

Crosswalk to the AWEA Core Skill Set (as of February, 2012)

The following table reflects the latest AWEA core skill set. Although their skill set is still listed as a “draft” because not all components (safety) have been completed, it is not expected to change in the Operational, Mechanical, Electrical, and General Work Skills areas. AWEA has not published a safety skill set as yet because they are waiting on OSHA to determine their requirements for national standards on safety for Wind Turbine Technicians.

AWEA Tasks	MAVCC Tasks
Operational Skills	
A. Turbine Fundamentals	
1. Identify the component, component location, and describe the general function and purpose of the following components:	
– Foundation	Unit 1, Object 8—Wind turbine foundations
– Tower	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Ladder	Unit 8, Objective 4—Components of a basic hydraulic system and their functions Unit 8, Job Sheet 1—Change fluids and filters; check system fluid level
– Nacelle	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Hub	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Blades	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 6, Objective 2—Types of wind turbine blades and blade construction Unit 6, Objective 3—Inspection and maintenance Unit 6, Student Supplement 1—Theory of turbine blade design/shape Unit 6, Student Supplement 2—Blade inspection and defect list
– Main Shaft	Unit 1, Objective 10—Parts of a wind turbine and their functions
–Gearbox	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 6, Objective 6—Types of gearboxes and their uses Unit 6, Student Supplement 5—Gearbox inspection procedures and troubleshooting
– High speed shaft	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Generator	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 7, Objective 26—Generators

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AWEA Tasks	MAVCC Tasks
Operational Skills	
A. Turbine Fundamentals (cont.)	
– Brake system	Unit 6, Objective 8—Components of a yaw system
– Controllers	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Transformers	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 7, Objective 23—Characteristics of a transformer
– Yaw assemblies	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 6, Objective 8—Components of a yaw system
– Pitch systems	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Hydraulic station	Unit 8, Objective 7—Components of hydraulic systems found in a wind turbine
– Tower cables	Unit 5, Objective 3—Fall protection system Unit 5, Objective 4—Rescue equipment Unit 5, Objective 5—Rescue equipment inspections and recordkeeping Unit 5, Objective 6—How to climb and descend
– Safety cable	Unit 5, Objective 3—Fall protection system Unit 5, Objective 4—Rescue equipment Unit 5, Objective 5—Rescue equipment inspections and recordkeeping Unit 5, Objective 6—How to climb and descend
– Service lift and climb assist	Unit 5, Objective 3—Fall protection system Unit 5, Objective 4—Rescue equipment
– Anemometer	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 7, Objective 32—Programmable Logic Controller (PLC)
– Wind vane	Unit 1, Objective 10—Parts of a wind turbine and their functions Unit 7, Objective 32—Programmable Logic Controller (PLC)
– FAA lighting	Unit 1, Objective 10—Parts of a wind turbine and their functions
– Internal crane	Unit 2, Objective 28—Safety considerations for working around cranes
– Sensors and general operation	Unit 6, Objective 8—Components of a yaw system Unit 7, Objective 32—Programmable Logic Controller (PLC)
2. Understand importance of referring to work instructions or maintenance manuals to determine how each job function is accomplished.	Throughout

AWEA Tasks	MAVCC Tasks
Operational Skills	
B. Maintenance Operations	
1. Understand SCADA basics.	Unit 7, Objective 33—SCADA
2. Understand maintenance operations in general.	Unit 4, Objective 14—Housekeeping on the job
3. Describe the function of a service report, demonstrate how to properly complete a service report, and explain what happens and where it goes when a service report is completed.	Unit 4, Assignment Sheet 3—Fill out an accident report Unit 6, Job Sheet 1—Inspect a wind turbine blade for damage (complete a damage report) Unit 6, Job Sheet 2—Inspect bearings (fill out a failure report)
4. Explain purpose and difference between scheduled and unscheduled maintenance.	Unit 1, Objective 15—Inspection, intervals and maintenance cycles
5. Describe function and general operation of sensors and instrumentation used in wind turbines to monitor pressure, temperature, flow, and level.	Unit 6, Objective 8—Components of a yaw system Unit 7, Objective 11—Applications of direct current (DC) circuits Unit 7, Objective 31—Sensors
C. Cranes and Rigging	Not covered
D. Project Operations	
1. Balance of plant requirements and expectations pertaining to wind turbine operation	Unit 1, Objective 11—Emerging applications of wind energy
2. Identify components that make up balance of plant including: roles and responsibilities of wind farm personnel positions, and chain of command. (Not specific to maintenance of wind turbine)	Unit 1, Objective 9—Wind farms Unit 1, Objective 14—Job classifications for wind turbine technicians
Mechanical Skills	
A. Bearings	
1. Understand basic bearing types designed for different loads.	Unit 6, Objective 4—Types of bearings
2. Understand installation.	Unit 6, Objective 5—Inspection and maintenance of bearings
3. Understand maintenance/visual inspection.	Unit 6, Objective 5—Inspection and maintenance of bearings Unit 6, Student Supplement 3—Inspection and evaluation of bearings Unit 6, Student Supplement 4—Bearing failure symptoms, causes, and fixes Unit 6, Job Sheet 2—Inspect bearings (fill out a failure report)

