time measuring signals in up to 10 NC channels (partly optional) can be acquired.
- Automatic adjustment of alarm limits: makes tedious adjustment to machines or readjustment of limits practically unnecessary - manual adjustments can be made as required or may be necessary for special applications
- Optimum use of tool lifetime: Based on the performance data or vibrations, optimum tool utilisation can be achieved by evaluating the set wear limit (optional)
- Analysis functions: Process signals are recorded and can be monitored online or offline
- Blackbox: an event recorder records limit violations with time stamping
- Data processing: Plug-ins (APPs) for error evaluation, for trends and for CSV data-output included
- Overview for quick decisions: the online visualisation MULTIVIEW shows all relevant signals and their deviations
- Adjustments: the password-protected EXPERT MODE allows many individual adjustments

Tech Specs

- Up to 16 real-time measuring signals distributed in up to 10 channels (optional)
- Adjusts the alarm levels automatically if possible
- Optimum tool utilisation by evaluating the set wear limits (optional)
- Modular structure, scalable system adaptable to most machine types, easy to install on DIN rail
- Additional analytic functionalities, data processing for the Industrial Internet of Things
- Networking with other systems
- MultiView and PlugIn technology to support users in process optimisation
- Expert Mode for individual adjustments
- OPTIONS: tool wear, adaptive control AC, machine condition monitoring, "Fingerprint", data import (data interface for C-THRU4.0)

Versions

GEMCPUDP/F: processor unit with Profibus and for FOCAS (FANUC controls)

GEMCPUPN: processor unit with ProfiNET
GEMCPUS828: Evaluation unit for SIEMENS SINUMERIK 828 controls

Various modules:

GEMIO01: Input/Output module for parallel wiring

GEMTP: True power module to connect up to 3 hall sensors

GEMFM01: Force module to connect various Artis/ Marposs force sensors (1 sensor per module)

GEMAM01: Acoustic Emission module to connect AE sensors (1 sensor per module)

GEMVM: Vibration module to connect the acceleration and temperature sensors

GEMCMV: Module for the connection of vibration sensors. GEMCMV protects the machine against dynamic collisions and additionally transmits the signals for process monitoring.

GEMCMS: Module for the connection of vibration sensors.

GEMCMS protects the machine against quasistatic and dynamic collisions and additionally transmits the signals for process monitoring.

GEMTF01: Torque module to connect DDU torque sensor technology (1 sensor per module)

Via the Ethernet connection, the visualisation can be performed on a PC like Artis operator panel IPC7 or IPC10, on any Windows or Linux-based PC in the machine or network

ZF Presents New Rail Gearbox at IREE 2025: Specially Made in India for India

- Purpose-built: new single-stage spur gear drive designed for the demanding requirements of Indian railways
- Reliable performance: thanks to decades of ZF experience, the gearbox delivers robust efficiency at lower lifecycle costs in tough conditions
- Local for local: gearbox manufactured at ZF's plant in Coimbatore

New Delhi (India). ZF is unveiling a new rail gearbox during the 16th International Railway Equipment Exhibition (IREE) from October 15-17, 2025. The single-stage spur gear drive is purpose-built for the nation's railways. True to the company's claim of 'Redefining Indian mobility', the gearbox is designed for reliable, efficient performance under harsh conditions. ZF will present the new gearbox, as well as other products from its rail portfolio, at its Booth 5.114 in Hall 5.

Indian Railways operates across a wide range of challenging terrains, facing extreme weather conditions such as heat, humidity, and snow. The extensive network also includes winding routes and changes in elevation. These diverse operating environments necessitate ongoing maintenance and modernisation to ensure the safety, reliability, and efficiency of one of the world's largest rail networks.

"These factors demand a lot from the driveline," says Markus Gross, Head of Product Line Rail Drive Systems at ZF. "We are proud to present technology that the Indian Railways can depend on. Our products perform both efficiently and reliably. This is exactly what our new single-stage spur gear drive offers."

Akash Passey, President of ZF Group in India, adds: "With a proven legacy of over a century in rail technology, ZF Group stands uniquely positioned to support the evolving needs of Indian railways. As one of the world's largest people movers, Indian Railways carries an immense responsibility for safe, efficient, and secure mobility across the nation. At ZF, we recognise this mission and are proud to offer advanced, reliable, and efficient solutions that are purpose-built for India's dynamic and revolutionary rail ecosystem. Together, we aim to empower safe and seamless connectivity for millions of passengers across millions of kilometres – today and into the future."

Tough conditions, reliable performance, proven over millions of kilometres in operation

- PRESS RELEASE

For the new single-stage spur gear drive, ZF was able to rely on existing components – with their quality proven over millions of kilometres in operation. This legacy has been adapted into a product purpose-built for high-speed applications in India, like the Vande Bharat Express and other train types. One of its defining features is its new, specially developed sphere cast housing, best suited for the tough environmental conditions in India and the oscillatory demands of the routes. Despite this robust housing, it is both compact and comparatively light, with a weight of approximately 315 kg (including torque arm). Designed for a maximum axle load of 17 tons, a nominal engine power of 300 kW and an input torque of 2,600 Nm, the gearbox ensures consistent and reliable performance at speeds up to 180 km/h. Thanks to its optimised gearing – and experience from decades of producing more than 30,000 high- and semi-highspeed gearboxes – it achieves both high efficiency and lower total lifecycle costs.

Made for India, made in India

While the single-stage spur gear drive is based on German know-how, its assembly takes place in ZF's newly inaugurated plant in Coimbatore. The company continues with its focus on growth in emerging markets with products and solutions that address the specific needs of the Indian customers and has invested accordingly to extend its existing assembly lines with rail-specific equipment. "Our local-for-local strategy is one of our company's greatest strengths," says Akash Passey. "It ensures that our products and services, including aftermarket, are always close and closely tailored to our customers. This means that we can not only guarantee benchmark-setting quality but also speed of delivery and a more robust supply chain."

"Our strengths and competencies are fully on display with this product. It also marks a further important step in our ongoing commitments to our international customers and global footprint," adds Markus Gross.
The first orders for the new gearbox have already been received. Delivery will start in the first quarter of 2026. Further investments in additional assembly lines are planned.

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Safe and reliable machining processes are a prerequisite for economically efficient production.
GENIOR MODULAR monitors machines and processes and transforms collected data into usable information for the SMART FACTORY. In real-time, the system monitors the limits set automatically or manually so that you can identify potential problems before they become costly issues.

Measurement data is acquired digitally via common fieldbus interfaces or via base modules with connected sensors.
A core element of the system is its flexibility, which allows you to adapt and expand monitoring capabilities to meet your changing needs. Seamlessly integrate GENIOR MODULAR into your existing machine tools, specialty systems and production areas.

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MARPOSS

The 14th VDMA Mechanical Engineering Summit

- By VDMA India

(From left to right – Ms. Rinsi Sud, Executive Director of DZ Bank and Vice President of Indo German Chamber of Commerce (IGCC), Mr. Oliver Richtberg, Head of Foreign Trade Department, VDMA Frankfurt, Mr. Rajnish Sharma, Director, Bharat Electronics Limited, Mr. Achim Burkart, Consul General of the Federal Republic of Germany in Karnataka and Kerala, and Mr. Rajesh Nath, Managing Director, VDMA India)

The 14th VDMA Mechanical Engineering Summit

The 14th VDMA Mechanical Engineering Summit was held on the 10th of October 2025 at Taj Yeshwantpur, Bangalore, which had a participation of more than 350 participants from 29 cities across India, Germany, and Europe.

The Summit commenced with an auspicious Lighting of the Lamp ceremony featuring distinguished dignitaries. Mr. Rajesh Nath, Managing Director, VDMA India, Mr. Achim Burkart, Consul General of the Federal Republic of Germany in Karnataka and Kerala, Mr. Rajnish Sharma, Director, Bharat Electronics Limited, and Mr. Oliver Richtberg, Head of Foreign Trade Department, VDMA Frankfurt, and Ms. Rinsi Sud, Executive Director of DZ Bank and Vice President of Indo German Chamber of Commerce (IGCC).

Mr. Rajesh Nath delivered the welcome address, warmly greeting all guests and expressing gratitude to

special guests and sponsors. He highlighted India's rapid ascent as the world's fourth-largest economy, soon to be third, driven by manufacturing growth and initiatives like Make in India and PLI schemes. He reflected on VDMA 2025 initiatives promoting engineering excellence and collaboration. Introduction of the new VDMA logo as a symbol of innovation, Mr. Nath thanked the partners, sponsors, and the VDMA India team, reaffirming their joint commitment to advancing India's journey toward Viksit Bharat 2047.

Following the welcome address by Mr. Rajesh Nath, the Guest of Honour, Mr. Achim Burkart, Consul General of the Federal Republic of Germany in Karnataka and Kerala, delivered his insightful address on "EU–India Free Trade Agreement (FTA): Accelerating Bilateral Relations." He highlighted that the FTA will be a transformative partnership extending beyond trade to foster economic and strategic integration between two of the world's largest markets. Mr. Burkart emphasised that the agreement would harness India's manufacturing strength and Europe's engineering and sustainability expertise to drive growth in key sectors such as automotive, renewable energy, pharmaceuticals, and digital technology.

