



# brainfiller®

Your International Source for  
Electrical Power Training

## Motors – Design, Application and Analysis

2 Days

1.6 CEUs



This 2 Day class shows you the fundamentals of motor operation and selection as well as how to design motor circuits. Learn concepts such as speed, slip NEMA Design and efficiency. Understand the basics of variable frequency drive application. See how to model various motor parameters for determining a motor's effect on the power distribution system including voltage flicker, harmonics and torque speed analysis.

### What you ***WILL*** receive:

- Training manuals containing over 300 pages
- Many design and application example problems
- Power system analysis of motors and starting
- Technical articles
- Protection of motors and motor circuits
- 16 hours of Continuing Education Credit



### What you ***WILL NOT*** receive:

- A commercial to sell you products or equipment
- A sales pitch to sell engineering study services
- A class that is just an overview or teaser

### What is so special about Jim Phillips' Power System Class?

Jim is not only one of the most popular and sought after instructors in the industry, he is also directly involved with the development of industry standards and practices. He is a member of the IEEE working group that develops *IEEE Std. 1584<sup>tm</sup>, IEEE Guide for Performing Arc Flash Hazard Calculations*. With a career spanning 30 years and having taught over 2000 training programs to people from all seven continents, Jim draws from his vast experience in the industrial, commercial and utility fields.



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## **Course Agenda**

### **Motors – Design, Application and Analysis**

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#### **DAY ONE**

##### **TYPES OF MOTORS**

Induction, Synchronous, Salient Pole, Wound Rotor

##### **MOTOR FUNDAMENTALS**

Motor Characteristics, Synchronous and Asynchronous Speed, Slip, Horsepower Ratings, NEMA Design, Motor Efficiency, Voltage Ratings, FLA and LRA Ratings

##### **NEC<sup>®</sup> REQUIREMENTS**

NEC<sup>®</sup> Article 430 Requirements, Nameplate Information, Short Circuit Protection, Overload Selection, Conductor Selection, Service Factor, Sizing Circuits for Multiple Motors

##### **DUTY CYCLES**

Duty Cycle Ratings, Sizing Motors for Varying Duty Cycle

##### **MOTOR STARTING**

Starter Sizes, Reduced Voltage Starting, Motor Starting Time Current Curves, Torque Speed Acceleration Curves

##### **MOTORS AND POWER FACTOR**

Reactive Power Requirements, Sizing Power Factor Correction Capacitors for Motor Circuits

##### **VARIABLE FREQUENCY DRIVES**

Torque Requirements, Load Characteristics, Vector Drives, V/F Control, PWM Drives, Sizing Requirements, Other Technical Considerations, PWM and Reflected Voltage





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## **Course Agenda**

### **Motors – Design, Application and Analysis**

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#### **DAY TWO**

##### **POWER SYSTEM ANALYSIS OF MOTORS**

Thevenin Equivalent Circuits, RLC Circuits, Series and Parallel Circuits, Wye Delta Conversions

##### **SOURCE MODELING AND STRENGTH**

Effect of Source Strength on Motor Starting and Operation, Per Phase Analysis, Short Circuit Considerations, Motor Contribution, Rotating Machine Subtransient Reactance, Motor Circuit Analysis Models, Rotor and Stator Impedances

##### **PER UNIT MODELING OF MOTORS**

Base Quantities, Per Unit Examples, Per Unit Worksheets, Developing Impedance Diagrams for Problem Solving, Induction Machine Modeling

##### **MOTOR MODELING**

Motor Starting and Voltage Drop, Voltage Flicker, Flicker Curve Interpretation, Impact of Source Impedance and Motor Size on Voltage Flicker

##### **HARMONIC CONSIDERATIONS**

Drives and Non Linear Loads, Constant Current Source Model, Harmonic Simulations, Capacitors and Resonance, Total Harmonic Distortion Calculations, IEEE 519 Limits, Point of Common Coupling, Relationship of Load vs. Source Strength in Determining Limits





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## **On Site Training Have This Course at Your Location!**

Hold this class at your location for a greater savings. For an all inclusive fee you receive the following for each attendee:

### **What you *WILL* receive:**

- Training manuals containing over 300 pages
- Many design and application example problems
- Power system analysis of motors and starting
- Technical articles
- Protection of motors and motor circuits
- 16 hours of Continuing Education Credit

**Call Brenda at 800-874-8883 or  
e-mail at: [brenda@brainfiller.com](mailto:brenda@brainfiller.com)  
for an On-Site Training Proposal!**

**Plan Ahead - Jim's schedule usually  
fills up months in advance!**





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## Jim Phillips, P.E.

Member of IEEE 1584 *IEEE Guide for Performing Arc Flash Hazard Calculations*

Vice - Chairman of Task Group - *IEEE 1584.1 Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation.*

Member of IEC 61482-1-2 Determination of arc protection class of material and clothing by using a constrained and directed arc (box test)

Author of the book: *Complete Guide to Arc Flash Hazard Calculation Studies*

Is a regular contributor to Electrical Contractor

Founder of the internationally known website: [www.ArcFlashForum.com](http://www.ArcFlashForum.com)

For 30 years, Jim has been helping tens of thousands of people around the world understand electrical power systems design, safety, theory and applications. Having taught over 2000 seminars during his career to people from all seven continents (Yes Antarctica is included!), he has developed a reputation for being one of the best trainers and public speakers in the industry.

Jim does not just talk about arc flash and electrical safety - he is part of the development of the arc flash standards! He is also the instructor that has taught other instructors in the industry. Jim is a member of the IEEE 1584 Committee - *IEEE Guide for Performing Arc Flash Hazard Calculations*. He is Vice-Chairman of the IEEE Task Group - IEEE 1584.1 "Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation study in accordance with IEEE 1584"

Jim literally wrote the book about arc flash studies with his book titled: ***Complete Guide to Arc Flash Hazard Calculation Studies*** available from [brainfiller.com](http://brainfiller.com) and [Amazon.com](http://Amazon.com) He also wrote "How to Perform an Arc Flash Study in 12 Steps" published by NFPA.

In addition to being a regular contributor to Electrical Contractor Magazine, he was one of the main contributors for the NEC Digest. He has authored many articles published in Europe and is a regular speaker at conferences around the world.

Jim earned a BS Degree in Electrical Engineering from the Ohio State University. His career began with Square D Company's Power System Analysis Group where he was responsible for system studies, power system software development and training at their engineering programs.

Later, Jim was in charge of the studies group of the System Protection Section of Ohio Edison Company. He was part of the adjunct faculty for Stark State College where he taught evening classes in electrical power systems.

Jim is a Registered Professional Engineer, with experience that includes everything from planning transmission systems, to design and analysis of industrial, commercial and utility power systems, cogeneration plant design, expert witness and forensic analysis.

Jim continues to travel the globe typically flying over 150,000 miles a year to work with various U.S. and international standards organizations and speak at many conferences and training events.