

MOTOR MANUFACTURING METHODS

Join Us LIVE, ON-LINE: August 18-20, 2020

Live Interactive Classroom experience by

Please Note: All Training courses are postponed until at least September 2021

The only course of this kind available anywhere!
Learn practical understanding & essential concepts of motor manufacturing methods.

- ◆ Overview of Motor Components and their Manufacture
- ◆ Lamination Options & Assembly Techniques
- ◆ Coil Options & Inserting Techniques
- ◆ Low & High Volume Manufacturing Processes, CAPEX
- ◆ Difference in Rotor Fabrication Among Motor Types
- ◆ Handling Parts, Sub-Assemblies, Final Assemblies, & Test
- ◆ Optional Accessories & Features, Finishing Touches



Objectives and Benefits:

This course provides a foundation of technical and practical principles used for electric motor and generator component manufacturing, assembly, and testing. The purpose of this one-of-a-kind course is to provide understanding of methods and choices for electric motor manufacturing, with attention to effect of design choices on cost, performance and reliability.

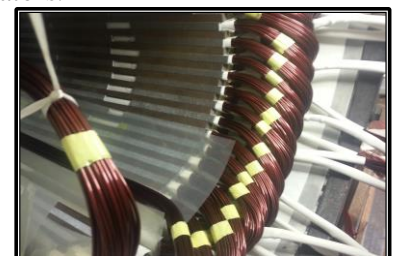
The focus is on topics important to managers, engineers, and production staff associated with motor engineering, manufacturing engineering & production of electric motors and generators. This unique information is also important to sales engineers, technical purchasers, customer service staff, and users of electric motors.

Your expert instructor will help you understand the technology of electric motors and then describe the many manufacturing methods options and tasks considering design requirements, materials, and tolerance issues. A heavy dose of what is practical and cost-effective is used throughout the course. Instruction assumes no formal technical education.

This acclaimed course uses a real-world, common sense attitude to help demonstrate how key choices affect the motor in terms of performance, quality and value delivered to the customer. Primary focus will be on integral horsepower Permanent Magnet motors and NEMA-frame squirrel-cage Induction machines, including both random-wound and form-wound configurations. Other motor types will be discussed to illustrate their unique features and benefits. Most of the material is on topics and issues common to all motors, as well as most generators.

Those who will benefit:

- ◆ Electrical, Mechanical, and Manufacturing Engineers & Managers
- ◆ Production, Assembly, Test Technicians for Electric Motors
- ◆ Application Engineers for Motor Manufacturers, OEMs & Distributors
- ◆ Sales, Marketing & Customer Service Personnel at All Levels
- ◆ Facility Engineers, Users, & Purchasers of Electric Motors
- ◆ Manufacturing Equipment Sales Staff and Engineers



Course Schedule (All times are Eastern Time Zone, USA)

Day 1:

9:45-10:10 On-Line Entry; AV check
10:15 Sessions Begin

1. Overview of Motors, their Components & Functions

- Motor types:-What is same & different
- Key components and their functions
- Manufacturing issues, operation effects
- Stator parts & some variations
- Rotor parts & many variations
- Major subassemblies
- Full motor assembly
- Importance of NEMA-MG1, IEC

2. Laminations

- Electrical steel materials
- Lamination dimensions & tolerances
- Segmented and hinged laminations
- Punching laminations
- Laser cutting laminations
- Coating & annealing, storage

3. Housing

- Housing types and materials
- Key housing features, tolerances
- Housing fabrication & machining
- Importance of feet tolerances
- Miscellaneous: fan, fan cover, terminal box, bearing caps, baffles

4. Endbells

- Endbell types and materials
- Key endbell features, tolerances
- Endbell fabrication & machining
- Importance of mounting face
- Miscellaneous: oil and grease ports, fan cover bolt-holes, bearing insulation

5. Shafts

- Common shaft designs, materials
- Key shaft features, tolerances
- Providing for rotor core attachment
- Shaft machining
- Adding special features to shafts

6. Bearings

- Common bearing types
- Why so many bearings?
- Key bearing features, tolerances
- Provisions for lubrication, service

18:00 Sessions End

Please Note:

Daily schedule includes:

- Three AM & Three PM sessions, approximately 1 hour, each
- 10 minute breaks between sessions
- 30 minute Lunch Break

Day 2:

9:45-10:10 On-Line Entry; AV check
10:15 Sessions Begin

7. Coil Insulation components

- Slot cell liner, powder coat
- Wedges, topsticks, sleeving
- Slot cell divider, mid-sticks
- Phase separator for end-turns
- Mica & cloth tapes
- Surge rope, blocking, lace

8. Random-wound Coils

- Round wire & coils for motors
- Key random winding coil features
- Common methods to manufacture coils
- Random coil manufacturing—lap coils
- Random coil manufacturing—concentric & concentrated coils
- In-slot winding methods

9. Form-wound Coils

- Types of wires & coils for motors
- Construction of form coils
- Form coil manufacturing
- Bobbin and field coil winding
- Hair-Pin coils

10. Stator & Rotor Core Stack

- Stacking methods, important issues
- Aligning the core slots
- Clamping methods and effects
- Bonding cores, pro's and con's
- Options for PM rotors cores
- Some post-assembly options
- Making individual stack, poles

11. Coil Insertion & Connections

- Effect of slot fill on manufacturing
- Inserting slot liners
- Methods for Inserting Coils
- Inserting wedges, likely problems
- Phase separator at endturns
- Connections, lead wires
- Bench test of winding assembly
- Lacing and shaping

12. Winding Resin Process

- Key functions of impregnation
- Impregnation methods, pro's & con's
- Compatibility of materials
- Choice of resins, effect on process
- No resin at all? Bondable wire
- Encapsulation or overmold
- Getting Stator into housing, fixing it

18:00 Sessions End

**Session breaks will not be coincident with topic breaks*

**Course content is subject to change.*

All issued material may not be covered

Day 3:

9:45-10:10 On-Line Entry; AV check
10:15 Sessions Begin

13. Rotor SubAssembly

- Construction concepts, features
- Methods of making cage rotors
- Performance issues of mfg process
- Methods of making rotors with coils
- Getting rotor onto shaft, fixing it
- Shaft fans, accessories
- Dynamic balance principles

14. Rotor Magnets & Installing

- Magnets types & coatings
- Placing/inserting magnets
- Fixing in place, more than adhesive?
- Retention methods, pro's & con's
- 'Charged magnet' assembly safety

15. Motor Assembly

- Getting rotor in stator without damage
- Attaching endbells, bearing caps
- Fastener choices; torques, adhesives
- Lifting eyebolts, safety in handling
- Nameplates & connection diagrams
- Box labels: What they care about
- Installation & operating manuals
- Terminals marking
- Accessories: thermals, space heaters, resolvers

16. Motor Testing

- In-process testing
- Full dynamometer testing
- Efficiency testing
- Commercial test
- Large motor testing
- Environmental qualification testing
- The "Acceptance Test Procedure"

17. Other Motor Manufacturing

- High speed motors
- High voltage motors
- Axial flux motors
- EV/HEV motors
- Reluctance motors
- Wind generators
- Liquid cooled motors

16:00 Closing & Adjourn

Onsite training is available!
Send inquiries to
sales@advancedmotortech.com

Instructor:



Dr. Keith W. Klontz is President and CEO of Advanced MotorTech LLC, an engineering services company with emphasis on electric machine design. He holds BS & MS degrees in Electrical Engineering from the University of Illinois, Champaign-Urbana, and a PhD in Electrical Engineering from the University of Wisconsin-Madison. Dr. Klontz is a world-recognized expert and instructor in electric machine design and has over 50 years of hands-on experience with electric machine applications and design engineering, from concept to performance to repair and failure analysis. He has been involved in the research, development, prototyping, testing and training of very high performance machines from 10 Watts to 50 MW, with speeds ranging from angle positioning torque-motors to 90,000 rpm machines. Recent work includes design of very high efficiency PM and induction motors, very high power density machines, permanent magnet alternators, brushless d.c. traction motors, and low cost manufacturing.