Following the address by Consul General Achim Burkart, the Guest of Honour, Mr. Rajnish Sharma, Director of Bharat Electronics Limited (BEL), delivered his insightful presentation on "Opportunities for Manufacturing in the Growing Defense Sector." He highlighted the rapid expansion of India's defence manufacturing ecosystem—spanning Defence PSUs, private companies, MSMEs, and startups—under the Atmanirbhar Bharat initiative, positioning India as a potential global hub. Mr. Sharma emphasised the need for stronger supply chain collaboration in areas such as semiconductors, AI-enabled machining, digital twins, fibre optics, and specialty materials to achieve true self-reliance. He further stressed the importance of strategic partnerships with VDMA, German, and European technology leaders to drive advanced manufacturing, technology transfer, and Industry 4.0 adoption, while highlighting BEL's deep engagement with MSMEs and startups in developing next-generation defence technologies.

Mr. Oliver Richtberg, Head of the Foreign Trade Department at VDMA Frankfurt, delivered his address on "New Global Economic (Dis)order – Consequences for the Mechanical Engineering Industry,". His analysis included the collapse of Europe's traditional business model built on open markets, affordable energy, and Chinese demand into a "broken triad" marked by self-defence imperatives, high energy costs, and intensified Chinese competition. He highlighted the impact of U.S. tariffs on mechanical engineering, including complex compliance requirements and uncertainty from expanding tariff lists, alongside the growing challenges in China, where subsidies, price advantages, and non-standard practices erode European competitiveness. Emphasising VDMA's policy priorities: strengthening EU manufacturing, securing new free trade agreements, countering unfair competition, and reducing dependencies. He identified India as the most promising market for European mechanical engineering due to its industrial growth, democratic alignment, and stable business environment.

After insights from Mr. Richtberg's address, the honourable dignitaries, including Mr. KC Mani, Managing Director, BDB India, Mr. Rahul Bhandurge, Vice President – Business Development, BDB India, Mr. Nath, Mr. Richtberg, and Mr. Sharma, officially released the Knowledge Paper by the Knowledge Partner, BDB India.

Following the release of the Knowledge Paper, Mr. Rahul Bhandurge, Vice President – Business Development, BDB India, delivered a presentation on "Powering India's Future: Strategic Opportunities in Electronics, Semiconductors, and Battery Manufacturing." He highlighted that India currently imports 95% of its chip requirements, valued at $26 billion. He outlined India's strategic semiconductor hubs across Gujarat, Punjab, Uttar Pradesh, Assam, Odisha, and Andhra Pradesh, driven by the India Semiconductor Mission and $18 billion in investments across ten major projects, including Tata Electronics' fab in Dholera and initiatives by Micron, HCL-Foxconn, and others. On electronics, he noted domestic production growth from $90 billion to $110 billion, with projections of $300 billion, supported by the Electronics Components Manufacturing Scheme. He also highlighted India's battery energy storage expansion to 66 Gigawatts ($60 billion) with government incentives and net-zero targets, covering the full value chain from cell manufacturing to recycling.

Concluding the inaugural session, Mr. Nath felicitated the distinguished guests, honouring Guest of Honor Mr. Achim Burkart, Consul General of the Federal Republic of Germany for Karnataka and Kerala, Guest of Honour Mr. Rajnish Sharma, Director, Bharat Electronics Limited, and Mr. Oliver Richtberg, Head of Foreign Trade Department, VDMA Frankfurt

Following the felicitation ceremony, the proceedings of the Knowledge Session commenced.

The Knowledge Session opened with a presentation by Mr. Atish Laddha, Associate Partner, Roedl & Partner Consulting, on "I Want to Trade Free! New Era of Free Trade Agreements for India with the World." He provided detailed insights into three major trade agreements: the India-EFTA

Trade and Economic Partnership Agreement, effective October 2025, granting 92% tariff concessions from EFTA and 83% from India while creating $100 billion

in investments and 1 million jobs over 15 years; the India-UK

(From left to right - Mr. Oliver Richtberg, Head of Foreign Trade Department, VDMA Frankfurt, Mr. Priyank Kharge, Hon'ble Minister of IT & Biotechnology and Rural Development and Panchayat Raj, Government of Karnataka and Mr Rajesh Nath, Managing Director, VDMA India)

Comprehensive Economic and Trade Agreement, offering duty-free access to 99% of India's exports, and the India-EU FTA, under its 14th negotiation round, addressing automobile tariffs, textile and pharmaceutical concessions, harmonised standards, simplified sanitary measures, and transitional support for the Carbon Border Adjustment Mechanism.

The next presentation, titled "Navigating an Uncertain World," was delivered by Ms. Anagha Deodhar, Senior Economist at ICICI Bank Limited. She highlighted the recent GST reforms that reduced taxes on everyday items. Ms. Deodhar observed a boost in consumption reflected in rising auto sales and electronic payments. She also cited India's first sovereign rating upgrade by S&P in over 15 years, signalling structural fiscal improvements and robust external accounts, projecting real GDP growth of 6.8% for FY26. She cautioned that the Balance of Payments outlook remained under pressure.

Ms. Deodhar was followed by Mr. M.R. Subramanya, Vice President, Siemens Technology & Services Private Limited, who delivered a presentation on "GenAI Transforming Industrial Automation." He highlighted Siemens' focus on automation and explained how Generative AI is reshaping the industrial landscape through three types of AI applications: Analytical AI for insights and predictive analytics, Autonomy & AI for autonomous decision-making, and Generative AI for creating new content from large datasets. Key technological advances discussed included Industrial Foundation Models, Multi-modal LLMs, Agentic AI, and Edge Models for real-time processing. Mr. Subramanya showcased Siemens' practical implementations, such as Engineering Copilot for TIA Portal, Design Copilot for NX, Manufacturing Copilot for NX X, and Maintenance Copilot Senseye.

Ms. Sujhatha A, Senior Manager at Guidance, delivered a presentation on "Tamil Nadu's Thriving Manufacturing Sector and Investment Potential." She mentioned the state as India's second-largest economy with a GSDP of $365.5 billion and 11.19% growth. She noted Tamil Nadu's industrial leadership, with over 40,000 factories employing 2.9 million people, and sectoral dominance in automobiles, EVs, electronics (41% exports), leather (60% of India's processing), and textiles. Ms. Sujhatha emphasised strong German-Tamil Nadu ties, including investments by over 100 German companies, Coimbatore's twinning with Esslingen am Neckar, and collaborations with the Fraunhofer Institute. She showcased the innovation ecosystem with 150,000 engineering graduates, 7,000+ patents, 400+ deep-tech startups, including 250+ GCC centres

Following Ms. Sujhatha's presentation, Chief Guest Mr. Priyank Kharge, Hon'ble Minister of IT & Biotechnology and Rural Development and Panchayat Raj, Government of Karnataka, delivered his special address on "Karnataka – Hub of GCCs in India." He highlighted Bengaluru as the 4th largest technology cluster globally, emphasising Karnataka's strong global rankings in startups (8th), skill development (3rd), R&D publications (3rd), and unicorn Hubs (5th). Mr. Kharge attributed the state's leadership in attracting GCCs to its robust technology ecosystem, skilled talent pool, and innovation-driven infrastructure. He outlined the state's "3 Ps" framework—People, Policy, and Participation backed by policies like AVGC-XR and LEAP, dedicated incentives for Tier 2/3 cities, and talent development via the NIPUNA policy to develop industry-aligned talent and adopt a co-investing approach, which demonstrates partnership with the private sector. The Minister proudly highlighted Karnataka's manufacturing achievements, noting that the first iPhone manufacturing in India was established in Bengaluru. The Minister concluded by reaffirming the government's commitment to being a "partner in growth," fostering healthy competition, and ensuring that every component manufactured adheres to three promises: "precision you can measure, sustainability you can verify, and delivery you can plan your business on". He also visited the B2B partner stalls at the venue, engaging with partners and exploring their offerings.

Mr. Nath, along with honourable dignitaries Mr. Priyank Kharge and Mr. Oliver Richtberg, officially released the VDMA Summit Special Issue on the occasion of the 14th VDMA Mechanical Engineering Summit. Mr. Nath felicitated the Chief Guest, Mr. Priyank Kharge. Hon'ble Minister of Information Technology & Biotechnology and Rural Development and Panchayat Raj, Government of Karnataka.

The second half of the 14th VDMA Mechanical

Engineering Summit commenced after a networking lunch with the release of the Knowledge Report by the HR Strategy Partner, Maier Vidorno Altios, titled "Future-Ready Workforce – Building Skills & Upskilling Strategies for Global SMEs in India." The report was unveiled by Mr. Rajesh Nath, Mr. Umesh Pai, Managing Director, Eplan Software Private Limited, Mr. Rajesh Ramachandran, Global Chief Digital Officer and Managing Director, ABB Process Automation, Mr. Ranjan Singh Chadha, National Sales Manager, Festo India Private Limited, and Mr. Manish Kumar Dwivedi, Assistant General Manager – Human Resources, Maier Vidorno Altios.

Thereafter, Mr. Manish Kumar Dwivedi, Assistant General Manager – Human Resources, Maier Vidorno Altios, highlighted India's vast yet under-skilled workforce, noting that only 4.7% have formal vocational training and nearly 80% of employers face difficulty sourcing skilled talent for technical and specialised manufacturing roles. He projected that by 2030, around 70 million workers will need upskilling to meet demands driven by AI, IoT, and automation. Addressing current challenges, he mentioned that SMEs train only a small fraction of staff due to limited budgets and high attrition. He highlighted government initiatives such as Skill India Mission and the Karnataka Model Skill Policy and recommended strategies for SMEs, including apprenticeship and dual training models, prioritising digital and technical skills.