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AWEA Tasks	MAVCC Tasks
Mechanical Skills	
A. Bearings (cont.)	
4. Understand replacement.	Unit 6, Objective 5—Inspection and maintenance of bearings
5. Understand lubrication.	Unit 6, Objective 5—Inspection and maintenance of bearings Unit 6, Job Sheet 2—Inspect bearings (fill out a failure report)
6. Understand do's and don'ts (best practices).	Unit 6, Objective 5—Inspection and maintenance of bearings Unit 6, Student Supplement 3—Inspection and evaluation of bearings Unit 6, Student Supplement 4—Bearing failure symptoms, causes, and fixes
B. Cooling/Heating Systems	
1. Understand inspection, maintenance, and operation (types of coolant, function, flow meters, types of systems for air a fluid).	Unit 6, Objective 9—Components of a cooling system Unit 6, Objective 10—Inspection and maintenance of a cooling system Unit 6, Objective 11—Components of a heating system
C. Fasteners and Torquing	
1. Basic understanding of metallurgical characteristics as it pertains to fasteners	Unit 6, Objective 15—Types of fasteners Unit 6, Objective 16—Characteristics of threaded fasteners
2. Demonstrate safe use of various torque and tension equipment.	Unit 6, Objective 19—Torquing safety Unit 6, Objective 20—Types of torquing tools Unit 6, Job Sheet 5—Assemble and check operation of a power torquing unit Unit 6, Job Sheet 6—Use a power torquing unit to torque bolts Unit 6, Job Sheet 8—Use a hydraulic tensioning unit to tension bolts
3. Understand basic hi-torque use and proper techniques of mechanical, electrical, and hydraulic torque wrench assembly and use.	Unit 6, Objective 12—Tools used in maintaining mechanical systems Unit 6, Objective 21—Components of hydraulic torquing tools Unit 6, Objective 22—How to use a hydraulic torquing tool Unit 6, Student Supplement 6—Hytorc standard torque chart Unit 6, Assignment Sheet 1—Select correct torque sequence Unit 6, Job Sheet 5—Assemble and check operation of a power torquing unit Unit 6, Job Sheet 6—Use a power torquing unit to torque bolts

AWEA Tasks	MAVCC Tasks
Mechanical Skills	
C. Fasteners and Torquing (cont.)	
4. Define the difference between torquing and tension.	Unit 6, Objective 23—Tensioning applications
5. Demonstrate proper use and storage in handling of mechanical torque wrench; use of a skidmore and torque log.	Unit 6, Job Sheet 7—Use a torque wrench to torque bolts to a specified BAR/Newton meter a failure report)
D. Gearboxes	
1. Basic characteristics of gearboxes: types of gear systems in gear boxes, maintenance, filter, cleanliness, lubrication, pumps, impurities	Unit 6, Objective 6—Types of gearboxes and their uses Unit 6, Objective 7—Inspection and maintenance of gearboxes Unit 6, Job Sheet 3—Inspect a gearbox for damage and wear (complete an inspection report)
2. Understand process and significance of oil sampling.	Unit 6, Objective 5—Inspection and maintenance of bearings Unit 6, Objective 7—Inspection and maintenance of gearboxes Unit 8, Job Sheet 2—Take an oil sample from a hydraulic system reservoir; complete form and labels
3. Understand inspection methods: normal wear or damage, gear ratios, input/output torque and force requirements.	Unit 6, Objective 6—Types of gearboxes and their uses Unit 6, Student Supplement 5—Gearbox inspection procedures and troubleshooting Unit 6, Job Sheet 3—Inspect a gearbox for damage and wear (complete an inspection report)
4. Do's and don'ts, functions, general operations	Unit 6, Objective 6—Types of gearboxes and their uses Unit 6, Objective 7—Inspection and maintenance of gearboxes Unit 6, Student Supplement 5—Gearbox inspection procedures and troubleshooting
E. Hydraulic Systems	
1. Basic theory of hydraulics	Unit 8, Objective 5—Basic operation of a hydraulic system Unit 8, Objective 6—Basic hydraulic principles and their applications Unit 8, Objective 7—Components of hydraulic systems found in a wind turbine
2. Basic understanding of hydraulic symbols and charts	Unit 4, Assignment Sheet 4—Identify types of schematics Unit 8, Objective 9—Schematics of hydraulic systems