Registration Fee Include:

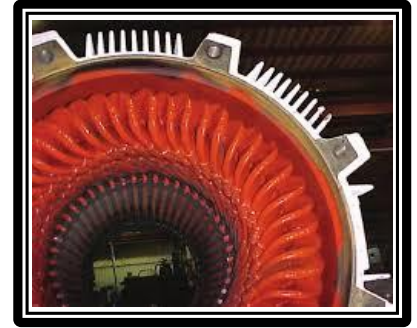
- Extensive 400+ page Training Manual (Full Color), materials shipped about 2-3 weeks before the course starts
- Access to the Live HD Broadcast, with two-way live interaction capability
- Hardcover Book "Mechanical Design of Electric Motors" by Dr. Wei Tong
- Signed Certificate of Course Completion

Broadcast Information:

Hours: Live 9:45am to 18:15pm, Eastern Time Zone USA

Type: Classroom Setting; Live Instructor at Large-View Screen (Not voice-over-slides)
(Just like a live classroom, session recordings will not be available for later viewing)

Platform: Custom 1080p WEBEX; Entry Credentials with Password Required



To Attend This Course:

- We will send a WEBEX Link and Entry credentials; please confirm receipt
- Recommended connection & bandwidth: Ethernet, 50MBs download (5 MBs minimum); Wireless quality is not assured
- Recommended viewing: 15 inch or larger monitor, (1280x800 minimum; viewing ability, streaming quality, and compatibility with mobile devices, smaller screens and lower resolution, cannot be assured)
- For now, we can accept only attendees located in: North America, UK/Europe, Japan, Korea, Australia, New Zealand
(Exceptions are not likely but possible, on a case-by-case only, at our sole discretion)

***Enrollment:** Yes! Please enroll me in the 3-day course: Course No. MMM-2008

Motor Manufacturing Methods – August 18-20, 2020

Fee: \$2125.00 for USA shipping addresses

\$2325.00 for all International shipping addresses

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Early Registration Discount!

Payment by July 15, 2020

Early Registration Fee†: \$1975.00 for USA shipping address

\$2175.00 for International shipping addresses

(We reserve the right to not enroll anyone, for any reason, at our sole discretion.)

Payment (USD\$ only): (Payment Deadline: Payment must be received 2 weeks before the course; Early Registration payment deadline extended, must be received by July 15, 2020, no exceptions; †Invoiced and †PO payments not eligible for early discount)

MasterCard VISA AMEX

▪ Cardholder Name _____

▪ Card No. _____

▪ Exp ____/____ Billing Zip _____ Security Code: _____

Check (payable to **Advanced MotorTech, LLC**); †Invoice me; †Purchase Order; *Subject to approved credit.*

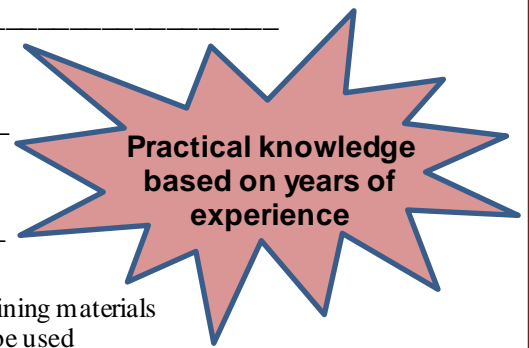
Name _____ Title _____

Company _____

Shipping Address _____

City _____ State _____ Zip _____

Phone () _____ Email _____



*By registering for our course, you agree:

- (1) To provide us a verifiable address with this enrollment for trackable shipment of training materials
Sorry, a PO Box is not acceptable for this; Delivery without signature required will be used
- (2) To not allow any unpaid individuals to view any of the training content with intent to learn from our broadcast
- (3) To screen-capture only handwritten white-board/flipchart writing, and visual samples shown.
- (4) With exception of (3) screen-captures, to not allow any recording of the broadcast without permission in writing and prior payment of a recording fee. All training material and broadcast content is copyright protected.
- (5) To not hold us responsible for poor connection, poor audio, or poor visual quality due to issues with your hardware, software, ISP, or facility. (If in doubt, please contact us in advance for an Audio/Visual check.)

Cancellations made more than 14 days before the course starts AND before shipment of the training materials, are subject to a 15% cancellation fee.
Cancellations made 14 days or less before the course starts, OR after shipment of training materials are subject to a 50% cancellation fee.

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