The Technical Session, themed "Accelerating Next Generation Manufacturing," featured leading companies including EPLAN, ABB, and FESTO. The session commenced with Mr. Umesh Pai, Managing Director of Eplan Software Private Limited, presenting on "AI in Industrial Automation." He traced the evolution from analog instruments and ON-OFF control to today's AI-driven Industry 4.0. Discussing India's 2025 automation landscape, he noted a low robot density of seven per 10,000 workers and that 38% of firms have no digital adoption plans. Mr. Pai showcased platform solutions that enhance efficiency, design quality, and accuracy while reducing costs by up to 40%, featuring engineering copilots, agentic software automation, physical AI robots, edge AI, and integrated regulation.

(From left to right - Mr. Sunil Mathur, Managing Director & CEO, Siemens India, Mr. Suvneet Jain, Country Managing Director, India Cluster, GEA Group India, Mr. Akash Passey, President and Head, ZF Group India, Mr. Ramesh Palagiri, Managing Director & CEO, Wirtgen India Private Limited, Mr. Guruprasad Mudlapur, President, Bosch Group India and Managing Director, Bosch Limited and Mr Rajesh Nath, Managing Director, VDMA India)

The next presentation was from Mr. Rajesh Ramachandran, Global Chief Digital Officer and Managing Director, ABB Process Automation, who spoke about "Automation to Autonomous: A New Era of Sustainable Manufacturing with Industrial AI". He outlined the transformative journey from traditional automation to autonomous operations powered by industrial IoT, AI, digital twins, and edge computing, highlighting ABB's leadership in this transition through ABB Ability Genix, an industrial IoT and AI platform that integrates operational, IT, and engineering data to deliver actionable insights across industries, including manufacturing and marine transportation. The platform, which supports over 6,000 marine vessels and numerous industrial systems. Mr. Ramachandran discussed the evolution of industry across five industrial revolutions, positioning Industry 5.0 as enabling autonomous operations with cognitive, data-driven AI at its core.

The final speaker of the session was Mr. Ranjan Singh Chadha, National Sales Manager, FESTO India Private Limited, presenting on "Sustainable Automation Technologies for Smart Manufacturing." He highlighted the manufacturing sector's 30% skilled manpower gap and the need to enhance Overall Equipment Effectiveness (OEE), energy efficiency, and reduce CO emissions. Mr. Chadha showcased Festo's "Blue World Approach," integrating automation technology with technical education to drive ecological innovation. He noted Festo's CO neutrality in Scope 2 emissions since 2023 and emphasised potential energy savings in compressed air systems of up to 49%. Innovative solutions such as the MSE6-C2M Energy Efficiency Module, saving up to 70% compressed air, and the VTEM Motion Terminal, an app-controlled valve terminal, reducing system complexity and energy use.

The Technical Session concluded, leading into the Panel Discussion on "3 Ts Shaping Indian Manufacturing." The session brought together a distinguished panel of industry leaders:

Mr. Sunil Mathur, Managing Director & CEO, Siemens India
Mr. Suvneet Jain, Country Managing Director, India Cluster, GEA Group India
Mr. Akash Passey, President and Head, ZF Group India
Mr. Ramesh Palagiri, Managing Director & CEO, Wirtgen India Private Limited
Mr. Guruprasad Mudlapur, President, Bosch Group India and Managing Director, Bosch Limited

Moderated by Mr. Rajesh Nath, Managing Director, VDMA India, the discussions delved into the critical trends, technologies, and talent shaping India's manufacturing landscape, providing valuable insights

from some of the nation's leading industrial voices.

Mr. Sunil Mathur mentioned that the global supply chain disruptions are reshaping manufacturing priorities, accelerating the adoption of digital transformation and advanced technologies like AI. He noted that events such as the semiconductor crisis have compelled manufacturers to rethink strategies and enhance resilience, balancing local initiatives, such as sourcing in India, with global supply chain demands. Key drivers for technology adoption include productivity gains, quality improvement, and demographic trends. Mr. Mathur also emphasised the importance of connecting academia with industry to enable SME innovation.

Mr. Suvneet Jain emphasised that successful smart manufacturing depends on clearly defined processes before technology implementation. He noted that many companies are "not ready" due to poorly understood processes and highlighted the need to enhance workforce capabilities. Mr. Jain stressed establishing robust operational technology frameworks to guide implementation and scaling, and balancing fresh graduates' innovation with experienced professionals' expertise through digital training tools. His approach underlines that process clarity, workforce readiness, and structured frameworks are prerequisites for technology adoption.

Mr. Akash Passey highlighted India's strong foundation for Industry 4.0, driven by growing manufacturing capabilities, government initiatives like Atmanirbhar Bharat, and improvements in infrastructure and logistics. He recommended that roughly 35% of investment be directed toward talent development across facilities. Mr. Passey also referenced India's goal to grow manufacturing to 25% of GDP, with 50% from the automotive sector, emphasizing that Industry 4.0 readiness requires collaborative ecosystems, infrastructure upgrades, and long-term strategic planning to transform India from a $4 trillion to a $13 trillion economic powerhouse.

Mr. Ramesh Palagiri highlighted the critical role of skill development, mentorship, and workforce diversity in enabling technology adoption and digital transformation. Mr. Palagiri emphasised a long-term approach to talent development, citing on-the-job training as crucial to building customer-focused capabilities. He outlined three transformation priorities: maintaining strong vendor partnerships, focusing on customer and growth, and embedding sustainable technology implementation.

Mr. Guruprasad Mudlapur highlighted India's strategic position as a hub for R&D and engineering excellence. He emphasised India's strong talent pool, including rural engineers whose technical skills match urban counterparts but require focused development of soft skills. Mr. Mudlapur underscored the need for operational efficiency, continuous improvement, and prioritising initiatives of high value, particularly in EV and renewable energy transitions. He stressed building a scalable talent ecosystem and fostering innovation, while noting the importance of strengthening academia-industry collaboration for long-term competitiveness.

The panel discussion concluded with the customary 'Rapid Fire Round', moderated by Mr. Rajesh Nath, which has become a hallmark of the VDMA Summit panel discussions. This segment offered quick, insightful perspectives from the panellists, adding a dynamic and engaging close to the session.

Following the Panel discussion, the panellists, joined by Mr. Rajesh Nath and Ms. Apalka Bareja, Senior Associate Advocate, S. S. Rana & Co., formally released the report authored by S. S. Rana & Co. on "Navigating the ADR Landscape for Businesses in India". The unveiling of this report highlighted a significant industry shift: the growing recognition of Alternative Dispute Resolution (ADR) as a critical mechanism for corporate strategy and operational efficiency. It details the Arbitration and Conciliation Act, 1996, the Mediation Act, 2023, and the Pre-Institution Mediation (PIM) mechanism under the Commercial Courts Act, 2015.

Following the speech by Ms. Apalka Bareja, Mr. Simon Puddu, Senior Associate, Roedl &
Partner delivered a talk on "Manufacturing with Heart: Shaping Impact beyond the Factory Floor." He emphasised that true success extends beyond productivity, rooted in values like energy efficiency, workplace safety, and corporate responsibility for a sustainable future. Defining modern CSR is aligned with the ESG principles in every business decision, he highlighted its role in driving inclusive growth

(Team Leser India- one of the recipients of the 8th VDMA Manufacturing Excellence Awards 2025)

After Mr. Puddu's speech, the VDMA's 8th Manufacturing Excellence Awards ceremony, held in partnership with Roedl & Partner, commenced. The awards recognised outstanding performance across three categories: Corporate Social Responsibility (CSR), Energy Efficiency & Conservation, and Work Condition & Work Safety. These awards were presented to companies selected from a total of 48 nominations received from 28

participating companies.

The Corporate Social Responsibility (CSR) Award saw Bosch Global Software Technologies Private Limited emerge as the winner in the Large Category, with Bosch Rexroth India Private Limited and Siemens Limited named as joint Runners Up. In the Medium Category, Vulkan Technologies Private Limited was the winner, while MAHLE Engineering Services India Private Limited was recognised as the Runner Up.

The Energy Efficiency and Conservation Award for the Large Category winner was Aumovio, while Freudenberg NOK Private Limited took the Runner Up position. In the Medium Category, LESER India Private Limited was named the winner, with Klaus Union Engineering India Private Limited being awarded the Runner Up position.

The Work Condition and Work Safety Award for the Large Category was won by SMS India Private Limited, with GEA India taking the Runner Up spot. For the Medium Category, R. Stahl Private Limited emerged as the winner, and Vulkan Technologies Private Limited was recognised as the Runner Up.

The final presentation of the day, delivered by Mr. Mudit Dobhal, Senior Vice President - Strategy & Business Development at IndoSpace, focussing on "Grade A Industrial Infrastructure" as the "Gamechanger" as the critical enabler for India's $1 trillion manufacturing ambition and achieving a 25% GDP share by 2030. He identified scalable, world-class industrial parks as the "Missing Link," essential for attracting FDI and reducing operational risk by providing plug-and-play facilities for high-growth sectors such as Auto & EV, Electronics, and Renewables.

After a full day of insightful presentations, speeches, and award presentations, Mr. Rajesh Nath concluded the successful event by extending his gratitude to all partners, participating companies, and delegates for their essential presence and interaction. Mr. Nath drew inspiration from Swami Vivekananda's famous quote: "Arise, awake, and stop not till the goal is reached," emphasising that industrial challenges and pressures are inevitable, yet they serve to test strength and lead to sharper, stronger emergence. The successful event culminated with a Networking Cocktail & Dinner, providing a final opportunity for partners, award winners, and delegates to engage in informal dialogue, solidify connections, and reinforce the spirit of collaboration.

