

Renewable Energy

COMMERCIAL WIND MAINTAINER

On-The-Job Training Guide

LEVEL 3



Good science, good engineering, good technology and good business practices delivered by ethical, well-trained, and motivated people will lead the way to energy independence.

Renewable Energy Career Path Milestones

COMMERCIAL WIND MAINTAINER (CWM)

Level One Apprentice:

- Attend an ETAI-approved school
- Pass the ETAI EM1-DC, EM2-AC written exams
- Pass Level One written exam and hands-on assessment

OR

- OJT with an ETAI-approved employer for a minimum of 12 months
- Pass the ETAI EM1-DC, EM2-AC written exams
- Pass the Level One written exam

Upon completion of the above, submit your Commercial Wind Maintainer OJT JTG package signed-off by your ETAI-approved trainer to ETAI.

Level Two Specialist:

- Hold a Level 1 Commercial Wind Maintainer certification
- OJT with an ETAI-approved employer for a minimum of 18 months
- Pass the Level Two written exam

Upon completion of the above, submit your Commercial Wind Maintainer OJT JTG package signed-off by your ETAI-approved trainer to ETAI.

Level Three Technician:

- Hold a Level 2 Commercial Wind Maintainer certification
- OJT with an ETAI-approved employer for a minimum of 36 months
- Pass the ETAI Level Three exam

Upon completion of the above, submit your Commercial Wind Maintainer OJT JTG package signed-off by your ETAI-approved trainer to ETAI.

	SCALE VALUE	PROFICIENCY CODE KEY
TASK PERFORMANCE LEVELS	1	Can do simple parts of the task. Needs to be told or shown how to do most of the task. (EXTREMELY LIMITED)
	2	Can do most parts of the task. Needs help only on hardest parts. (PARTIALLY PROFICIENT)
	3	Can do all parts of the task. Needs only a spot check of completed work. (COMPETENT)
	4	Can do the complete task completely and accurately. Can tell or show others how to do the task. (HIGHLY PROFICIENT)
TASK KNOWLEDGE LEVELS	a	Can name parts, tools, and simple facts about the task. (NOMENCLATURE)
	b	Can determine step-by-step procedures for doing the task. (PROCEDURES)
	c	Can identify why and when the task must be done and why each step is needed. (OPERATING PRINCIPLES)
	d	Can predict, isolate, and resolve problems about the task. (ADVANCED THEORY)
SUBJECT KNOWLEDGE LEVELS	A	Can identify basic facts and terms about the subject (FACTS)
	B	Can identify relationship of basic facts and state general principles about the subject. (PRINCIPLES)
	C	Can analyze facts and principles and draw conclusions about the subject. (ANALYSIS)
	D	Can evaluate conditions and make proper decisions about the subject. (EVALUATION)

*A task knowledge scale value may be used alone or with a task performance scale value to define a level of knowledge for a specific task. **(Examples: b and 1b)**

** A subject knowledge scale value is used alone to define a level of knowledge for a subject not directly related to any specific task, or for a subject common to several tasks.

— Not required for this Level.

+ Reserved for future use.

RENEWABLE ENERGY TECHNOLOGY - 2010 COMMERCIAL WIND MAINTAINER

The following is a listing of the major categories and items considered necessary to be included in a course of study directed towards the education of workers needed in the commercial wind turbine industry.

The Commercial Wind Maintainer will be required to properly perform the following:

- Identify major components of a Commercial Wind (CW) System
- Identify types of CW systems
- Identify mounting and turbine types, and characteristics
- Determine proper maintenance for turbine types
- Install basic CW wind turbine components
- Determine proper site location
- Understand Basic performance characteristics
- Understand basic systems sizing methods
- Troubleshoot basic systems problems and installation errors

Understand safe working practices for:

- Tower Safety
- Working aloft (ladder, roof, lanyard and harness)
- Working with hand and basic power tools
- Eye and ear protection
- Electrical safety

Certification examination questions and skill demonstrations (when required) are based on the topical outline provided in the ITEMS LIST. The specific COMPETENCIES are derived from the ITEMS LIST.

There are 25 general categories of required knowledge and skills. The ITEM LISTING defines the particular content areas in which the certification candidate must demonstrate proficiency.

COMMERCIAL WIND MAINTAINER

MAJOR CATEGORIES:

- 1.0 DC
- 2.0 AC
- 3.0 GENERATORS
- 4.0 MOTORS
- 5.0 PLCs
- 6.0 MECHANICAL SYSTEMS
- 7.0 HYDRAULIC SYSTEMS
- 8.0 TURBINES
- 9.0 BLADES
- 10.0 YAW CONTROL SYSTEMS
- 11.0 CONVERTERS
- 12.0 CRANES AND RIGGING
- 13.0 CONDUCTORS, ELECTRICAL HARDWARE, BONDING AND GROUNDING
- 14.0 COOLING AND HEATING SYSTEMS
- 15.0 LUBRICATION SYSTEMS
- 16.0 NETWORKING & FIBER OPTICS
- 17.0 SCADA (Supervisory Control and Data Acquisition)
- 18.0 SENSORS & INSTRUMENTATION (INCLUDING MET TOWERS)
- 19.0 TOOLS AND THEIR USE
- 20.0 TEST EQUIPMENT
- 21.0 PREVENTIVE MAINTENANCE AND TROUBLESHOOTING
- 22.0 SAFETY
- 23.0 CUSTOMER SERVICE
- 24.0 WIND FARM MANAGEMENT
- 25.0 CODES AND STANDARDS

1.0 DIRECT CURRENT ELECTRICAL THEORY	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
1.1 Basic Electrical Theory					
1.1.1 Describe the causes and effects of static electricity	D				
1.1.2 Describe atomic structure, the components of the atom, their charges and importance to electronics technology	D				
1.1.3 Explain electronic physics terminology of work and energy	D				
1.1.4 Explain the different forms of energy and their applications	D				
1.2 Magnetism					
1.2.1 Explain basic electrical and magnetic properties	C				
1.2.2 Describe the properties of magnetic materials	C				
1.2.3 Explain magnetic fields and lines of force	C				
1.2.4 Explain magnetomotive force	C				
1.3 Basic Electrical Safety					
1.3.1 Safe practices and standards					
1.3.1.1 Describe personal safety precautions for working with electric and electronic devices	D				
1.3.2 Electrical shock					
1.3.2.1 Describe the human physiological reactions electrical shock causes	D				
1.3.2.2 List various degrees of current the human body can tolerate	D				
1.3.3 Emergency response					
1.3.3.1 Explain the concept of First Aid and its particular importance to workers in electric and electronic fields	D				
1.3.3.2 Explain precautions needed in the area of electronic safety	D				
1.3.4 Fire safety					
1.3.4.1 Describe the different classes (A, B, C, & D) of fires and the type of extinguishers used to fight them	D				
1.3.4.2 List applicable governing fire safety regulations NEC (National Electrical Code) and NFPA 70 (National Fire Protection Association)	D				
1.4 Electronic Equipment					
1.4.1 Explain multimeter construction, components and usage	D				
1.4.2 List the uses for light level meters	D				
1.5 Electronic Components					
1.5.1 Identify the following electronic components and their usages:					
1.5.1.1 Capacitors	D				

1.0 DIRECT CURRENT ELECTRICAL THEORY Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
1.5.1.2 Resistors	D				
1.5.1.3 Insulators	D				
1.5.1.4 Conductors	D				
1.5.1.5 Switches	D				
1.5.1.6 Fuses	D				
1.5.1.7 Circuit breakers	D				
1.5.1.8 Batteries	D				
1.6 Ohms Law for Electronics					
1.6.1 Summarize Ohms law	D				
1.6.2 Calculate current, voltage or resistance using Ohms Law	D				
1.6.3 Define Joules and Kilowatt-hour as an energy unit	D				
1.6.4 Describe Watts Law	D				
1.6.5 in the characteristics of DC resistance	D				
1.7 Basic Mathematics for Electronics					
1.7.1 Demonstrate the functions of a scientific calculator e	4d				
1.7.2 Explain basic algebraic math and its application in DC electronics	D				
1.7.3 Identify the scientific symbols used in DC electronics	D				
1.7.4 Convert fixed numbers to scientific notation	D				
1.7.5 Identify the fundamental and supplementary units that are the bases of the International System of Units (SI)	D				
1.7.6 Explain the following metric prefixes:					
1.7.6.1 Peta	D				
1.7.6.2 Tera	D				
1.7.6.3 Giga	D				
1.7.6.4 Mega	D				
1.7.6.5 kilo	D				
1.7.6.6 milli	D				
1.7.6.7 micro	D				
1.7.6.8 nano	D				
1.7.6.9 pico	D				
1.7.7 Demonstrate standard metric conversions	4d				
1.7.8 Explain algebraic equations relevant to DC circuitry	D				