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AWEA Tasks	MAVCC Tasks
Mechanical Skills	
E. Hydraulic Systems (cont.)	
3. Demonstrate component verification and component function including: function of various pumps, meaning of pump parameters, and types of hydraulic systems.	Unit 8, Objective 6—Basic hydraulic principles and their applications Unit 8, Objective 7—Components of hydraulic systems found in a wind turbine Unit 8, Job Sheet 4—Test hydraulic pressure in system and accumulator
4. Understand function, implementation, and disassembly and assembly of hydraulic components: cylinders, pumps, valves, filters, concepts of hydraulic circuit construction and uses.	Unit 8, Objective 4—Components of a basic hydraulic system and their functions Unit 8, Objective 10—Leak detection and repair Unit 8, Objective 11—Troubleshooting/Diagnosing a hydraulic system Unit 8, Student Supplement 1—How a pitch ram works Unit 8, Job Sheet 1—Change fluid and filters; check system fluid level Unit 8, Job Sheet 3—Replace faulty lines, connectors, and valves
F. Lubrication	
1. Basic principles of lubrication: sampling, different types of lubricants and uses, lubrication methods, basic knowledge of auto lubers	Unit 6, Objective 5—Inspection and maintenance of bearings Unit 8, Objective 8—Wind turbine hydraulic fluid considerations Unit 8, Student Supplement 2—Equivalent viscosity of ISO-VG grades and SAE crankcase oil grades
2. Contamination control and effects of poor lubrication	Unit 8, Objective 5—Basic operation of a hydraulic system Unit 8, Objective 7—Components of hydraulic systems found in a wind turbine
3. Oil and grease; oil base (soap, clays, synthetic animal byproduct); impurities, byproducts; self-lubricators, grease gun; maintenance and troubleshooting	Unit 8, Objective 8—Wind turbine hydraulic fluid considerations
G. Shaft Alignment	
1. Demonstrate knowledge of basic principles, methods and techniques of shaft alignment, such as laser equipment in the laser alignment process.	Unit 6, Objective 12—Tools used in maintaining mechanical systems Unit 6, Objective 13—Methods of determining shaft alignment tolerances Unit 6, Job Sheet 4—Use laser alignment tool
H. Tools and Test Equipment	
1. Demonstrate proper tool inspection and inventory tool control.	Unit 4, Job Sheet 2—Perform shop clean-up and tool inventory duties Unit 6, Objective 12—Tools used in maintaining mechanical systems

AWEA Tasks	MAVCC Tasks
Mechanical Skills	
H. Tools and Test Equipment (cont.)	
2. Steps for taking care of a defective tool	Unit 4, Job Sheet 2—Perform shop clean-up and tool inventory duties
3. Demonstrate ability to measure and interpret information from test equipment and tools. Multimeter voltage detectors.	Unit 6, Objective 12—Tools used in maintaining mechanical systems Unit 7, Job Sheet 1—Use a multimeter to diagnose electrical conditions Unit 7, Job Sheet 2—Repair/Replace components of an electrical device
4. Demonstrate proper selection of test equipment.	Unit 7, Student Supplement 2—Multimeters
I. Yaw Systems	
1. Basic understanding of Yaw systems	Unit 6, Objective 8—Components of a yaw system
2. Maintenance routines: potential failures and preventive maintenance	Unit 6, Objective 8—Components of a yaw system
3. Function of Yaw control system including: wind vane, anemometer, yaw angle (alignment vs. misalignment), and Yaw drive system	Unit 6, Objective 8—Components of a yaw system
Electrical Skills	
A. Electrical Theory	
1. Understand and comprehend basic electrical theory.	Unit 7, Objective 2—Principles of electron flow Unit 7, Objective 3—Basic sources of electrical generation Unit 7, Objective 4—Voltage, resistance, current, power Unit 7, Objective 5—Ohm's law Unit 7, Objective 6—Uses of Ohm's law Unit 7, Objective 7—Units of measure formulas from Ohm's law Unit 7, Objective 8—Ohm's law for power Unit 7, Objective 9—Uses of Ohm's law for power Unit 7, Objective 10—Units of measure formulas from Ohm's law for power Unit 7, Student Supplement 1—Facts about magnetism