The summit attracted predominantly senior professionals, with 96% of attendees from top and middle management. Feedback was overwhelmingly positive, as 70% rated their experience as excellent while the remaining 30% found it good.

CTI Expands Global Footprint with New USA Service Center

- By Gear Technology India

Capital Tool Industries (CTI) has announced the launch of its new CTI-USA Service Center, dedicated to the re-sharpening and re-coating of Gear Hobs, Gear Shaper Cutters, and Skiving Cutters. This strategic expansion marks another milestone in CTI's ongoing global growth and reaffirms its commitment to providing localized support and world-class quality to its customers worldwide.

For years, CTI-USA has been a trusted source for high-quality gear cutting tools from Capital Tool Industries, including hobs, shaper cutters, broaches, and skiving tools. The company also offers industrial storage solutions designed to protect and organize precision tooling.

Further strengthening its portfolio, CTI-USA recently became an authorized dealer for EIFCO CNC gear cutting machines, enabling customers to source both machines and tooling from a single, reliable partner.

The establishment of the new U.S.-based service center represents the final step in completing CTI-USA's comprehensive offering—providing local, high-quality sharpening and recoating services for gear cutting tools. This investment is designed to ensure shorter turnaround times, improved tool life, and enhanced performance for manufacturers across North America.

"Our goal has always been to deliver a full spectrum of gear cutting solutions—from the tools themselves to the machines that use them, and now the services that maintain them," said Richard Potesta, President of CTI-USA. "With our new U.S. service center, customers can count on us for consistent precision, faster service, and reduced downtime."

About CTI-USA

CTI-USA provides precision gear cutting tools, machinery, and support services to manufacturers across North America. Partnering with world-class brands such as Capital Tool Industries and EIFCO, CTI-USA delivers end-to-end solutions for gear manufacturing applications—from tooling and storage systems to machinery and maintenance services. For all your gear cutting tool needs in North America, contact CTI-USA.

Celebrating 25 Years of Excellence in Gear Processing Automation

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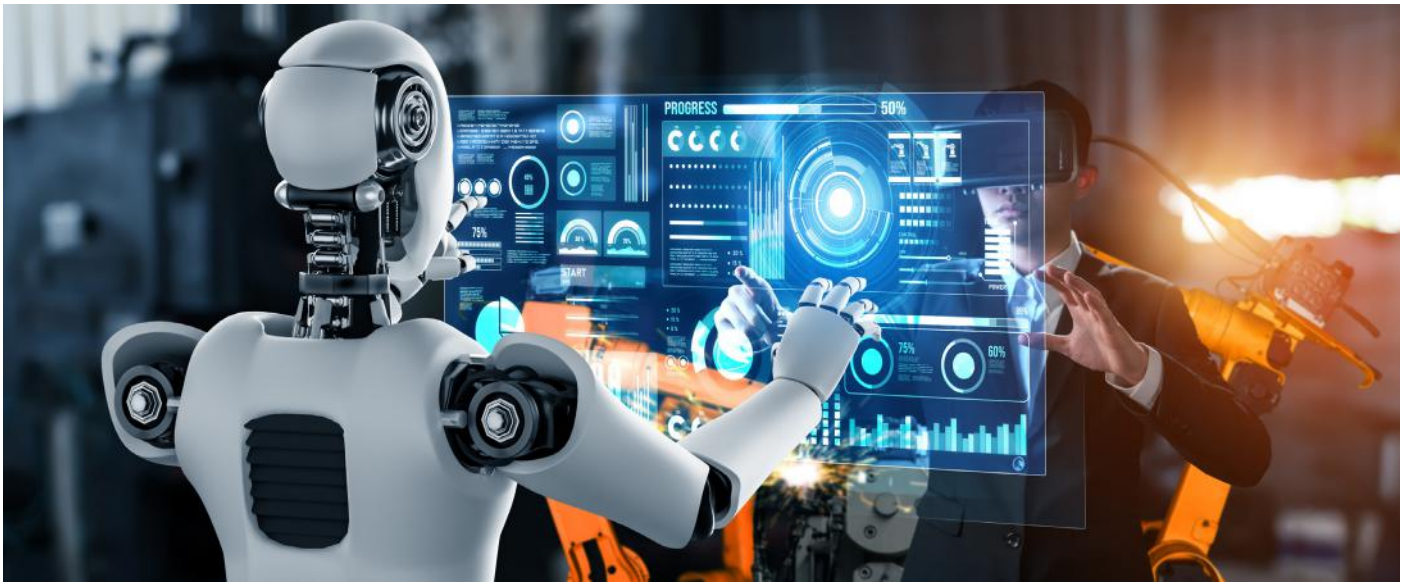
Cylindrical Grinding Automation: The Next Big Step for Indian Gear Manufacturers

- By Vivek Singh



Currently, 91% of Indian businesses recognise the urgent need for digitisation, with consistency and quality control cited as the main motivators. Although many Indian SME gear manufacturers are currently investing in automation and measurement technology, the budget remains below 10%.

The consequences of these errors are costly. A top gearbox manufacturer estimated that 15% of rework occurs as a result of manual inspection limitations and uneven gear quality. A significant part of this can be due to finish variability, with cylindrical grinding acting as the primary last line of defence.

In wind, automotive, EV, and aerospace gears, micron-level variations can cause noise, short lifecycles, or expensive failures. failures. With global benchmarks tightening and skilled labour shrinking, automation in grinding via in-process gauging, auto-compensation, CNC, and closed-loop systems is no longer optional but essential.

Automation Delivers Repeatable Accuracy in Gear Grinding

Indian gear shops are changing as a result of the shift to Industry 4.0. IMTMA says that OEM demands for increased repeatability and tolerances have led to about 60% of machine tool users in India already exploring digital and smart manufacturing upgrades. Gears with ±2–3 micron uniformity across batches are expected by international customers, but this is difficult to achieve with operator-dependent methods.

The difficulties on the shop floor are obvious: relying on highly skilled grinders is no longer feasible due to the industry's shrinking skilled talent and labour, manual gauging adds unpredictability, and inspection loops slow down output.

Automation handles these issues head-on. With in-process measuring and CNC-driven repairs, faults are detected in real time, eliminating the costly rework loop. Automation is more than just a driver of efficiency for Indian gear makers trying to balance cost demands with global quality criteria; it is the foundation of repeatable precision at scale.

In-Process Gauging: Real-Time Accuracy

In-process gauging gives the machine constant feedback by monitoring workpiece measurements while grinding using touch or non-contact sensors. It is proven to be quite useful for controlling factors like thermal expansion on gear shafts during longer cycles that are usually missed by routine inspections. When you do away with human checks and trial grinding, it guarantees that bore sizes and ODs remain consistent throughout high-volume runs.

These gauges have already been integrated into CNC cylindrical grinders by Tier-1 Indian carmakers, providing micron-level accuracy with little operator

involvement. Faster cycles, lower rejection rates, and repeatability, all of which manual inspection just cannot provide, are the ultimate results.

Benefits:

- Detects thermal expansion effects on gear shafts.
- Eliminates trial-grinding and manual measurement steps.
- Ensures consistent bore diameters and OD in high-volume runs.

Auto-Compensation Systems

For many years, the ability of skilled operators to "feel" adjustments in the process was the main tool of cylindrical grinding in India. But the model breaks down when tolerance windows get smaller. When deviations occur, auto-compensation modifies wheel feed by using precise, sensor-driven corrections in place of subjective human input. This lowers the learning curve for beginner operators and keeps tolerances below ±2 microns. Auto-compensation, which makes consistency the responsibility of the machine rather than the human, is becoming a game-changer in clusters like Pune and Rajkot, where suppliers serve export markets.

CNC Advancements in Cylindrical Grinding

For many years, the ability of skilled operators to "feel" adjustments in the process was the main tool of cylindrical grinding in India. But the model breaks down when tolerance windows get smaller. When deviations occur, auto-compensation modifies wheel feed by using precise, sensor-driven corrections in place of subjective human input. This lowers the learning curve for beginner operators and keeps tolerances below ±2 microns. Auto-compensation, which makes consistency the responsibility of the machine rather than the human, is becoming a game-changer in clusters like Pune and Rajkot, where suppliers serve export markets.

Closed-Loop Quality Assurance

Every gear manufacturing line was slowed by the inspection bottleneck that was created by sending gears from the grinder to the CMM lab and back again if they weren't up to standard. By feeding CMM or in-machine data straight into the CNC, closed-loop grinding systems close the loop and allow rapid, automated repairs. This minor change has increased first-pass output and freed up capacity for Indian OEM suppliers by reducing inspection-to-correction times by 30–40%. Connecting grinders to MES/ERP systems for predictive quality control across the entire factory presents the true opportunity. Gear plants will integrate quality control into the production flow by preparing for deviations rather than responding to them.

Indian Gear Industry Context

Despite decades of machining experience in clusters like Pune, Chennai, and Rajkot, there is a significant amount of manual intervention and a dispersed use of gauging, auto-compensation, and CNC automation. The industry is also evolving: export contracts demand more stringent PPAP compliance, while EV drivetrains demand gears with tighter tolerances and almost zero noise. Local machine tool manufacturers are beginning to provide retrofit automation kits, which enable legacy grinders to meet these new performance requirements without necessitating a complete machine replacement. Government initiatives like PLI and Make in India are also encouraging businesses to modernise. The gap between current capabilities and expectations around the world is evident, but so is the path forward.