1.0 DIRECT CURRENT ELECTRICAL THEORY Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
1.8 Electronic Measurements					
1.8.1 Describe the following electronic measurements and their application to DC electronics:					
1.8.1.1 Current	D				
1.8.1.2 Voltage	D				
1.8.1.3 Resistance	D				
1.8.1.4 Power	D				
1.9 Series Circuits for Electronics					
1.9.1 Explain how a series circuit is used in DC electronic equipment	D				
1.9.2 Find total resistance in a series circuit	D				
1.9.3 Calculate an unknown current, voltage or resistance in a series circuit, using Ohms law	4d				
1.9.4 Describe Kirchoff's voltage law in a series circuit	4d				
1.10 Parallel Circuits for Electronics					
1.10.1 Explain how a parallel circuit is used in DC electronic equipment	D				
1.10.2 Solve for total resistance of a parallel circuit	D				
1.10.3 Apply Kirchoff's current law in a parallel circuit	D				
1.10.4 Calculate current, in a parallel circuit, using the current-divider rule	D				
1.11 Series/Parallel Combination Circuits for Electronics					
1.11.1 Describe the basic series/parallel combination circuit	D				
1.11.2 Calculate current, voltage, and resistance in a combination circuit	4d				
1.11.3 Describe how Thevenin's theorem is used to simplify an equivalent series/parallel circuit	D				
1.11.4 Solve for an unknown value in a combination circuit using Kirchoff's law	4d				
1.11.5 Define Wheatstone bridge circuit and its usage	D				
1.11.6 Identify unknown voltages, currents, resistances and power dissipation in a loaded voltage divider circuit	D				
1.12 Battery Power Supplies					
1.12.1 Describe battery construction	D				
1.12.2 Describe battery ratings	D				

2.0 ALTERNATING CURRENT	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
2.1 Principles of Alternating Current					
2.1.1 Describe AC wave form characteristics					
2.1.1.1 Effective voltage (RMS)	D				
2.1.1.2 Average voltage	D				
2.1.1.3 Negative Alternation	D				
2.1.1.4 Positive Alternation	D				
2.1.1.5 Wavelength	D				
2.1.1.6 Amplitude	D				
2.1.1.7 Period	D				
2.1.2 Calculate peak, RMS, and average voltage values for an AC waveform	4d				
2.1.3 Identify the frequency terms:					
2.1.3.1 Cycle	D				
2.1.3.2 Hertz	D				
2.1.3.3 Phase	D				
2.2 Electronic Components and Terms					
2.2.1 Identify capacitor types; list common usages; methods of varying capacitance	D				
2.2.2 Identify inductor types and reasons for various core materials	D				
2.2.3 Identify common types of transformers and list uses for each; explain why laminations are used	D				
2.2.4 Identify the following terms:					
2.2.4.1 Charge	D				
2.2.4.2 Coulomb	D				
2.2.4.3 Joule	D				
2.2.4.4 Reluctance	D				
2.2.4.5 Capacitors	D				
2.2.4.6 Inductors	D				
2.2.4.7 Capacitance	D				
2.2.4.8 Inductance	D				
2.2.4.9 Reactance	D				
2.2.4.10 Impedance	D				
2.3 Principles of Inductance					
2.3.1 Describe the requirements for inductance in AC electrical circuits	D				
2.3.2 Explain Lenz's law in complement with Faraday's law of induction	D				

2.0 ALTERNATING CURRENT Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
2.3.3 Identify the differences between self-inductance and mutual inductance	D				
2.3.4 Explain the factors affecting inductance					
2.3.4.1 Number of turns of a coil	D				
2.3.4.2 Coil Diameter	D				
2.3.4.3 Length of the coil	D				
2.3.4.4 Core material	D				
2.3.5 List the factors used in calculating inductance for a single and multi-layer air core coil	D				
2.3.6 Explain how inductance relates to magnetism and describe coil construction, cores and usages	D				
2.3.7 Describe the differences between reactance and resistance and describe current/voltage relationships	D				
2.3.8 Compare impedance with reactance and resistance and explain the causes and effects of impedance	D				
2.3.9 Describe the types of power losses associated with inductors	D				
2.3.10 Calculate power consumption and requirements in inductors in AC circuits	4d				
2.3.11 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power	D				
2.4 Transformer Theory					
2.4.1 Describe the different types of transformer construction and operation	D				
2.4.2 List the various types of transformers	D				
2.4.3 Determine the method for determining a step-up or step-down transformer	D				
2.4.4 Describe the operation of a saturable reactor	D				
2.5 Principles of Capacitance					
2.5.1 Describe the factors affecting capacitor operation in AC circuits	D				
2.5.2 Show the different purposes for capacitors and list common types and construction of the different types	D				
2.5.3 Explain the advantages and disadvantages of utilizing an electrolytic capacitor in an AC circuit	D				
2.5.4 Describe the differences between capacitive reactance and resistance and describe current/voltage relationships	D				
2.5.5 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power	D				

2.0 ALTERNATING CURRENT Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
2.6 AC Generator Theory					
2.6.1 Describe the components associated with an AC generator	D				
2.6.2 Explain the Left-Hand rule for generators	D				
2.6.3 Define Lenz's law for induction	D				
2.6.4 Explain the difference between single and three-phase power generation	D				
2.6.5 Describe how three-phase power can be manipulated to obtain a desired voltage and number of phases	D				
2.6.6 List the differences associated with Delta and Wye three-phase power connections	D				
2.7 AC Motor Theory					
2.7.1 List different types of AC motors and methods of operation	D				
2.7.2 Describe the components and principles associated with the operation of an AC motor	D				
2.7.3 Describe the basic methods of using electricity to operate an induction motor and how transferred mechanical motion causes a generator to produce electrical current	D				
2.7.4 Calculate the number of pole pairs needed to produce desired rpm's	3c				
2.7.5 Explain the principle behind Shaded-pole and Split-phase induction motors	D				
2.7.6 Describe the various methods used for starting induction motors	D				
2.8 RC, RL and RCL Principles					
2.8.1 Explain phase relationships of voltage and current for series and parallel RL, RC and RCL circuits	D				
2.8.2 Calculate power, current, impedance and voltage vectors for series and parallel RCL circuits	4d				
2.8.3 Explain bandwidth and selectivity for series and parallel resonant circuits	D				
2.8.4 Describe the component configurations used in PI, L, and T type high and low pass filter circuits	D				
2.9 Cabling					
2.9.1 Describe impedance and its causes; explain reasons for maintaining a cable's characteristics	D				
2.9.2 Explain the effects of proper and improper termination	D				
2.9.3 Explain the purposes of grounding and common conventions used in electrical and electronics work	D				

2.0 ALTERNATING CURRENT Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
2.10 Test Equipment & Measurements					
2.10.1 Describe how volt-ohm-current meters operate	D				
2.10.2 List the purposes and types of signal generators	D				
2.10.3 Describe how oscilloscope front panel controls are used	D				
2.10.4 Explain what LRC substitution equipment is and its purposes	D				
2.10.5 Explain reasons for using rheostats, isolation transformers and variacs	D				
3.0 GENERATORS					
3.1 DC Generators	D				
3.1.1 State the principal by which generators convert mechanical energy to electrical energy	D				
3.1.2 State the left hand rule for generators	D				
3.1.3 Explain the process of commutation in DC Generators	D				
3.1.4 Describe the design and operation of a DC generator	D				
3.1.5 Describe the voltage and current variation from no load to full load in a DC generator	D				
3.1.6 Describe how and why field strength can and may be varied in a DC generator	D				
3.1.7 Describe the construction and operation of series wound, shunt wound, and compound wound generators	D				
3.2 AC Generators					
3.2.1 Describe the principle of magnetic induction as it applies to AC generators	D				
3.2.2 Describe the construction and operation of both rotating-armature and rotating-field alternators, and the advantages of each design	D				
3.2.3 Describe the construction and operation of single-phase, two-phase, and three- phase alternators	D				
3.2.4 Describe the construction, operation and advantage of both delta and wye three-phase connections for AC generators	D				
3.2.5 Explain the principles of voltage control with AC generators	D				
3.3 Generator maintenance					
3.3.1 Demonstrate the ability to inspect generators for serviceability	4d				
3.3.2 Demonstrate the ability to perform preventive maintenance on generators	4d				
3.3.3 Demonstrate the ability to lubricate generators	4d				
3.3.4 Demonstrate the ability to remove and replace unserviceable parts on a generator	4d				

2.0 ALTERNATING CURRENT Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
3.3.5 Demonstrate the ability to remove and reinstall a generator in a wind turbine	4d				
3.3.6 Demonstrate the ability to bring a generator on line	4d				
4.0 MOTORS					
4.1 DC Motors					
4.1.1 State the factors that determine the direction of rotation of DC motors	D				
4.1.2 State the right hand rule for motors	C				
4.1.3 Explain the process of commutation in DC motors	C				
4.1.4 Describe the construction and operational characteristics of series, shunt, and compound DC motors	C				
4.1.5 Describe speed and direction control techniques for DC motors	C				
4.2 AC Motors					
4.2.1 Describe the construction and operational characteristics of single-phase, two-phase, and three-phase AC motors	D				
4.2.2 Describe the construction, operation and advantage of both delta and wye three-phase connections for AC motors	D				
4.2.3 State the primary application of synchronous motors	D				
4.2.4 Describe the construction and operational characteristics of an induction motor	D				
4.3 Electric Motor Maintenance					
4.3.1 Demonstrate the ability to inspect electric motors commonly used with wind turbines for serviceability	4d				
4.3.2 Demonstrate the ability to perform preventive maintenance on electric motors commonly used with wind turbines	4d				
4.3.3 Demonstrate the ability to perform any necessary lubrication on electric motors commonly used with wind turbines	4d				
4.3.4 Demonstrate the ability to remove and replace unserviceable parts on a electric motors commonly used with wind turbines	4d				
4.3.5 Demonstrate the ability to remove and reinstall a electric motor commonly used with wind turbines	4d				
4.3.6 Demonstrate the ability to perform an operational check on an installed electric motor commonly used with wind turbines	4d				