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AWEA Tasks	MAVCC Tasks
Electrical Skills	
A. Electrical Theory (cont.)	
<p>2. AC/DC voltage and current principles, resistance (series and parallel circuits), inductance, and capacitance</p>	<p>Unit 7, Objective 4—Voltage, resistance, current, power Unit 7, Objective 11—Applications of direct current (DC) circuits Unit 7, Objective 12—Application of Ohm’s law to DC circuits Unit 7, Objective 13—Characteristics of series circuits Unit 7, Objective 14—Kirchoff’s voltage law Unit 7, Objective 15—Characteristics of parallel circuits Unit 7, Objective 16—Kirchoff’s current law Unit 7, Objective 17—Characteristics of capacitance Unit 7, Objective 18—Types, ratings, and common defects of capacitors Unit 7, Objective 19—Uses of capacitors Unit 7, Objective 20—Principles of alternating current (AC) circuits Unit 7, Objective 21—Principles of induction Unit 7, Objective 22—Characteristics of inductance Unit 7, Objective 24—Single and three-phase AC circuits Unit 7, Assignment Sheet 1—Solve problems for unknown voltage Unit 7, Assignment Sheet 2—Solve problems for unknown amperage Unit 7, Assignment Sheet 3—Solve problems for unknown resistance and wattages Unit 7, Assignment Sheet 4—Solve problems for an unknown quantity Unit 7, Assignment Sheet 5—Determine total resistance in series circuits Unit 7, Assignment Sheet 6—Determine unknown resistance values in series circuits Unit 7, Assignment Sheet 7—Solve problems for unknown current in series circuits Unit 7, Assignment Sheet 8—Solve problems for unknown resistance in series circuits Unit 7, Assignment Sheet 9—Solve problems for unknown voltage in series circuits Unit 7, Assignment Sheet 10—Solve problems for unknown resistance in parallel circuits Unit 7, Assignment Sheet 11—Solve problems unknown current in parallel circuits Unit 7, Assignment Sheet 12—Apply Kirchoff’s current law to parallel circuits</p>

AWEA Tasks	MAVCC Tasks
Electrical Skills	
A. Electrical Theory (cont.)	
3. Understand power generation principles.	Unit 7, Objective 3—Basic sources of electrical generation
4. Understand and identify electrical components such as motor starter, manual switches, control relays.	Unit 7, Objective 23—Characteristics of a transformer Unit 7, Objective 26—Generators Unit 7, Objective 27—Electric motors Unit 7, Objective 28—Motor starters Unit 7, Objective 29—Relays Unit 7, Objective 30—Batteries
5. Demonstrate ability to work safely around transformers.	Unit 3, Objective 5—Safety practices around live circuits
B. Basic Wiring	
1. Ability to inspect conductors and connectors used in wind turbines through visual inspection to identify the following: open circuit, shorted circuit, ground, turbine type wiring connectors	Unit 7, Objective 34—Characteristics of good connections Unit 7, Objective 35—Types of connectors, terminals, and lugs
2. Understand the limitations of wire gauge capacity.	Not covered
3. Circuit diagnostics tools used in basic wiring such as: voltage testing, ohm meter testing, basic wiring tools	Unit 7, Objective 25—Types of test equipment Unit 7, Student Supplement 2—Multimeters
4. Describe the methods of conductor strain relief, insulation and termination of conductive paths.	Unit 7, Objective 35—Types of connectors, terminals, and lugs
5. Demonstrate insulation testing.	Unit 7, Objective 25—Types of test equipment
6. Wiring diagrams, schematics, U.S. and European component symbols	Unit 4, Assignment Sheet 4—Identify types of schematics Unit 7, Objective 36—Electrical schematic symbols Unit 7, Objective 37—United States/European color coding Unit 7, Student Supplement 3—Examples of wiring diagrams
C. Bonding and Grounding, and Lighting Protection	
1. Ability to inspect bonding and grounding points (to include lightning protection) inside and outside of turbine	Unit 3, Objective 6—Basic electrical safety practices Unit 7, Job Sheet 3—Inspect grounding/bonding points
2. Understand proper grounding techniques, theory, significance.	Unit 3, Objective 6—Basic electrical safety practices
3. Basic understanding of how a wind turbine detracts and dissipates lightning	Not covered