Roadmap for Smart Upgrades in Indian Gear Grinding

A phased adoption strategy could work just optimally for the Indian gear shops. It will ensure operational continuity and return on investment:

- Accuracy gains can be achieved immediately by retrofitting gauging and auto-compensation to cylindrical grinders that are already in use.
- Incorporating CNC adaptive controls for load monitoring, optimised spark-out, and multi-axis precision.
- Putting in place complete closed-loop quality systems that link ERP/MES and in-process measurement to enable predictive corrections.

Reduced scrap rates, less reliance on staff, higher throughput, and a quicker time to market are just a few of the obvious advantages. Even little improvements can raise a shop's output to global standards, positioning it for both domestic EV demand and export potential.

Conclusion

Operator proficiency alone is no longer enough and shouldn't be a scale of precision in today's gear world. Automation reduces production cycles, removes rework, and offers repeatable quality at scale, from closed-loop control to in-process measuring. Adopting cylindrical grinding automation is more than just a technological update for Indian gear shops searching for global supply chains; it is a strategic necessity. Modernisation has improved a company's ability to meet OEM requirements, compete with global rivals, and prepare for the expanding needs of the EV, aerospace, and renewable energy sectors.

EMO 2025 is pushing AI and Automation for Greater Competitiveness in the Global Industry

The whole world of metalworking – for five days, Hannover was the venue for EMO, the world's leading trade fair for production technology. Attracting a number of 80,000 trade visitors from all over the world, the exhibition grounds provided important innovative impulses for greater competitiveness in the industry. The main focus was above all on the topics of automation and artificial intelligence, which have once again found their way into industrial processes as drivers of production efficiency. Technology, information, exchange, international networking, and cooperation – this is what EMO has embodied for 50 years. More than 1,600 exhibitors from 45 countries and a diverse supporting program presented a host of solutions for modernizing and upgrading production.

"There is a profusion of smart and impressive technical solutions. This EMO has convincingly demonstrated that," says Carl Martin Welcker, General Commissioner of EMO 2025. "For them to be effective, the booster engine of investment now really needs to fire. Many projects are in the pipeline after three years of investment restraint, but the uncertainty in the political sphere continues to put the brakes on investment," Welcker continues.

Confidence is already picking up abroad, particularly outside Europe. In the visitor survey, two thirds of visitors from there state that they intend to invest. In Germany, the figure is less than half. This is reflected by the current trend in foreign orders placed with the German machine tool industry, which increased by 6 percent in the first seven months of 2025 compared to the same period of the previous year. Demand from Germany fell by 22 percent over the same period. Nevertheless, EMO exhibitors are reporting sales. Norbert Teeuwen, Managing Director of Okuma Europe says: "Open Possibilities – that is precisely what connects EMO and Okuma. Our appearance at the exhibition was a complete success – among plenty of sales, we even sold three exhibition machines directly off the booth to our customers. For us, EMO is always a highlight. Thank you!"

Automation is a hot topic in the industry

The big topic in the industry is automation. This is driven by costs and a shortage of skilled workers. 50 percent of the visitors surveyed are interested in how they can use automation to boost their productivity. "Automation is everywhere here and is going to make a big difference", says Aaron Morrill, CNC mechanic from the USA. The importance of the use of robots is growing, as numerous robot manufacturers have impressively demonstrated at EMO. Ralf Winkelmann, CEO of Fanuc Europe, says: "We also see that robots will become increasingly important in the machine tool industry. Industrial robots will coexist with human operators. In the future, they will provide the most efficient solutions."

Interfaces to digitalization and sustainability

More than a third of the trade visitors want to learn about new aspects of digitalization and AI. "We see added volume in processes where all the possibilities for processing data from sensors are utilised. AI is useful

for this and improves quality in the factory", says Jan Otoupakik, CEO 4dot Mechatronics, a startup from the Czech Republic. This was also reflected in the popularity of the P.O.P Talks, which were held daily at the central innovation stage, and highlighted numerous aspects of AI in production.

Automation, digitalization, and artificial intelligence ensure higher productivity, efficiency and quality. This also increases sustainability in production, for example by promoting efficiency in energy and materials. Sustainability is an important factor in research and among talented young people. "We are working on various solutions. One very important example is to reduce the energy consumption of production systems, for example by reducing the coolant flow so that only as much coolant as necessary is used, rather than as much as possible. That was the strategy in the past. This allows us to save up to 95 per cent of the pump energy, electrical energy and up to 60 per cent of the total energy consumption of the production system. So, this is a big step forward," says Professor Berend Denkena from the Leibniz University Hannover.

Top platform for international managers

Once again, EMO has proven to be a top platform for managers and buyers. In the visitor survey, more than half of the respondents stated that they were top or middle managers. They also have the authority to make procurement decisions.

Overall, 94 percent of visitors felt their objectives for the visit had been achieved. 98 percent rated EMO between satisfactory and very good. This is also reflected in the verdict of the exhibitors. Irene Bader, Board Member at the German-Japanese company DMG Mori, puts it in a nutshell: "What we presented at EMO in 2025 is a glimpse into the future of production. Our customers' enthusiasm and their valuable feedback have once again shown us how important face-to-face exchange is for real innovation. For five days, EMO was a global meeting place for ideas, partnerships, and new perspectives." And German Wankmiller, Chairman of the Board of Management of Grob-Werke, adds: "Overall, we are satisfied with how this year's EMO went, and we've been positively surprised considering the currently challenging market situation. The number of visitors and the quality of the discussions have also been consistently positive and have given us important ideas to follow up over the coming months."

"Once again, it has proven possible to attract international market leaders in metalworking to EMO and address the new topics in industrial production," concludes Dr. Markus Heering, Executive Director of the EMO organizer, the VDW. "As a result, it has consolidated its position as the world's leading trade fair and barometer of trends," he summarizes.

EMO 2027 will take place from October 4 to 8 in Milan, Italy.

Additive Manufacturing For Gears: When It's Ready And When It's Not

- By Sudhanshu Nayak

The gear: one of the oldest mechanical components still in use, remains the backbone of motion transmission across nearly every industry. Whether in automotive drivetrains, aircraft gearboxes, robotics, or wind turbines, gears continue to define the efficiency and reliability of power transfer systems. For more than a century, gear manufacturing has been the realm of precision subtractive processes such as hobbing, shaping, grinding, and honing. These processes, refined through decades of experience, deliver micrometer-level accuracy and surfaces smooth enough to sustain hydrodynamic lubrication under extreme loads.

Now, additive manufacturing (AM), commonly referred to as 3D printing, has entered this space, promising new possibilities: near-net-shape fabrication, design freedom, topology optimisation, material efficiency, and rapid iteration. Yet the question remains: is additive manufacturing truly ready for production gears? The answer, as modern research and industrial practice suggest, lies somewhere between "partially" and "conditionally." AM is ready for certain gear applications when combined with hybrid post-processing workflows, but not yet ready for high-volume, high-performance transmission gears without significant finishing and validation.

Understanding the Gearmaker's Benchmark

Before assessing AM's readiness, it's important to recall the demanding performance envelope of conventional gears. High-quality gears typically conform to AGMA or ISO Grade 6-8 accuracy, requiring lead and profile deviations below ±5–10 µm, and surface roughness

values (Ra) under 0.2 µm on the flanks after grinding or super finishing. Mechanically, gears are designed to resist contact stresses of 1000-2000 MPa and bending stresses at the tooth root exceeding 400–800 MPa, depending on material and heat treatment. Any deviation in geometry or surface integrity can alter load distribution, initiate premature pitting, or amplify noise and vibration.

Traditional manufacturing methods like hobbing and grinding inherently achieve these precision levels due to stable material microstructures, controlled residual stresses, and predictable machining behaviour. Additive manufacturing, however, introduces new variables layer-by-layer anisotropy, porosity, surface roughness, and thermal distortion that challenge these established quality standards.

Additive Manufacturing Processes for Gears

Several AM processes are relevant to gear manufacturing, each with its distinct strengths and limitations. For polymer gears, technologies like Fused Deposition Modeling (FDM), Selective Laser Sintering (SLS), and Multi Jet Fusion (MJF) are widely used for rapid prototyping and functional testing. These methods allow designers to verify gear geometry, fitment, and assembly kinematics within hours, using materials such as PA12, PEEK, or carbon-fibre-reinforced composites. However, their mechanical and tribological properties limit their use to low-load, low-speed applications such as robotic end-effectors, medical devices, or instrumentation drives.

For metal gears, the primary AM technologies include Laser Powder Bed Fusion (LPBF) also known as Direct Metal Laser Sintering (DMLS), Directed Energy Deposition (DED), and Binder Jetting followed by sintering. LPBF and DED enable near-net-shape fabrication using alloys such as 17-4PH, 316L, Ti-6Al-4V, and maraging steel. These materials can achieve tensile strengths comparable to wrought counterparts after proper heat treatment, but they exhibit unique challenges: internal porosity (0.1-1%), as-built surface roughness typically between 6-12 µm Ra, and microstructural anisotropy due to directional solidification. Binder jetting, on the other hand, offers higher throughput but demands precise sintering control to avoid distortion and achieve full density.

Hybrid Manufacturing: The Practical Middle Ground

Given the inherent limitations of AM in producing precision functional surfaces, hybrid manufacturing workflows have emerged as the most viable path for functional gears. In such workflows, the gear is additively built to near-net shape, retaining complex internal geometries or lightweight features, followed by conventional machining or grinding to achieve final dimensional accuracy and surface finish.