5.0 PROGRAMMABLE LOGIC CONTROLLERS	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
5.1 Explain the function of Programmable Logic Controllers	D				
5.2 Explain the function of the three parts of Programmable Logic Controllers					
5.2.1 Input/output section	D				
5.2.2 Processor	D				
5.2.3 Terminal	D				
5.3 Define terms associated with programmable logic controllers					
5.3.1 I/O rack	D				
5.3.2 I/O group	D				
5.3.3 Slot	D				
5.3.4 Module	D				
5.3.5 Terminal	D				
5.3.6 Instruction-rung	D				
5.3.7 User-program	D				
5.3.8 Input image file	D				
5.3.9 Output image file	D				
5.3.10 Central processing unit	D				
5.4 Explain how a central processing unit used with programmable logic controllers executes one instruction string	D				
5.5 Explain the operation of basic relay instructions					
5.5.1 Examine-on	D				
5.5.2 Examine-off	D				
5.5.3 Output-energize	D				
5.6 Explain the capabilities of a programmable logic controllers					
5.6.1 Timing	D				
5.6.2 Counting	D				
5.6.3 Value comparison	D				
5.6.4 Arithmetic	D				
5.7 Describe the operating modes of programmable logic controllers					
5.7.1 Program	D				
5.7.2 Test	D				
5.7.3 Run	D				
5.8 Using a terminal key board demonstrate the ability to inter a program in to a programmable logic controllers memory	4d				

5.0 PROGRAMMABLE LOGIC CONTROLLERS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
5.9 Demonstrate the ability to use the editing function	4d				
5.10 Demonstrate the ability to assign appropriate addresses to the various devices within programmable logic controllers	4d				
5.11 Demonstrate the ability to write a program for programmable logic controllers that would be used with a wind turbine	4d				
5.12 Demonstrate the ability to troubleshoot malfunctioning programmable logic controllers used with a wind turbine	4d				
5.13 Demonstrate the ability to remove and replace programmable logic controllers used with a wind turbine	4d				
5.14 Demonstrate the ability to perform an operational check of a programmable logic controllers used with a wind turbine	4d				
6.0 MECHANICAL SYSTEMS					
6.1 Define terms used in Mechanical Systems:					
6.1.1 Force	D				
6.1.2 Work	D				
6.1.3 Power	D				
6.1.4 Energy	D				
6.1.5 Torque	D				
6.1.6 Mechanical advantage	D				
6.1.7 Mechanical efficiency	D				
6.1.8 Fulcrum	D				
6.1.9 Friction	D				
6.1.10 Moment of force	D				
6.1.11 Balancing moments	D				
6.1.12 Pitch	D				
6.2 Theory of operation of basic machines:					
6.2.1 Describe the theory of operation of levers:	D				
6.2.1.1 First class	D				
6.2.1.2 Second class	D				
6.2.1.3 Third class	D				
6.2.2 Describe the theory of operation of wheel and axle	D				
6.2.3 Describe the theory of operation of inclined plane and the wedge	D				
6.2.4 Describe the theory of operation of the screw	D				

6.0 MECHANICAL SYSTEMS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
6.2.5 Describe the theory of operation of gears:	D				
6.2.5.1 Simple	D				
6.2.5.2 Spur	D				
6.2.5.3 Pinion	D				
6.2.5.4 Sector	D				
6.2.5.5 Rack	D				
6.2.5.6 Internal	D				
6.2.5.7 Helical	D				
6.2.5.8 Herringbone	D				
6.2.5.9 Bevel	D				
6.2.5.10 Spiral bevel	D				
6.2.5.11 Meter	D				
6.2.5.12 Worm	D				
6.2.5.12.1 Single-threaded	D				
6.2.5.12.2 Double-threaded	D				
6.2.5.13 Idler	D				
6.2.6 Describe how gears change direction of motion	D				
6.2.7 Describe how gears change speed	D				
6.2.8 Describe how gears transmit force	D				
6.2.9 Describe the mathematical relationship between gear ratios and the increase or decrease of torque speed and direction produced by gears	D				
6.2.10 Describe the theory of operation of block and tackle	D				
6.2.11 Describe the theory of operation of a gear train	D				
6.2.12 Explain the functions of the driven gear and the driver gear	D				
6.2.13 Explain the theory of operation and function of a cam					
6.2.13.1 Drum or barrel	D				
6.2.13.2 Edge	D				
6.2.13.3 Face	D				
6.2.14 Explain the construction, theory of operation and function of a various types of bearings	D				
6.2.15 Explain the construction, theory of operation and function of a various types of springs					
6.2.15.1 Flat	D				

6.0 MECHANICAL SYSTEMS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
6.2.15.2 Spiral	D				
6.2.15.3 Helical	D				
6.2.16 Explain the construction, theory of operation and function of gear differentials	D				
6.2.17 Explain the construction, theory of operation and function of gear universal joints					
6.2.17.1 Hooke	D				
6.2.17.2 Ring-and-trunnion	D				
6.2.17.3 Bendix-Weiss	D				
6.2.18 Explain the construction, theory of operation and function of clutches	D				
6.2.19 Explain the construction, theory of operation and function of drive belts	D				
6.2.20 Explain the construction, theory of operation and function of drive chains	D				
6.3 Hardware and lubricants used in wind turbine mechanical systems					
6.3.1 Identify types and specifications of fasteners used in wind systems	D				
6.3.2 Identify types and specifications and compatibility of lubricants used in wind turbine systems	D				
6.4 Specialized tools used in wind turbine mechanical systems					
6.4.1 Demonstrate the proper use of specialized tools used in maintaining wind turbine systems	4d				
6.5 Gear boxes used with wind:					
6.5.1 Describe the types of gear boxes used in wind turbines	D				
6.5.2 Demonstrate the ability to inspect gear boxes	4d				
6.5.3 Explain the advantages and disadvantages of using hybrid and planetary versus helical/parallel shaft gear boxes	D				
6.5.4 Demonstrate the ability to troubleshoot gear boxes used in wind turbines	4d				
6.5.5 Identify rpm, gear ratio, and failure mechanisms	D				
7.0 PNEUDRAULICS					
7.1 Hydraulics					
7.1.1 Fluid Power Theory					
7.1.1.2 Identify electrical appliances that may be replaced by more energy efficient ones	D				
7.1.1.3 Explain the appliance Energy Star rating system	D				
7.1.1.4 Explain Bernoulli's Principle and its relationship to Pneudraulics	D				

7.0 PNEUDRAULICS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
7.1.1.5 Explain the transmission of force through fluids	D				
7.1.1.6 Describe how energy is transmitted through fluids	D				
7.1.1.7 Calculate system values related to pressure, force, and area	4d				
7.1.1.8 Calculate work, power, and efficiency of a hydraulic system	4d				
7.1.1.9 Characteristics of liquids and factors affecting them					
7.1.1.9.1 Describe the characteristics of liquids in motion	D				
7.1.1.9.2 Describe the characteristics of liquids at rest	D				
7.1.1.9.3 Describe the characteristics of mineral based liquids	D				
7.1.1.9.4 Describe the characteristics of vegetable based liquids	D				
7.1.2 Symbols, terms and schematics					
7.1.2.1 Identify symbols commonly used with Pneudraulics	D				
7.1.2.2 Define terms commonly used with Pneudraulics	D				
7.1.2.3 Demonstrate the ability to read schematics commonly used with Pneudraulics	4d				
7.1.3 Individual components of a hydraulic system					
7.1.3.1 Describe the construction and function of a hydraulic reservoir	D				
7.1.3.2 Describe the construction and characteristics of hydraulic tubing	D				
7.1.3.3 Describe the construction and characteristics of flexible hydraulic hose and their various types	D				
7.1.3.4 Describe the construction and characteristics of hydraulic fittings	D				
7.1.3.5 Describe the construction, characteristics and the uses of o-rings, gaskets, backups, and wipers	D				
7.1.3.6 Describe the operational and physical characteristics of various hydraulic valves					
7.1.3.6.1 Check valve	D				
7.1.3.6.2 Restrictor valve	D				
7.1.3.6.3 Flow Control valve	D				
7.1.3.6.4 Pressure relief valve	D				