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AWEA Tasks	MAVCC Tasks
Electrical Skills	
D. Motors and Generators	
1. Basic theory and operation of motors and generators	Unit 7, Objective 26—Generators Unit 7, Objective 27—Electric motors Unit 7, Objective 28—Motor starters Unit 7, Job Sheet 4—Inspect/replace brushes in a generator
E. PLC – Basic Fundamentals	
1. Basic functions of PLC and applications	Unit 7, Objective 32—Programmable Logic Controller (PLC) Unit 8, Student Supplement 1—How a pitch ram works
F. SCADA Basics	
1. General aspects of SCADA including: operability and limitations, how general fiber optics operate, type of data collection in industry (use of data).	Unit 7, Objective 33—SCADA
General Work Skills	
A. Basic Computer Skills	
1. Able to create, save, and modify documents; online learning, e-mail etiquette	Unit 4, Objective 10—Technical writing and accident reports Unit 4, Assignment Sheet 1—Complete a computer assessment
2. Able to transfer reports electronically with picture documentation	Unit 4, Objective 9—Communication theory Unit 4, Assignment Sheet 1—Complete a computer assessment
3. Possess technical communications skills	Unit 4, Objective 9—Communication theory
4. Fluent in basic use of Microsoft Word and Excel	Unit 4, Assignment Sheet 1—Complete a computer assessment
B. Report Writing and Reading Comprehension of Technical Documents	
1. Ability to clearly and properly convey technical information to others in written format	Unit 4, Objectiv 10—Technical writing and accident reports Unit 4, Assignment Sheet 3—Fill out an accident report
2. Ability to read, comprehend, and plan work from a technical inspection or condition report	Unit 5, Student Supplement 1—Safety task assignment report (STA) and job safety analysis (JSA)
3. Ability to use manufacturer documents in the O&M of the WECS	Throughout

AWEA Tasks	MAVCC Tasks
General Work Skills	
C. Conversion of Units	
1. Understanding metric symbols and ability to distinguish between metric and English (SAE) units in volume, pressure, distance, force, mass, temperature, and length	Unit 4, Objective 11—Basic electrical and hydraulic schematic symbols Unit 4, Objective 12—Metrics in the American workplace Unit 4, Objective 13—Values of prefixes associated with metric measurement Unit 4, Student Supplement 2—How to use English/metric conversion charts Unit 4, Assignment Sheet 5—Complete metric conversions
D. Schematics	
1. Basic reading and component identification of schematics (symbols and difference between U.S. and European schematics)	Unit 4, Objective 11—Basic electrical and hydraulic schematic symbols Unit 4, Assignment Sheet 4—Identify types of schematics Unit 7, Objective 36—Electrical schematic symbols Unit 7, Objective 37—United States/European color coding Unit 7, Student Supplement 3—Examples of wiring diagrams Unit 8, Objective 9—Schematics of hydraulic systems
E. Soft Skills	
1. Ability to communicate/work in small group operations, and in teams	Unit 4, Objective 5—Reasons for teamwork Unit 4, Objective 8—Communication theory Unit 4, Job Sheet 1—Use radio communication to relay information
2. Professional conduct, respect, courteous	Unit 4, Objective 3—Professional conduct on the job Unit 4, Objective 4—What not to do on the job
3. Customer service skills to meet customer needs	Unit 4, Objective 6—Customer service
4. Cultural awareness and the ability to work with people of other cultures, age, gender, and beliefs	Unit 4, Objective 7—Diversity and generational awareness Unit 4, Student Supplement 1—Diversity in the workplace Unit 4, Assignment Sheet 1—Complete a computer assessment Unit 4, Assignment Sheet 2—Solve workplace problems