A typical process chain involves AM Stress-relief or HIP (Hot Isostatic Pressing) CNC Machining Gear Grinding or Honing Surface Finishing (e.g., shot peening, isotropic polishing) Inspection. This integration bridges the flexibility of additive manufacturing with the repeatability and precision of subtractive processes. By intentionally designing machining allowances of 0.3–0.5 mm on the gear flanks and root, engineers can ensure that the final geometry meets ISO Grade 7 or better, while still benefiting from reduced material waste and lead time.
Modern hybrid machines that combine DED or LPBF deposition heads with multi-axis CNC milling spindles are gaining attention. These systems can deposit a near-net gear blank and immediately finish-machine the critical surfaces in the same setup, minimising distortion and alignment errors. Studies have shown that hybrid-finished maraging steel gears can achieve fatigue strengths approaching 90% of wrought equivalents when properly post-processed and heat treated.

When Additive Manufacturing Is Ready

Despite its constraints, AM has proven ready and even advantageous in several practical gearmaking scenarios.

1. Prototyping and Design Validation:

AM excels in the prototyping stage, where the goal is not durability but geometry and fitment verification. Polymer-based AM enables engineers to iterate gear designs rapidly, conduct interference and assembly checks, and evaluate noise and kinematic characteristics at a fraction of traditional prototyping costs. In many R&D labs, functional polymer gears are used for transient torque or NVH testing, where the emphasis is on dynamics rather than endurance.

2. Low-Load, Low-Speed Functional Applications:

Additive polymer gears made from SLS or MJF PA12 and reinforced composites have demonstrated reliable performance in moderate torque and intermittent duty applications such as robotic joints, laboratory automation, and small electric actuators. These environments value customizability and noise reduction over absolute strength.

3. High-Value, Low-Volume Metal Gears:

In sectors such as aerospace, motorsport, and defence, the equation changes. Here, the cost of precision

finishing is justified by the gains in part consolidation and mass reduction. One well-cited example is the titanium gearbox produced by Rodin Cars for its hypercar program, leveraging metal AM to achieve complex weight-optimised geometries impossible through traditional forging. After HIP and precision grinding, these gears exhibited mechanical performance close to conventionally machined counterparts. Similarly, aerospace manufacturers have explored AM-integrated gear housings where weight reduction and component integration drive adoption.

4. Tooling and Fixtures in Gear Production:

Even when not directly producing gears, AM has found a solid role in tooling for gearmaking. Conformal-cooled mold inserts, alignment jigs, and customised fixturing systems are now routinely printed, improving efficiency and throughput in conventional production lines.

When Additive Manufacturing Is Not Yet Ready

In contrast, certain application domains expose the remaining weaknesses of AM.

1. High-Torque, High-Cycle Transmission Gears:

Automotive main gears and heavy industrial gearboxes demand fatigue resistance under millions of load cycles. Even a small amount of porosity or surface microcracking can drastically reduce bending and contact fatigue life. AM materials, particularly in as-built or lightly machined states, still fall short of the endurance limits of carburized and ground forged steels. Although HIP treatment and surface finishing improve performance, they do so at the expense of cost and cycle time, offsetting AM's primary advantages.

2. Dimensional Accuracy and Surface Integrity:

The as-built tolerance of LPBF components (±50–100 µm) is inadequate for high-quality gears, which often require tooth-to-tooth variation within ±5 µm. Surface roughness, even after mild machining, can lead to poor lubrication film formation, increased wear, and pitting initiation. Post-processing such as grinding, honing, or superfinishing is not optional it is mandatory for load-bearing gear applications.

3. Repeatability and Scaling:

Achieving consistent quality across batches remains difficult due to variations in powder characteristics, layer adhesion, machine calibration, and build orientation. Unlike machined gears whose variability is well-controlled, AM gears can show significant scatter in microstructure and fatigue life even under identical process parameters. This lack of repeatability complicates mass production and certification.

4. Economic Competitiveness:

While AM shortens lead time for prototypes or spares, its cost per part increases sharply with volume. The finishing, inspection, and qualification steps often negate the time savings achieved during printing. Therefore, AM's economic sweet spot lies in specialised, low-volume production far from mainstream automotive gear manufacturing.

Technical Barriers and Ongoing Research

The major engineering hurdles preventing AM from fully replacing conventional gearmaking are largely materials and process-related. Surface roughness remains the primary challenge. Gears rely on elastohydrodynamic lubrication (EHL) regimes, where the oil film thickness is often less than 0.5 µm. When surface irregularities exceed that threshold, asperity contact occurs, promoting micropitting and wear. Even with post-machining, the near-surface porosity of AM parts can disrupt EHL performance under cyclic loading.

Porosity and lack of fusion defects also serve as crack initiation sites under tooth-bending fatigue. Advanced non-destructive techniques such as micro-CT scanning and ultrasonic inspection are now used to characterise and quantify these defects. The introduction of Hot Isostatic Pressing (HIP) has significantly reduced defect density and improved fatigue life, but its cost and long cycle time limit scalability.

Residual stresses introduced during layer-by-layer melting can lead to distortion during heat treatment or finishing. Computational thermal modelling and optimised scan strategies (chessboard or contour scanning) are helping minimise distortion, while in-situ monitoring and feedback control improve process stability.

Build orientation also affects performance: printing gears with the tooth flanks aligned parallel to the build direction minimises surface stair-stepping but can weaken tooth-root strength. Hence, design-for-AM guidelines now emphasise orientation trade-offs and sacrificial machining allowances.

Material science plays an equally critical role. Maraging steel and 17-4PH are currently the preferred alloys for AM gears because they exhibit low distortion after ageing and good printability. However, their fatigue

life still depends heavily on surface integrity and finishing quality. New alloy systems specifically formulated for AM such as cobalt-chromium steels and high-strength tool steels with controlled solidification, are under active investigation.

Design for Additive Gears

Designing gears for AM requires a paradigm shift. Instead of directly replicating conventionally machined geometries, designers must leverage AM's capabilities while compensating for its weaknesses. Tooth-root fillets can be thickened or blended to reduce stress concentration from potential inclusions. Gear blanks can incorporate internal lattice structures for weight reduction or integrated lubrication channels for thermal management. Sacrificial outer layers or ribs may be added to facilitate machining and minimise warpage during heat treatment.

Build orientation, support structures, and machining access must be planned together. The concept of "print-for-finish", printing near-net geometry with intentional material allowances, is now central to hybrid gear design. Combined with simulation-driven optimisation, AM allows engineers to create functionally graded or integrated components where conventional methods are infeasible.

Testing, Validation, and Performance Metrics

To validate AM gears for production use, rigorous testing is essential. Mechanical characterisation typically includes single-tooth bending fatigue tests, pitting endurance tests, and rolling contact fatigue (RCF) assessments under lubricated conditions. Comparative studies have shown that fully finished AM maraging steel gears, after HIP and isotropic superfinishing, can achieve bending fatigue strength between 80–95% of forged reference gears. However, as-built or partially finished AM gears may fall to 50–60% of conventional performance.

Microstructural analysis through optical and scanning electron microscopy helps link defect morphology to crack initiation behaviour. Residual stress measurements via X-ray diffraction (XRD) confirm the effectiveness of stress-relief treatments. Surface metrology, using gear measurement centres, quantifies deviations in lead, profile, and pitch, ensuring conformity with ISO quality grades.

Endurance tests performed on dedicated gear test rigs reveal that AM gears often exhibit higher noise levels and faster wear onset unless ground to fine surface finishes. The combination of HIP, surface polishing, and shot peening remains the most effective route to extend fatigue life.

Industrial Use Cases and Emerging Success Stories

Several organisations are already leveraging AM for gear-related components. In motorsport, where component weight and turnaround speed outweigh cost, AM titanium gears and carriers have been successfully deployed after hybrid finishing. In aerospace, printed planetary carriers and gear housings reduce mass and part count, integrating lubrication passages and mounting features that would require multiple machining operations otherwise.

Research collaborations between universities and OEMs are exploring binder-jet-printed steel gears, followed by full-density sintering and grinding, an approach that shows promise for scaling production. In tooling applications, AM has revolutionised the design of conformal-cooled molds for gear injection, indirectly improving production efficiency and extending mold life. These examples demonstrate that when AM is integrated intelligently within a hybrid manufacturing chain, it can deliver tangible industrial value.

Future Outlook and Conclusion

The trajectory of additive manufacturing for gears is clear: it is not about outright replacement, but integration. AM will not supplant hobbing or grinding for high-volume automotive gears anytime soon; instead, it will complement these processes by enabling what they cannot: complex geometries, integrated assemblies, and rapid iteration. The rise of hybrid systems combining AM deposition, machining, and in-situ metrology represents the most promising evolution in precision gear production.

Future breakthroughs are likely to emerge from three directions: (1) development of AM-specific alloys optimised for fatigue resistance and low defect sensitivity, (2) intelligent monitoring systems that provide real-time quality assurance, and (3) automation of post-processing and finishing to reduce cost. As material databases expand and hybrid workflows mature, AM gears will gradually transition from experimental curiosities to fully qualified components in specialised, high-value systems.

In short, additive manufacturing for gears is ready when it is hybridised, validated, and intelligently applied. It remains not ready for commodity-scale gear production, where speed, cost, and proven reliability dominate. The future of gear making will likely belong to those who understand both the strengths and the boundaries of this technology and can combine them with the century-old precision of conventional engineering.