7.0 PNEUDRAULICS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
7.1.3.6.5 Directional control valve					
7.1.3.6.5.1 Open center	D				
7.1.3.6.5.2 Closed center					
7.1.3.7 Describe the operational and physical characteristics of various hydraulic actuators	D				
7.1.3.8 Describe the operational and physical characteristics of various hydraulic accumulators	D				
7.1.3.8.1 Piston	D				
7.1.3.8.2 Flask	D				
7.1.3.9 Describe the operational and physical characteristics of various hydraulic pumps					
7.1.3.9.1 Variable vane	D				
7.1.3.9.2 Gear	D				
7.1.3.9.3 Piston					
7.1.3.9.3.1 Variable angle	D				
7.1.3.9.3.2 Fixed	D				
7.1.3.10 Describe the operational and physical characteristics of various hydraulic motors	D				
7.1.3.11 Describe the operational and physical characteristics of various hydraulic strainers and filters	D				
7.1.3.12 Explain the theory of operation and use of a venturi	D				
7.1.3.13 Demonstrate the ability to troubleshoot a hydraulic system	4d				
7.1.3.14 Explain the customary preventative maintenance procedures used in maintaining a hydraulic system	D				
7.1.3.15 Demonstrate the ability to perform an operational check on a hydraulic system	4d				
7.2 Pneumatics					
7.2.1 Describe the characteristics of gas and how it functions in a pneumatic system	D				
7.2.2 Describe the characteristics of vacuum and how it functions in a pneumatic	D				
7.2.3 Differentiate between the construction and characteristics of components used in hydraulic and pneumatic systems	D				
7.2.4 Explain the theory of operation of pneumatic systems	D				
7.2.5 Demonstrate the ability to troubleshoot a pneumatic system	4d				

7.0 PNEUDRAULICS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
7.2.6 Explain the customary preventative maintenance procedures used in maintaining a pneumatic system	D				
7.2.7 Demonstrate the ability to perform an operational check on a pneumatic system	4d				
8.0 TURBINES					
8.1 Explain the theory of operation and design options of the major components of wind turbines and how each functions in the wind turbine system:					
8.1.1 Generator	D				
8.1.2 Gearbox	D				
8.1.3 Bearings	D				
8.1.4 Low Speed Shaft	D				
8.1.5 High Speed Shaft	D				
8.1.6 Coupling	D				
8.1.7 Controller	D				
8.1.8 Nacelle	D				
8.1.9 Wind Vane	D				
8.1.10 Brake	D				
8.1.11 Anemometer	D				
8.1.12 Yaw Drive	D				
8.1.13 Yaw Motor	D				
8.1.14 Rotor	D				
8.1.15 Blades	D				
8.1.16 Hub	D				
8.1.17 Extenders	D				
8.1.18 Pitch control	D				
8.1.19 Tower	D				
8.1.20 Base	D				
8.1.21 Power Electronics	D				
8.1.22 Cooling system	D				
8.1.23 Sensors	D				
8.1.24 Communication System	D				

8.0 TURBINES Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
8.2 Explain how turbines convert wind energy to electrical energy					
8.2.1 Demonstrate how to make calculations using the swept area equation	4d				
8.2.2 Explain Bernoulli's principle	D				
8.2.3 Explain the effects that design factors have on converting wind energy to electrical energy					
8.2.3.1 Number of Blades	D				
8.2.3.2 Blade Length	D				
8.2.3.3 Blade Geometry	D				
8.2.3.4 Blade Bending	D				
8.2.3.5 Pitch	D				
8.2.3.6 Height	D				
8.2.3.7 Horizontal verses Vertical design	D				
8.2.3.8 Upwind verses downwind rotor design	D				
8.2.3.9 Blade surface condition	D				
8.2.3.10 Betz Limit	D				
8.2.4 Demonstrate the ability to perform normal maintenance procedures on wind turbine systems	4d				
8.2.4.1 Demonstrate the ability to perform a functional check on an operable wind turbine system	4d				
8.2.4.2 Demonstrate the ability to perform a preventative maintenance inspection on a wind turbine system	4d				
8.2.4.3 Demonstrate the ability to troubleshoot and identify malfunctioning major components in a wind turbine system.	4d				
8.2.4.4 Demonstrate the ability to remove and replace malfunctioning major components in a wind turbine system	4d				
9.0 WIND TURBINE BLADES					
9.1 Explain the theory of wind turbine blade design					
9.1.1 Explain the properties of materials used in the design of wind turbine blades and the advantages and disadvantages of each, as well as their indicated use	D				
9.1.1.1 Balsa wood – spar reinforced	D				
9.1.1.2 Steel structure	D				
9.1.1.3 Resin core	D				
9.1.1.4 Carbon fiber	D				

9.0 WIND TURBINE BLADES Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
9.1.1.5 Fiberglass	D				
9.1.1.6 Gel coat	D				
9.1.2 Explain the aerodynamic properties of various parts of wind turbine blades and how each affects their performance					
9.1.2.1 Leading edge	D				
9.1.2.2 Trailing edge	D				
9.1.2.3 Leeward	D				
9.1.2.4 Wayward	D				
9.1.2.5 Lift	D				
9.1.2.6 Drag	D				
9.2 Explain lightning suppression techniques used with wind turbine blades	D				
9.3 Demonstrate the ability to inspect a wind turbine blade for serviceability	4d				
9.4 Demonstrate the ability to remove and replace a wind turbine blade	4d				
10.0 YAW CONTROL SYSTEMS					
10.1 Reversing motor controls					
10.1.1 Explain the theory of operation of reversing motor controls used in yaw control systems	D				
10.1.2 Demonstrate the ability to perform a functional check on reversing motor controls used in yaw control systems	4d				
10.1.3 Demonstrate the ability to perform a serviceability inspection on a reversing motor controls used in yaw control systems	4d				
10.1.4 Demonstrate the ability to trouble shoot and Identify malfunctioning reversing motor controls used in yaw control systems	4d				
10.1.5 Demonstrate the ability to remove and replace defective components used in a reversing motor controls	4d				
10.2 Position sensing					
10.2.1 Explain the theory of operation of position sensors used in yaw control systems	D				
10.2.2 Demonstrate the ability to perform a functional check of a position sensor used in yaw control systems	4d				
10.2.3 Demonstrate the ability to perform a serviceability inspection on position sensors used in yaw control systems	4d				
10.2.4 Demonstrate the ability to trouble shoot and Identify malfunctioning position sensors used in yaw control systems	4d				
10.2.5 Demonstrate the ability to remove and replace defective components used in a position sensors	4d				

10.0 YAW CONTROL SYSTEMS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
10.3 Yaw brakes					
10.3.1 Explain the theory of operation of brakes used in yaw control systems	D				
10.3.2 Demonstrate the ability to perform a functional check of a brakes used in yaw control systems	4d				
10.3.3 Demonstrate the ability to perform a serviceability inspection on brakes used in yaw control systems	4d				
10.3.4 Demonstrate the ability to trouble shoot and Identify malfunctioning brakes used in yaw control systems	4d				
10.3.5 Demonstrate the ability to remove and replace defective components used in a yaw brakes	4d				
10.4 Pinion gear inspection					
10.4.1 Demonstrate the ability to perform an inspection on a pinion gear used in yaw control systems	4d				
10.4.2 Demonstrate the ability to remove and replace a defective pinion gear used in a yaw system	4d				
11.0 CONVERTERS					
11.1 Describe the theory of operation of converters used with wind turbines					
11.1.1 Generator side	D				
11.1.2 Network side	D				
11.2 Explain the theory of operation of Voltage Source Converters					
11.2.1 Explain the theory of operation of two level Voltage Source Converters	D				
11.2.2 Describe the various switching strategies used with Voltage Source Converters					
11.2.2.1 Square waves	D				
11.2.2.2 Hysteresis	D				
11.2.2.3 Carrier based pulse-width modulation	D				
11.2.2.4 Switching frequency pulse-width modulation	D				
11.2.2.5 Sinusoidal regular sampled pulse-width modulation	D				
11.2.2.6 Non-regular sampled pulse-width modulation	D				
11.2.2.7 Selective harmonic elimination pulse-width	D				
11.2.2.8 Space vector pulse-width modulation	D				

11.0 CONVERTERS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
11.3 Explain how a fully rated converter is connected and functions in a variable speed configuration:					
11.3.1 Used with synchronous generators	D				
11.3.2 Used with asynchronous generators	D				
11.4 Explain the theory of operation and interface of a doubly fed induction generator commonly used with wind turbines	D				
11.5 Converter maintenance					
11.5.1 Demonstrate the ability to inspect converters commonly used with wind turbines for serviceability	4d				
11.5.2 Demonstrate the ability to perform preventive maintenance on converters commonly used with wind turbines	4d				
11.5.3 Demonstrate the ability to remove and replace unserviceable parts on converters commonly used with wind turbines	4d				
11.5.4 Demonstrate the ability to remove and reinstall a converter commonly used with wind turbines	4d				
11.5.5 Demonstrate the ability to perform an operational check on an installed converter commonly used with wind turbines	4d				
12.0 CRANES AND RIGGING					
12.1 Describe the principles of craning operations					
12.1.1 General crane terminology	D				
12.1.2 Structural limitations of the crane	D				
12.1.3 Wire rope	D				
12.1.4 Rigging and rigging hardware	D				
12.2 Explain jobsite considerations for commercial wind crane and rigging operations					
12.2.1 Ground stability	D				
12.2.2 Electrical hazards	D				
12.2.3 Blocking, cribbing, and mats	D				
12.3 Demonstrate the ability to perform the following operational task related to commercial wind crane and rigging operations					
12.3.1 Communications and signaling	4d				
12.3.2 Common hand signals	4d				
12.3.3 Pre-operational inspection	4d				
12.3.4 Proper crane set up	4d				
12.3.5 Adverse weather conditions	4d				
12.3.6 Load movement	4d				

12.0 CRANE AND RIGGING Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
12.4 Demonstrate the ability to read, interpret, and use the information contained in capacity charts used with commercial wind cranes and rigging					
12.4.1 General capacity chart knowledge	4d				
12.4.2 Determine capacity using capacity charts	4d				
13.0 CONDUCTORS, ELECTRICAL HARDWARE, BONDING AND GROUNDING					
13.1 Electrical Conductors					
13.1.1 Define insulation resistance and dielectric strength	D				
13.1.2 Define mil-foot, square mil, circular mil and the mathematical equations for calculations for each	D				
13.1.3 Explain the meaning of 'resistivity'	D				
13.1.4 Explain the American Wire Gauge system and how to measure wire using the AWG system	D				
13.1.5 Explain the factors required in selecting proper size wire	D				
13.1.6 State the advantages and disadvantages of copper, aluminum, and silver as conductors	D				
13.1.7 Describe the effects that temperature coefficient of a given wire type can have on its operation	D				
13.1.8 Describe types of insulation and factors in their selection for use	D				
13.1.9 Describe conductor types, both solid and stranded, as well as the various bundling techniques	D				
13.1.10 Describe the proper splicing and termination techniques for both solid and stranded conductors	D				
13.1.11 Describe each of the following cable types, their construction, use, and termination:					
13.1.11.1 Coaxial cable	D				
13.1.11.2 Unshielded twisted pair	D				
13.1.11.3 Shielded twisted pair	D				
13.1.11.4 Given a wiring requirement to support a commercial wind generator system demonstrate the ability to select the proper wire and insulation type	D				
13.2 Circuit Protection					
13.2.1 Describe the physical design of fuses and their current and voltage rating systems	D				
13.2.2 Describe the numbering marking system used with fuses and their schematic symbols	D				

13.0 CONDUCTORS, ELECTRICAL HARDWARE, BONDING & GROUNDING Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
13.2.3 Describe the physical design and current and voltage rating system of circuit breakers	D				
13.2.4 Describe the numbering marking system used with circuit breakers and their schematic Symbols	D				
13.2.5 Demonstrate the ability to perform a serviceability check on a typical fuse used in a commercial wind generating system	4d				
13.2.6 Demonstrate the ability to perform a serviceability check on a typical circuit breaker used in a commercial wind generating system	4d				
13.2.7 Demonstrate the ability to remove and replace a typical circuit breaker used in a commercial wind generating system	4d				
13.3 Circuit Controls					
13.3.1 List the general types of circuit control devices and their use	D				
13.3.2 Identify the schematic symbol for circuit control devices used in a commercial wind generating system:					
13.3.2.1 Switch	D				
13.3.2.2 Solenoid	D				
13.3.2.3 Relay	D				
13.3.3 Describe the operating principles and characteristics for circuit control devices used in a commercial wind generating system:					
13.3.3.1 Solenoid	D				
13.3.3.2 Relay	D				
13.3.3.3 Switch	D				
13.3.4. State the meaning of current and voltage ratings for circuit control devices used in a commercial wind generating system:					
13.3.4.1 Switch	D				
13.3.4.2 Solenoid	D				
13.3.4.3 Relay	D				
13.3.5 Demonstrate the ability to perform a serviceability check on circuit control devices used in a commercial wind generating system:					
13.3.5.1 Solenoid	4d				
13.3.5.2 Relay	4d				
13.3.5.3 Switch	4d				
13.3.6 Demonstrate the ability to remove and replace a circuit control devices used in a commercial wind generating system:					
13.3.6.1 Solenoid	4d				

13.0 CONDUCTORS, ELECTRICAL HARDWARE, BONDING & GROUNDING Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
13.3.6.2 Relay	4d				
13.3.6.3 Switch	4d				
13.4 Bonding and Grounding					
13.4.1 Explain the difference between bonding and grounding	D				
13.4.2 Explain the proper grounding procedures used with commercial wind turbines	D				
13.4.3 Explain the proper bonding procedures used with commercial wind turbines	D				
13.4.4 Explain the proper lightning protection techniques used with commercial wind turbines	D				
13.4.5 Demonstrate the ability to prepare an attachment point for a proper ground or bond on a commercial wind turbine	4d				
13.4.6 Demonstrate the ability to select the proper hardware for making a ground or bond on a commercial wind turbine					
13.4.6.1 Type	4d				
13.4.6.2 Size	4d				
13.4.6.3 Metal composition	4d				
14.0 COOLING AND HEATING SYSTEMS					
14.1 Radiators					
14.1.1 Explain the theory of operation and functional characteristics of radiators used in commercial wind turbine systems	D				
14.1.2 Demonstrate the ability to do a functional check on radiators used in commercial wind turbine systems	4d				
14.1.3 Demonstrate the ability to do a serviceability inspection on radiators used in commercial wind turbine systems	4d				
14.1.4 Demonstrate the ability to remove and replace radiators used in commercial wind turbine systems	4d				
14.2 Forced air cooling					
14.2.1 Explain the theory of operation and functional characteristics of forced air cooling systems used in commercial wind turbine systems.	D				
14.2.2 Demonstrate the ability to do a functional check on forced air cooling systems used in commercial wind turbines	4d				
14.2.3 Demonstrate the ability to do a serviceability inspection on forced air cooling systems used in commercial wind turbines	4d				

14.0 COOLING AND HEATING SYSTEMS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
14.2.4 Demonstrate the ability to troubleshoot and identify malfunctioning components used in forced air cooling systems	4d				
14.2.5 Demonstrate the ability to remove and replace defective components used in forced air cooling systems	4d				
14.3 Tank heaters					
14.3.1 Explain the theory of operation and functional characteristics of tank heaters used in commercial wind turbine systems	D				
14.3.2 Demonstrate the ability to do a functional check on tank heaters used in commercial wind turbine systems	4d				
14.3.3 Demonstrate the ability to do a serviceability inspection on tank heaters used in commercial wind turbine systems	4d				
14.3.4 Demonstrate the ability to troubleshoot and identify malfunctioning components used in tank heaters	4d				
14.3.5 Demonstrate the ability to remove and replace defective components used in tank heaters	4d				
14.4 Cabinet heaters					
14.4.1 Explain the theory of operation and functional characteristics of cabinet heaters used in commercial wind turbine systems	D				
14.4.2 Demonstrate the ability to do a functional check on cabinet heaters used in commercial wind turbine systems	4d				
14.4.3 Demonstrate the ability to do a serviceability inspection on cabinet heaters used in commercial wind turbine systems	4d				
14.4.4 Demonstrate the ability to troubleshoot and identify malfunctioning components used in cabinet heaters	4d				
14.4.5 Demonstrate the ability to remove and replace defective components used in cabinet heaters	4d				
14.4 Thermostats					
14.5.1 Explain the theory of operation and functional characteristics of thermostats used in commercial wind turbine systems	D				
14.5.2 Demonstrate the ability to do a functional check on thermostats used in commercial wind turbine systems	4d				
14.5.3 Demonstrate the ability to do a serviceability inspection on thermostats used in commercial wind turbine systems	4d				
14.5.4 Demonstrate the ability to troubleshoot and identify a malfunctioning thermostat	4d				
14.5.5 Demonstrate the ability to remove and replace defective thermostats	4d				

15.0 LUBRICATION SYSTEMS	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
15.1 Manual lubrication					
15.1.1 Explain the procedure for doing a manual lubrication of a commercial wind turbine	D				
15.1.2 Demonstrate the ability to do a manual lubrication of a commercial wind turbine	4d				
15.2 Centralized/automatic lubrication systems					
15.2.1 Explain the theory of operation and functional characteristics of centralized/automatic lubrication systems used in commercial wind turbine systems	D				
15.2.2 Demonstrate the ability to do a functional check on centralized/automatic lubrication systems used in commercial wind turbines	4d				
15.2.3 Demonstrate the ability to do a serviceability inspection on centralized/automatic lubrication systems used in commercial wind turbines	4d				
15.2.4 Demonstrate the ability to troubleshoot and identify malfunctioning components used in centralized/automatic lubrication systems	4d				
15.2.5 Demonstrate the ability to remove and replace defective components used in centralized/automatic lubrication systems	4d				
15.2.6 Demonstrate the ability to change oil in a centralized/automatic lubrication systems	4d				
15.3 Filtration					
15.3.1 Explain the purpose and functional characteristics of oil filtration used in commercial wind turbine lubrication systems	D				
15.3.2 Demonstrate the ability to re move and replace oil filters used in commercial wind turbine lubrication systems	4d				
15.4 Oil sampling and analysis					
15.4.1 Explain the purpose and procedure for conducting an oil sampling & analysis	D				
15.4.2 Demonstrate the ability to collect an oil sample for analysis.	4d				
15.4.3 Demonstrate the ability to select a proper course of action based on the results of an oil analysis	4d				
15.5 Demonstrate the ability to research and interpret the manufacturer's specifications for lubrication systems used in commercial wind turbines	4d				