IMTEX Forming 2026- Asia's Largest Metal Forming Technology Show to Bring Global Industry Leaders to Bengaluru

Asia's largest exhibition on metal forming and manufacturing technologies to feature over 600 exhibitors from 20 countries across 4 exhibition halls, covering a space of 46,000 square metres. exhibition space.

Indian Machine Tool Manufacturers' Association (IMTMA) will organise IMTEX FORMING 2026 from 21 to 25 January 2026 at Bangalore International Exhibition Centre (BIEC), Bengaluru. IMTEX FORMING 2026 will feature the following concurrent events:

- Tooltech, which focuses on machine tool accessories, metrology solutions, CAD / CAM tools, tooling systems, and the latest trends in tooling industry
- Digital Manufacturing, which showcases real-time solutions in additive manufacturing and Industry 4.0Weldexpo, in association with the Indian Institute of Welding (IIW-India) that showcases the latest

welding technologies

- •Moldex India and Fastenex India, organised by Messe Stuttgart, focusing on moulding, fasteners, and fixing technologies respectively, will be co-located alongside IMTEX FORMING 2026

IMTEX FORMING 2026 will also feature parallel events, such as:

- International Seminar on Forming Technology, ninth edition, on 22 – 23 January 2026, to explore new trends, equipment, processes, and technologies in metal forming and related fields
- i2 Academia Square, a platform for research institutions to present their R&D initiatives to industry stakeholders
- Jagruti-IMTMA Youth Programme to raise awareness about the latest advancements in manufacturing among young professionals.

The forthcoming edition will feature exhibitor group participation from Germany, Italy, Japan, and Taiwan, showcasing the latest manufacturing technologies and innovations. Visitors from various sectors, including automotive and auto components, aerospace and defence, medical equipment, power, railway, construction equipment, general and heavy engineering, capital goods, electrical and electronics, white and brown goods, and many others, are anticipated to visit.

"Although metal forming currently accounts for 29% of the Indian machine tool market, the segment is expected to grow measurably in the coming years. In FY25, the consumption of metal forming machine tools was 9,139 crores, while production was valued at 2,696 crores. Overall, metal forming machine tool exports increased by approximately 6% year-on-year. Among the exports, presses led the list, followed by press brakes, bending machines, and shearing machines," said Ms. Mohini Kelkar, President - IMTMA.

"Laser and laser-based applications are finding increasing acceptance across industry sectors and we have seen a steady increase in participation by laser-based manufacturers at IMTEX FORMING. Exhibitors will display fibre laser machines, precision levellers, pick-and-place units, servo presses, machine production monitoring systems, welding and 3D printing solutions. IMTEX FORMING 2026 will accelerate the manufacturing of homegrown products and their exports," said Mr. Jibak Dasgupta, Director General & CEO, IMTMA.
The five-day exhibition is a unique platform to further accelerate the adoption of digital transformation and high productivity solutions in manufacturing.

About IMTMA

Established in 1946, Indian Machine Tool Manufacturers' Association (IMTMA) is the apex industry association for machine tool industry in India. IMTMA has a membership of more than 500 companies from public and private sectors, manufacturing a wide range of metal cutting and metal forming machines, accessories, cutting tools, and other related equipment. IMTMA plays an active role in the growth of the machine tool industry through policy advocacy, exhibitions, knowledge platforms, publications, research reports, training, and skill development. IMTMA has also developed a green exhibition facility called Bangalore International Exhibition Centre for organising exhibitions, conferences, and corporate events.

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Efficient and flexible: KAPP NILES presents new profile grinding machine

- KAPP NILES

High flexibility in a compact design: The new KNG 5P expert profile grinding machine from KAPP NILES is ideal for the precise machining of external and internal gear teeth. As a next-level development of the successful ZE series, it combines the advantages of the previous model with enhanced features. 'The KNG 5P expert can be used for a wide variety of applications and enables efficient work with excellent gear quality,' emphasises KAPP NILES product specialist Boris Maschirow.

Ergonomic handling

The KNG 5P expert is characterised by its outstanding set-up efficiency. To change the diamond dressing tool, the direct-driven dressing spindle swivels into an ergonomic accessible position. Dressing tools can thus be conveniently changed from outside the machine. The optimised tailstock features a stroke of 850 mm and a swivelling-mounted tailstock with An adjustable pressure up to 2,000 N significantly extends the range of applications for clamping between centres.

Wide range of applications

From gear wheels to pinion shafts and worms, the KNG 5P expert can grind a wide variety of workpieces with a face width of up to 670 mm. The powerful grinding spindle is direct driven with speeds of up to 9,500 rpm and drive torque of up to 64 Nm. This allows the use of grinding wheels with diameters ranging from 60 to 350 mm.

The 400 mm diameter rotary table is a direct drive solution and features a deep bore for long shafts. Despite its extremely wide range of applications and sturdy main components, the machine has a small footprint thanks to its compact design.

Additional options

Complex modifications can be produced efficiently and almost twist-free by means of double-flank grinding on the KNG 5P expert, thanks to 5-axis interpolated grinding via an open swivelling axis. For grinding worms, the dressing arm swivels completely out of the working area of the grinding slide, allowing the full stroke of 675 mm to be used.

The machine can be equipped with automatically CNC- CNC-controlled cooling lubricant nozzles. In addition, the KNG 5P expert can be optioned with a loading hatch for automated loading of the machine.

'With the KNG 5P expert, we are consistently continuing our long-standing successful ZE series. In addition to all the advantages of this proven series, the profile grinding machine impresses with additional and new features that offer the user maximum flexibility,' summarises product specialist Boris Maschirow.

About KAPP NILES

KAPP NILES is a globally operating group of companies with high-quality and economical solutions for finishing gears and profiles and is partner for companies from numerous industrial sectors in the mobility, automation and energy segments.

The perfect interaction between machine, tool, technology and metrology enables extremely precise machining to a thousandth millimetre.

Image 1: KAPP NILES presents the new profile grinding machine KNG 5P expert.

Image 2: The KNG 5P expert can be used to grind workpieces with a gear width of up to 670 mm.

Image 3: The directly driven dressing spindle swivels between a working position and a parking position.

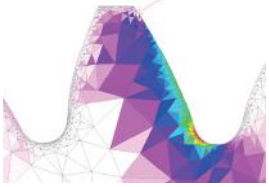
Image 4: The tailstock can be swiveled away and is infinitely adjustable to a tip pressure of up to 2,000 N.

Image 5: The KNG 5P expert can be used to grind worms with pitch angles of up to 45 degrees.

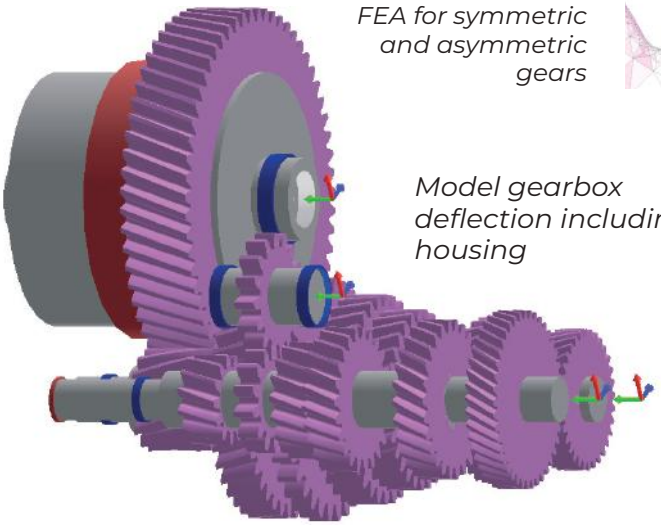
Dontyne

Systems

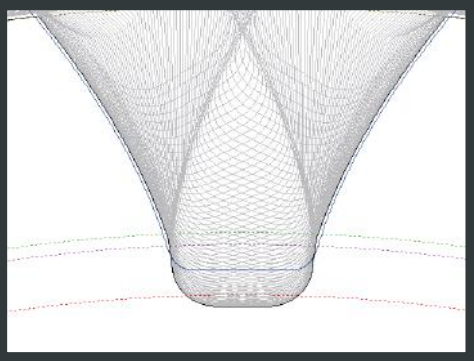
Automatic tool designs and simulations for Hobbing, Continuous Grinding (with dressing),Shaping, Shaving, Profile Grinding, Skiving, Honing, End Mill or Face Mill, Forging, Injection Moulding.