16.0 NETWORKING AND FIBER OPTICS	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
16.1 Identify network topology types and list the characteristics, advantages and disadvantages of each:					
16.1.1 Logical					
16.1.1.1 Bus	D				
16.1.1.2 Token passing	D				
16.1.2 Physical					
16.1.2.1 Bus	D				
16.1.2.2 Star	D				
16.1.2.3 Mesh	D				
16.1.2.4 Ring	D				
16.1.2.5 Wireless					
16.1.2.5.1 Infrastructure	D				
16.1.2.5.2 Ad hoc	D				
16.2 Network Security					
16.2.1 Identify vulnerabilities in network security	D				
16.2.2 Evaluate physical security requirements	D				
16.2.3 Determine vulnerabilities for cyber-security					
16.2.3.1 Log-in security	D				
16.2.3.2 Spam	D				
16.2.3.3 Virus	D				
16.2.3.4 Denial of Service	D				
16.3 Identify the purposes, features, and functions of various physical network components:					
16.3.1 Hubs	D				
16.3.2 Switches	D				
16.3.3 Bridges	D				
16.3.4 Routers	D				
16.3.5 Gateways	D				
16.3.6 NICs	D				
16.3.7 WAPs	D				
16.3.8 Modems	D				
16.3.9 Transceivers	D				
16.3.10 Antennas	D				

16.0 NETWORKING AND FIBER OPTICS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
16.3.11 Firewalls	D				
16.3.12 UPS	D				
16.4 Network Media					
16.4.1 Identify performance characteristics of each type of networking media:					
16.4.1.1 Twisted pair	D				
16.4.1.2 Fiber optics	D				
16.4.2 Select appropriate connectors for the media	4d				
16.4.3 Demonstrate the ability to terminate networking media	4d				
16.4.4 Demonstrate the ability to test and troubleshoot networking media	4d				
16.5 Networking Protocols					
16.5.1 Ethernet					
16.5.1.1 Explain the characteristics and theory of IEEE 802.3	D				
16.5.1.2 Configure a Windows workstation to communicate on an Ethernet network	4d				
16.5.1.3 Explain the physical address scheme used with IEEE 802.3	D				
16.5.2 TCP/IP					
16.5.2.1 Explain theory and characteristics of the network protocols used in the TCP/IP suite:					
16.5.2.3.1 DNS	D				
16.5.2.3.2 Wins	D				
16.5.2.3.3 DHCP	D				
16.5.3 Explain the TCP/IP network addressing schemes and naming conventions:					
16.5.3.1 V 4	D				
16.5.3.2 V 6	D				
16.5.3.3 Subnetting	C				
16.5.4 Identify the differences between public and private networks	C				
16.5.5 Explain the role NAT in configuring public and private networks	C				
16.5.6 Identify the main characteristics of Virtual Local Area Networks (VLANs)	C				
16.6 Troubleshoot network connectivity					
16.6.1 Select the appropriate network utility and interpret its output	4d				

16.0 NETWORKING AND FIBER OPTICS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
16.6.2 Interpret visual indicators to determine the nature of the problem in a malfunctioning network	4d				
16.6.3 Select an appropriate course of action to restore a malfunctioning network based on logical troubleshooting strategies	4d				
16.7 Identify the purpose and characteristics of fault tolerance and disaster recovery					
16.7.1 Identify the purpose and characteristics of fault tolerance related to:					
16.7.1.1 Power	D				
16.7.1.2 Link redundancy	D				
16.7.1.3 Storage	D				
16.7.1.4 Services	D				
16.7.1.5 Backup/restore	D				
16.7.1.6 Offsite storage	D				
16.7.1.7 Hot and cold spares	D				
17.0 SCADA (Supervisory Control and Data Acquisition)					
17.1 Define SCADA nomenclature	D				
17.2 Recognize the impact that radio and computer development have had on SCADA					
17.2.1 Describe radio communications in SCADA systems	D				
17.2.2 Describe Satellite/Cell phone use in SCADA					
17.3 Describe centralized computer system location	D				
17.4 Define the terms that deal with time response	D				
17.5 Identify the criteria to be considered when selecting scan intervals	D				
17.6 Explain how communication can unify "Islands of Control"	D				
17.7 Describe the typical architecture of a SCADA system	D				
17.8 Identify the precursor technologies that contributed to SCADA	D				
17.9 Recognize the significant cost of process interface equipment	D				
17.10 Explain special considerations of the sensors and actuators selection and installation process	D				
17.11 Describe the elements of PC control	D				
17.12 Explain the advantages of programmable Logic Controllers (PLCs)	D				
17.13 Describe the benefits, functions, and shortcomings of common communications equipment used in SCADA systems	D				
17.14 Describe the communications terms as they relate to remote data acquisition and control	D				

17.0 SCADA (Supervisory Control and Data Acquisition) Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
17.15 Define real time in SCADA systems	D				
17.16 List the functions, benefits, and shortcomings of common topologies used in SCADA	D				
17.17 Describe the advantages of distributed Input/Output (I/O)	D				
17.18 Identify and describe Safety Instrumented Systems	D				
17.19 Demonstrate knowledge of the basic technology of each of SCADA's major building blocks					
17.19.1 Identify functional components of the SCADA system	D				
17.19.2 Describe placement and installation of components	D				
17.19.3 Explain the operational characteristics of each component	D				
17.20 Determine when a SCADA system would be useful to your operation					
17.20.1 Explain various ways information is presented from the system to the operator	D				
17.20.2 Describe how the SCADA system can be developed to make the presentation of information to the operator more effective	D				
17.20.3 Identify range limits	D				
17.20.4 Identify the elements of alarm management	D				
17.20.5 Describe alarm access architecture	D				
17.20.6 Describe database technology in SCADA	D				
17.20.7 Identify the uses of date/time stamp	D				
17.20.8 Describe the uses of preformatted vs. ad-hoc reporting	D				
17.21 Select the appropriate SCADA technologies for your operational requirements					
17.21.1 Determine the functional requirements of the system being monitored	D				
17.21.2 Explain functional characteristics of different topologies	D				
17.21.3 Explain the interconnectivity of various control systems	D				
18.0 SENSORS AND INSTRUMENTATION					
18.1 Pressure sensing devices					
18.1.1 Describe the theory of operation for pressure sensing devices	D				
18.1.2 List the components normally used in a pressure sensing system and explain their function	D				
18.1.3 Explain the various Units of measurement used with pressure sensing devices	D				

18.0 SENSORS AND INSTRUMENTATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
18.1.4 Explain how data derived from pressure sensing systems is used in wind farms	D				
18.1.5 Demonstrate the ability to trouble shoot pressure sensing systems and identify malfunctioning components	4d				
18.1.6 Demonstrate the ability to remove and replace defective components used in the pressure sensing systems of a wind farm	4d				
18.1.7 Demonstrate the ability perform a functional check of pressure sensing systems used in wind farms	4d				
18.1.8 Demonstrate the ability perform a serviceability inspection of pressure sensing systems used in wind farms	4d				
18.2 Inductive and capacitive proximity position sensing systems					
18.2.1 Describe the theory of operation for both inductive and capacitive proximity position sensing devices	D				
18.2.2 List the components normally used in a position sensing system and explain their function	D				
18.2.3 Explain the various units of measurement used with position sensing devices	D				
18.2.4 Explain how data derived from position sensing systems is used in wind farms	D				
18.2.5 Demonstrate the ability to troubleshoot position sensing systems and identify malfunctioning components	4d				
18.2.6 Demonstrate the ability to remove and replace defective components used in the position sensing systems of a wind farm	4d				
18.2.7 Demonstrate the ability perform a functional check of position sensing systems used in wind farms	4d				
18.2.8 Demonstrate the ability perform a serviceability inspection of position sensing systems used in wind farms	4d				
18.3 Temperature sensing devices					
18.3.1 Describe the theory of operation for temperature sensing devices	D				
18.3.1.1 Thermocouple	D				
18.3.1.2 RTDS (Resistance Temperature Detection Sensors)	D				
18.3.2 List the components normally used in a temperature sensing system and explain their function	D				
18.3.3 Explain the various units of measurement used with temperature sensing devices	D				
18.3.4 Explain how data derived from temperature sensing systems is used in wind farms	D				

18.0 SENSORS AND INSTRUMENTATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
18.3.5 Demonstrate the ability to trouble shoot temperature sensing systems and identify malfunctioning components	4d				
18.3.6 Demonstrate the ability to remove and replace defective components used in the temperature sensing systems of a wind farm	4d				
18.3.7 Demonstrate the ability perform a functional check of temperature sensing systems used in wind farms	4d				
18.3.8 Demonstrate the ability perform a serviceability inspection of temperature sensing systems used in wind farms	4d				
18.3.9 Define 'temperature' and explain the various temperature scales in use	D				
18.4 Wind speed sensing devices					
18.4.1 Describe the theory of operation for wind speed sensing devices					
18.4.1.1 Sonic anemometers	D				
18.4.1.2 Three-cup anemometers	D				
18.4.1.3 Propeller anemometers	D				
18.4.2 List the components normally used in a wind speed sensing system and explain their function	D				
18.4.3 Explain the various units of measurement used with wind speed sensing devices	D				
18.4.4 Explain how data derived from wind speed sensing systems is used in wind farms	4d				
18.4.5 Demonstrate the ability to trouble shoot wind speed sensing systems and identify malfunctioning components	4d				
18.4.6 Demonstrate the ability to remove and replace defective components used in the wind speed sensing systems of a wind farm	4d				
18.4.7 Demonstrate the ability perform a functional check of wind speed sensing systems used in wind farms	4d				
18.4.8 Demonstrate the ability perform a serviceability inspection of wind speed sensing systems used in wind farms					
18.5 Wind direction sensing devices	D				
18.5.1 Describe the theory of operation for wind direction sensing devices	D				
18.5.2 List the components normally used in a wind direction sensing system and explain their function	D				
18.5.3 Explain the various Units of measurement used with wind direction sensing devices	D				
18.5.4 Explain how data derived from wind direction sensing systems is used in wind farms	D				

18.0 SENSORS AND INSTRUMENTATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
18.5.5 Demonstrate the ability to trouble shoot wind direction sensing systems and identify malfunctioning components	4d				
18.5.6 Demonstrate the ability to remove and replace defective components used in the wind direction sensing systems of a wind farm	4d				
18.5.7 Demonstrate the ability perform a functional check of wind direction sensing systems used in wind farms	4d				
18.5.8 Demonstrate the ability perform a serviceability inspection of wind direction sensing systems used in wind farms	4d				
18.5.9 Describe a wind vane that would normally be used in wind farms	D				
18.6 Vibration detection systems					
18.6.1 Describe the theory of operation for vibration detection devices	D				
18.6.2 List the components normally used in a vibration detection system and explain their function	D				
18.6.3 Explain the various units of measurement used with vibration detection devices	D				
18.6.4 Explain how data derived from vibration detection systems is used in wind farms	D				
18.6.5 Demonstrate the ability to trouble shoot vibration detection systems and identify malfunctioning components	4d				
18.6.6 Demonstrate the ability to remove and replace defective components used in the vibration detection systems of a wind farm	4d				
18.6.7 Demonstrate the ability perform a functional check of vibration detection systems used in wind farms	4d				
18.6.8 Demonstrate the ability perform a serviceability inspection of vibration detection systems used in wind farms	4d				
18.7 Explain the theory of operation and use of an accelerometer	D				
18.8 Explain the theory of operation and use of a strain gage	D				
18.9 Electrical Measurement devices					
18.9.1 Explain the theory of operation and use of electrical measurement devices					
18.9.1.1 Current	D				
18.9.1.2 Voltage	D				
18.9.1.3 Resistance	D				
18.9.1.4 Power	D				

18.0 SENSORS AND INSTRUMENTATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
18.10 Explain the theory of operation and use of encoders used in wind farms					
18.10.1 Incremental	D				
18.10.2 Absolute	D				
18.10.3 Shaft encoders	D				
18.11 Explain the theory of phasor measurement units and how they are used in wind farms	D				
18.12 Explain the theory of phasor data concentrators and how they are used in wind farms	D				
19.0 TOOLS AND THEIR USE					
19.1 Demonstrate the ability to select, maintain, and safely use the proper tool for a given job:					
19.1.1 Hand tools					
19.1.1.1 Drivers					
19.1.1.1.1 Nut	4d				
19.1.1.1.2 Allen	4d				
19.1.1.1.3 Common or flat blade	4d				
19.1.1.1.4 Torx	4d				
19.1.1.1.5 Cross tip	4d				
19.1.1.1.6 Cross Head	4d				
19.1.1.1.7 Clutch head-old style	4d				
19.1.1.1.8 Clutch head-new style	4d				
19.1.1.1.9 Offset	4d				
19.1.1.2 Wrenches					
19.1.1.2.1 Open end	4d				
19.1.1.2.2 Box end	4d				
19.1.1.2.3 Adjustable jaw	4d				
19.1.1.2.4 Socket	4d				
19.1.1.2.5 Pipe	4d				
19.1.1.2.6 Crowfoot	4d				
19.1.1.2.7 Ford	4d				
19.1.1.2.8 Strap	4d				
19.1.1.2.9 B-nut	4d				
19.1.1.2.10 Hook	4d				

19.0 TOOLS AND THEIR USE Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
19.1.1.2.11 Spanner	4d				
19.1.1.2.12 Combination	4d				
19.1.1.3 Hammers					
19.1.1.3.1 Claw	C				
19.1.1.3.2 Ball peen	4d				
19.1.1.3.3 Cross peen	A				
19.1.1.3.4 Sledge	A				
19.1.1.3.5 Riveting	A				
19.1.1.3.6 Soft-Faced	3c				
19.1.1.3.7 Mallet	3c				
19.1.1.4 Measuring devices					
19.1.1.4.1 Rules and steel tapes	4d				
19.1.1.4.2 Dividers	3c				
19.1.1.4.3 Calipers	3c				
19.1.1.4.4 Micrometers	3c				
19.1.1.4.5 Squares	A				
19.1.1.4.6 Snap gage	A				
19.1.1.4.7 Depth and height gages	A				
19.1.1.4.8 Protractors	3c				
19.1.1.4.9 Wire gages	4d				
19.1.1.4.10 Screw pitch gage	4d				
19.1.1.4.11 Center gage	A				
19.1.1.4.12 Telescoping gage	A				
19.1.1.4.13 Thread cutting tool gage	B				
19.1.1.4.14 Fillet and radius gage	A				
19.1.1.4.15 Drill point gage	A				
19.1.1.4.16 Drill gage	4d				
19.1.1.4.17 Marking gage	A				
19.1.1.4.18 Ring gage	A				
19.1.1.4.19 Levels	3c				
19.1.1.4.20 Plumb bobs	3c				

19.0 TOOLS AND THEIR USE Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
19.1.1.5 Pliers					
19.1.1.5.1 Diagonal Cutting	4d				
19.1.1.5.2 Needle nose	4d				
19.1.1.5.3 Common	4d				
19.1.1.5.4 Slip Joint	4d				
19.1.1.5.5 Vise grips	4d				
19.1.1.5.6 Flat nose or Duckbill	4d				
19.1.1.5.7 Round nose	4d				
19.1.1.5.8 Linemen's	A				
19.1.1.6 Vises	4d				
19.1.1.7 Jacks	4d				
19.1.1.8 Drills	4d				
19.1.1.8.1 Brace	3c				
19.1.1.8.2 Hand	A				
19.1.1.9 Extractors					
19.1.1.9.1 Screw	4d				
19.1.1.9.2 Tap	4d				
19.1.1.9.3 Cotter pin	4d				
19.1.1.10 Hack Saw	4d				
19.1.1.11 Pullers					
19.1.1.11.1 Universal gear	4d				
19.1.1.11.2 Gear and bearing	4d				
19.1.1.11.3 Universal bearing and bushing	4d				
19.1.1.11.4 Electrical unit bearing puller	4d				
19.1.1.11.5 Battery Terminal	4d				
19.1.1.11.6 Wheel	4d				
19.1.1.11.7 Slide hammer	4d				
19.1.1.12 Benders					
19.1.1.12.1 Spring tube	A				
19.1.1.12.2 Hand tube	A				
19.1.1.13 Sharpening stone	4d				
19.1.1.14 Hand grinders	A				
19.1.1.15 Scribes	3c				

19.0 TOOLS AND THEIR USE Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
19.1.1.16 Punches	3c				
19.1.1.17 Chisels	3c				
19.1.1.18 Bolt and cable cutters	3c				
19.1.1.19 Tube cutting and flaring tools	4d				
19.1.1.20 Clamps	3c				
19.1.1.21 Taps and dies	4d				
19.1.1.22 Reamers	4d				
19.1.2 Specials tools					
19.1.2.1 Torque wrenches					
19.1.2.1.1 Hand	4d				
19.1.2.1.2 Hydraulic	4d				
19.1.3 Power tools					
19.1.3.1 Drills	4d				
19.1.3.2 Saws	4d				
19.1.3.3 Grinders	4d				
19.1.3.4 Drivers	4d				
19.1.3.5 Sanders	4d				
19.1.3.6 Winch	4d				
19.1.3.7 Hoist	4d				
19.2 Tool management					
19.2.1 Storage	D				
19.2.2 Accountability	D				
19.2.3 Inspection	D				
20.0 TEST EQUIPMENT					
20.1 Meter Display					
20.1.1 Interpret analog and digital displays	D				
20.1.2 Identify range, units	C				
20.2 Voltage Measurement					
20.2.1 Demonstrate proper connection to circuit under test	4d				
20.2.2 Explain proper input techniques and meter selection	D				
20.3 Amperage Measurement					
20.3.1 Demonstrate proper connection to circuit under test	4d				
20.3.2 Demonstrate how to properly test fused inputs to meter	4d				