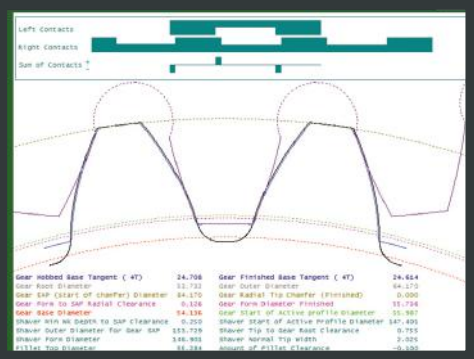
FEA for symmetric and asymmetric gears



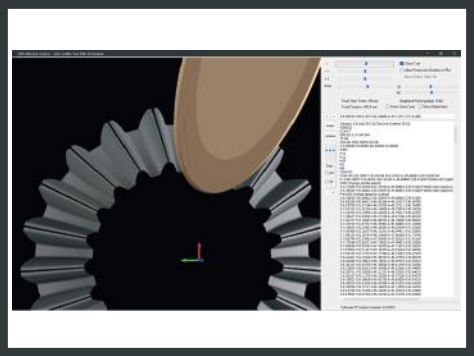
Model gearbox deflection including housing



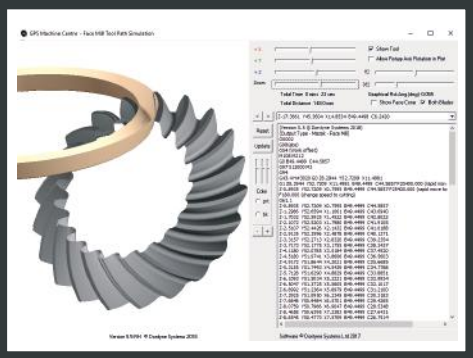
Hob / Grind Roll Out



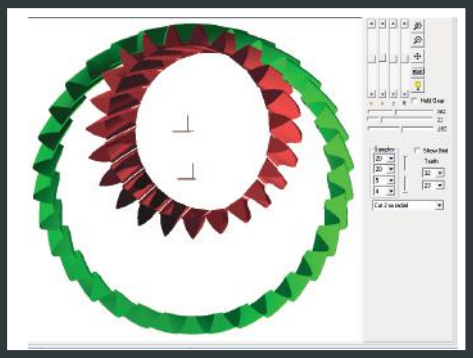
Shaving' and Shaping



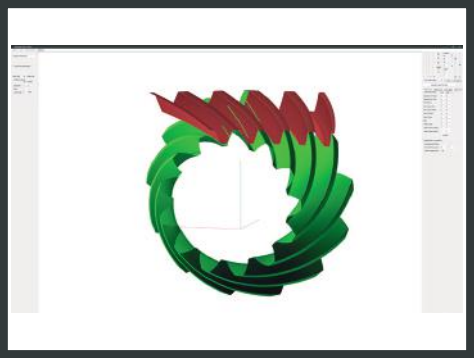
Coniflex CNC



End Mill / Face Mill CNC



Skiving



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Flender Unveils REVO: A Groundbreaking Drive Concept for Wind Turbines

- By Gear Technology India

- Revolutionary torque density: REVO is the first drive concept to reach the benchmark of 300 Nm/kg.
- Lower energy production costs: Wind turbines can be built more compactly and efficiently or deliver greater output without increasing in size.
- Competitive edge by a global setup: Global engineering teams collaborate on a unique technological innovation.

As the global wind turbine market will continue to grow in the coming years, the size and output of turbines—both onshore and offshore—are steadily increasing. Amid ongoing public and political debate about the future of energy supply, manufacturers in the wind sector are striving to enhance the efficiency of their systems and reduce the cost of wind energy. A major milestone in this effort is the introduction of REVO, a new drive concept launched today by German drive specialist Flender under its wind energy brand, Winergy. For the first time, a turbine drive has achieved the coveted threshold of 300 Newton meters per kilogram (Nm/kg) in torque density.

"With REVO, we are setting a new standard in wind power technology," said Andreas Evertz, CEO of the Flender Group. "By increasing torque density, we boost efficiency while reducing material usage—making the wind industry even more
competitive and sustainable."

Efficiency Through Enhanced Torque Density

REVO is a validated design concept that offers 300 Nm/kg for new turbine developments. The result is a significantly more compact drive system. For the same power output, the required outer diameter can be reduced by up to 25 percent. Andreas Klein, Vice President of Drive Systems and Gear Engineering at Flender's wind segment, explains: "Torque density—sometimes also named power density—refers to how much torque a drive can transmit per kilogram of material. It's a key metric for the overall CAPEX of a wind farm."

The compact gearbox design addresses several critical challenges in developing next-generation turbines and offers wide-ranging benefits. Transportation costs are reduced, and drive systems remain road-transportable—even for current and future turbine classes exceeding 8 megawatts. REVO's compactness opens previously inaccessible installation sites, accelerating wind energy deployment.

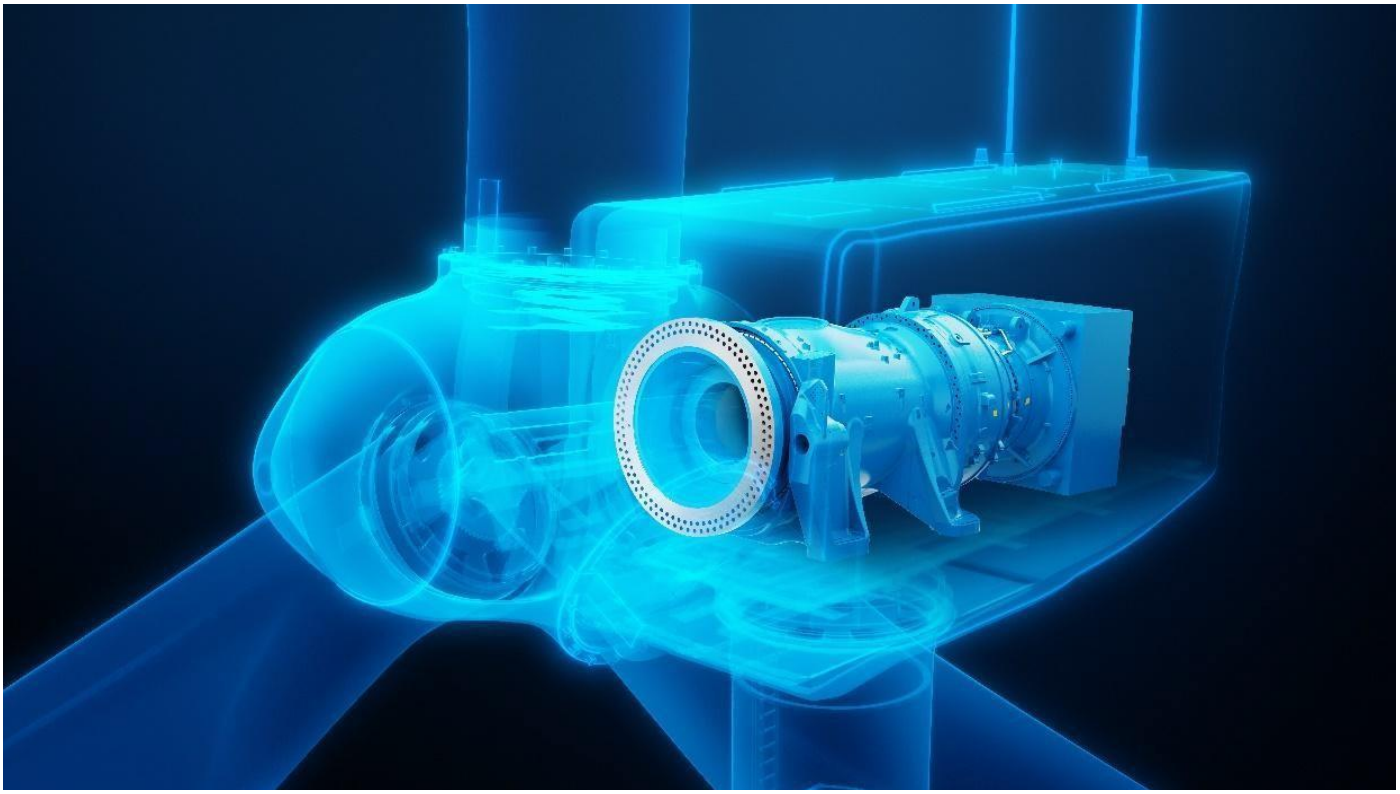
REVO sets new standards with a torque density of 300Nm/kg.

Reduced material usage also enables smaller, lighter nacelles and lowers the mass at the top of the tower. This, in turn, allows for cost savings in tower and foundation construction. Compared to gearboxes of the same power class in 2010, REVO enables a 70 percent reduction in CO emissions thanks to its efficient use of materials. Additionally, the use of low noise journal bearings ensures compliance with European noise emission regulations and increases reliability.

A Collaborative Effort of a Global Team

REVO is the product of Flender's global setup and strong engineering capabilities. Flender creates a competitive edge by utilizing the close collaboration within its global engineering team. By advancing existing technological trends and introducing new gear materials, the team has created a unique prototype. Key element of this design is the unique combination of new technologies, that result in an unprecedented torque density. These include an optimized combination of planetary stages and gears per stage, as well as space-saving, noise-reducing second- generation journal bearings. Enhanced gear materials and induction hardening further improve drive reliability. Validated through extensive testing, REVO sets a new benchmark for torque density and represents a new generation of wind turbine technology.

"In recent years, we've already managed to



The compact design reduces the design space required for the nacelle and thus the tower head mass of the turbine.

double the torque density of our drives," said Tommy Rahbek Nielsen, President of Winergy. "With REVO and the achievement of the 300 Nm/kg mark, we're unlocking even more possibilities for our customers—greater output in the same footprint, or more compact components without sacrificing performance and reliability. Together, we select the optimal technology package for each project."

First Presentation at Winergy in Voerde

After the extensive validation and testing phase, the REVO design concept is currently on display at the Winergy facility in Voerde, Germany. "Its compactness compared to previous drive systems is striking," said Tommy Rahbek Nielsen. "The prototype is intended to inspire conversations with our customers as we work together to develop the best drive solutions for new projects. Our shared goal is to make wind energy as efficient and cost-effective as possible."

"With REVO, we offer a solution tailored to the demands of today's and tomorrow's wind energy projects," added Flender CEO Andreas Evertz. "We're proud to present this innovation—a step forward in securing the future of energy supply."

Second-generation journal bearings are part of the technology package.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