20.0 TEST EQUIPMENT Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
20.3.3 Demonstrate how to properly use a clamp-on ammeter	4d				
20.3.4 Explain proper input techniques and meter selection	D				
20.4 Resistance					
20.4.1 Demonstrate proper connection to circuit under test	4d				
20.4.2 Demonstrate proper input and meter selection	4d				
20.5 Megohmmeter					
20.5.1 Demonstrate proper use of megohmmeter to test insulation of motors and cables	4d				
20.6 Non-Contact Temperature Measurement					
20.6.1 Explain the principle of infrared temperature measurement	D				
20.7 Perform a proper inspection of test leads and meter	4d				
21.0 PREVENTIVE MAINTENANCE AND TROUBLESHOOTING					
21.1 Explain the need for time scheduled maintenance inspection and service events:					
21.1.1 Calendar scheduled	D				
21.1.2 Hourly scheduled	D				
21.2 Demonstrate the ability to read and interpret the manufacturers recommended procedures, schematics and technical literature	4d				
21.3 Given the manufacturers recommended procedures and proper tools demonstrate the ability to properly check and adjust power supplies to the manufacturer's specifications	4d				
21.4 Demonstrate the ability to do a 10% torque test in accordance with the manufacturers recommended procedures	4d				
21.5 Given the manufacturers recommended procedures and proper tools demonstrate the ability to apply proper torque.	4d				
21.6 Demonstrate the ability to do a tower walk-through (top to bottom) inspection	4d				
21.7 Demonstrate the ability to do a corrosion control inspection and identify areas for remediation.	4d				
21.8 Demonstrate the ability to interpret fault codes	4d				
21.9 Demonstrate the ability to interpret SCADA logs	4d				
21.10 Demonstrate the ability to perform a functional check of a commercial wind turbine.	4d				
21.11 Demonstrate the ability to identify malfunctioning sub systems in a commercial wind turbine.	4d				
21.12 Demonstrate the ability to interpret historical maintenance information and develop maintenance policy	4d				

22.0 SAFETY	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
22.1 Occupational Safety and Health Act					
22.1.1 Identify the value of Safety and Health	D				
22.1.2 Understand his/her rights and responsibilities under OSHA	D				
22.1.3 Demonstrate knowledge of OSHA inspections, citations and penalties	4d				
22.2 Fall Protection					
22.2.1 Identify hazards associated with walking and working surfaces	D				
22.2.2 Identify requirements for fall protection in the wind industry under OSHA requirements	D				
22.3 Fire Protection					
22.3.1 Identify the types of fires and the extinguisher used for each	D				
22.3.2 Evaluate emergency action plans	D				
22.4 Electrical Safety					
22.4.1 Identify the hazards of electric shock	D				
22.4.2 Recognize, evaluate, and control electrical hazards	D				
22.4.3 Explain proper lockout/tagout procedures	D				
22.4.4 Explain proper ladder safety procedures	D				
22.5 Personal Protective Equipment					
22.5.1 Explain proper eye protection procedures	D				
22.5.2 Explain proper use of the hard hat	D				
22.5.3 Explain proper foot protection techniques	D				
22.5.4 Explain proper use of protective clothing	D				
22.6 Hazard Communication					
22.6.1 Identify hazards through Material Safety Data Sheet	D				
22.6.2 Use proper materials handling	D				
22.7 Confined Spaces					
22.7.1 Define a confined space	D				
22.7.1 Determine if the space is a permitted confined space	D				
22.8 First Aid					
22.8.1 Understand Industrial Hygiene	D				
22.8.2 Demonstrate the ability to administer CPR and first aid for electrical shock and burns	4d				
22.8.3 Identify blood-borne pathogens and precautions used	C				

23.0 CUSTOMER SERVICE AND COMMUNICATION	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
23.1 Demonstrate the ability to produce written communication customarily required in the commercial wind industry					
23.1.1 Technical report	4d				
23.1.2 Incident report	4d				
23.1.3 Letter of inquiry	4d				
23.1.4 Letter of apology	4d				
23.1.5 Letter of introduction	4d				
23.1.6 Announcements	4d				
23.1.7 Job Review	4d				
23.1.8 Policy letters	4d				
23.1.9 Statements of Work	4d				
23.1.10 Technical Manuals	4d				
23.1.11 Technical Letters of Instruction	4d				
23.1.12 Technical Logs	4d				
23.1.13 Demonstrate the ability to perform written record keeping customarily required in the commercial wind industry	4d				
23.2 Demonstrate the ability to conduct proper verbal communication customarily required in the commercial wind industry					
23.2.1 Give a technical explanation of the operation of a subsystem to a customer	D				
23.2.2 Demonstrate proper phone etiquette	4d				
23.2.3 Demonstrate the ability to listen to verbal instructions	4d				
23.3 Demonstrate the ability to properly use digital communications					
23.3.1 Demonstrate proper email etiquette	4d				
23.3.2 Demonstrate proper fax etiquette	4d				
23.3.3 Demonstrate proper texting etiquette	4d				
23.4 Explain the effects good customer service has on sales and marketing					
23.4.1 Explain the difference between sales and marketing	C				
23.4.2 Explain key sales strategies and how the commercial wind technician's personal relationships with the customer can affect each of these	C				
23.4.3 Define the three functions of customer service	C				
23.4.3.1 General customer support	C				
23.4.3.2 Technical customer support	C				
23.4.3.3 Customer satisfaction monitoring	C				

23.0 CUSTOMER SERVICE AND COMMUNICATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
23.4.4 Define the five techniques used to maintain world-class customer service:	C				
23.4.4.1 Commitment to quality	C				
23.4.4.2 Focused customer service	C				
23.4.4.3 Customer involvement	C				
23.4.4.4 Continuous improvement	C				
23.4.4.5 Integrity	C				
23.5 Define the characteristics of a pro-profit employee	C				
23.6 Explain the legal responsibilities a worker has in relation to coworkers, the company, and the customer	C				
23.7 Describe the different legal relationships and responsibilities a company employee has as compared to an independent contractor	C				
23.8 Describe the proper way an employee should deal with company policies, both good and bad	C				
23.9 Demonstrate the ability to conduct a performance evaluation on a subordinate:	4d				
23.9.1 Written	4d				
23.9.2 Verbal	4d				
23.10 Demonstrate the ability to differentiate between ethical and unethical behavior in the conduct of commercial wind operations	4d				
23.11 Explain the affects that company pride and loyalty have on good customer relations	C				
23.12 Explain the proper techniques for handling personal emotions when dealing with both coworkers and customers	C				
23.13 Explain the employee responsibilities and techniques for protecting customer values and property	D				
23.14 Demonstrate the ability to handle conflicts with:					
23.14.1 Customers	4d				
23.14.2 Co-workers	4d				
23.14.3 Subordinates	4d				
23.14.4 Supervisors	4d				
23.14.5 Venders	4d				
23.15 Demonstrate the ability to overcome resistance to change with:					
23.15.1 Yourself	4d				
23.15.2 Customers	4d				
23.15.3 Co-workers	4d				

23.0 CUSTOMER SERVICE AND COMMUNICATION Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
23.15.4 Subordinates	4d				
23.15.5 Supervisors	4d				
23.15.6 Venders	4d				
24.0 WIND FARM MANAGEMENT					
24.1 Describe the factors that affect wind farm energy production availability, and best practices to effect a positive outcome					
24.1.1 Warranty/Contractual Availability	D				
24.1.2 SCADA Status Counters:	D				
24.1.2.1 Down Time	D				
24.1.2.2 Line out Time	D				
24.1.2.3 Maintenance Time	D				
24.1.2.4 Repair time	D				
24.1.3 Force Majeure	D				
24.2 Explain the wind farm production metrics and how they are used to manage wind farms					
24.2.1 Units of Production (Gigawatt Hours)	D				
24.2.2 Capacity factor	D				
24.2.3 Rated power	D				
24.2.4 Power curve	D				
24.2.5 Net production	D				
24.2.6 Line loss	D				
25.0 CODES AND STANDARDS					
25.1 IEC 1400-11 Acoustic Emission Measurements					
25.2 IEC 1400-12-1 Performance Measurements					
25.3 IEC 1400-13 Structural Loads Measurements					
25.4 IEC 1400-14 Decoration of Apparent Sound Power Level and Tonality					
25.5 IEC 1400-21 Power Quality Measurements					
25.6 IEC 1400-22 Wind Turbine Certification					
25.7 IEC 1400-23 Blade Structural Testing					
25.8 AGMA 6006-A03 Standard Design and Specification of Gearboxes for Wind Turbines					
25.9 IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems					
25.10 NEC Article 100 General Wiring					

25.0 CODES AND STANDARDS Cont'd.	Lev 3	OJT Start Date	OJT End Date	Trainer Initials	Comments
25.11 NEC Article 250 Grounding and Bonding	D				
25.12 NEC Article 445 Generators	D				
25.13 NEC Article 685 Integrated Electrical Systems	D				
25.14 NEC Article 700 Emergency Systems	D				
25.15 NEC Article 705 Interconnected Electric Power Production Sources	D				
25.16 NFPA 500 Building Construction and Safety Code	D				
25.17 NFPA 900 Building Energy Code	D				
25.18 UL 1741 Standards for Static Inverters, Converters & Controllers for use in Independent Power Systems	D				
25.19 ASSE A10.21-20xx American National Standard for the Safe Construction and Demolition of Wind Generation/Turbine Facilities	D				
25.20 FAA Form 7460	D				
25.21 FAA Wind Letter Volume 22, Issue 8	D				
END OF COMMERCIAL WIND MAINTAINER OJT					