

Unit/Standard Number	 <p style="text-align: center;"> pennsylvania <small>DEPARTMENT OF EDUCATION</small> </p> <p style="text-align: center;"> <u>High School Graduation Years 2011, 2012 and 2013</u> </p> <p style="text-align: center;"> Electromechanical Technology /Electromechanical Engineering Technology CIP 15.0403 Task Grid </p>	Proficiency Level Achieved: (X) Indicates Competency Achieved to Industry Proficiency Level
Secondary Competency Task List		
100	DEMONSTRATE KNOWLEDGE OF TECHNICAL REPORTS	
101	Identify components of technical reports.	
102	Demonstrate knowledge of the common components of technical documents.	
103	Maintain a daily journal or timecard.	
200	DEMONSTRATE SAFETY IN THE LABORATORY	
201	Demonstrate knowledge of accident prevention.	
202	Identify safe work habits.	
203	Demonstrate safe and proper use of hand tools.	
204	Demonstrate safe and proper use of portable power tools.	
205	Demonstrate safe and proper use of the drill press.	
206	Describe the dangers of unruly behavior.	
207	Identify electric shock hazards.	
208	Identify fire dangers of electronic circuits.	
209	Use appropriate fire extinguishers for different classes of fires.	
210	Describe the importance of MSDS information.	
211	Describe and Understand Arc Flash Protection and National Fire Protection Act 70E.	
212	Describe and demonstrate the Lock Out/Tag Out procedure.	
300	INTERPRET ELECTRICAL SYMBOLS ON BLUEPRINTS AND SCHEMATICS	
301	Identify and interpret electrical symbols, notes, details and components on schematics.	
302	Draw a schematic of electrical circuits, either by hand or by using computer software.	
400	DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY	
401	Describe the origins and applications of magnetism.	
402	Describe the idea of a magnetic force.	
403	Describe the atomic structure for materials.	
404	Describe the direction of electron flow in circuits.	

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405	List the effect of electric current flow.	
406	Construct simple circuits.	
407	Define electricity.	
408	Describe what is meant by a charge of electricity.	
409	Describe the electrical force, which causes current flow.	
410	Describe the characteristics and purposes of good conductors of electricity.	
411	Demonstrate the use of prefixes in the metric system of measurement.	
412	Demonstrate knowledge of "power."	
413	State Ohm's law.	
414	State Watt's Law.	
500	MEASURE COMPONENTS OF ELECTRICAL SYSTEMS	
501	Use an analog and a digital multi-meter to measure voltage, amperage and resistance.	
502	Use and care for analog and digital meters.	
503	Perform a continuity test.	
600	USE THE NATIONAL ELECTRIC CODE (NEC) REFERENCE BOOK	
601	Describe regulations for wiring.	
602	Explain the NEC code for sizes and types of wire conductors, raceways and boxes.	
603	State the NEC rules for grounding and bonding.	
604	Describe the NEC rules for over-current protection devices.	
605	Locate the NEC code for motor circuit wiring.	
606	Use the NEC reference book to locate regulations for industrial electrical installations.	
700	DEMONSTRATE KNOWLEDGE OF ELECTRICAL RESISTANCE	
701	Define resistance.	
702	Identify resistor materials.	
703	Describe how length and thickness of wire affect resistance.	
704	Measure resistance using a meter.	
705	Calculate resistance.	
706	Describe how the flow of an electric current generates heat.	

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707	Demonstrate knowledge of power in a resistor.	
708	Calculate total resistance values.	
709	Explain power dissipation in a resistor.	
710	Describe the construction of a variable resistor.	
711	Measure current flowing through a variable resistor.	
712	Describe how a variable resistor is used as a potentiometer.	
713	Demonstrate knowledge of resistor color-coding.	
714	Explain resistor tolerance.	
715	Identify values for color-coded resistors.	
716	Demonstrate knowledge of resistors when connected in series and parallel circuits, and in combinations of series/parallel circuits.	
800	DEMONSTRATE KNOWLEDGE OF DIRECT CURRENT (D.C.) MOTORS	
801	Demonstrate knowledge of basic direct current circuits.	
802	Explain the theory of operation of a direct current motor.	
803	Operate and test a direct current motor.	
804	Operate and test a direct current shunt motor.	
805	Perform calculations for horsepower, speed and torque for direct current motors.	
806	Measure performance and efficiency of a direct current motor.	
807	Demonstrate knowledge of technical terms and units used in a basic direct current circuit.	
808	Demonstrate knowledge of the basic operations of variable speed control for direct current motors.	
900	DEMONSTRATE KNOWLEDGE OF INDUCTANCE AND CAPACITANCE	
901	Describe the operation of a capacitor.	
902	Calculate the time required to charge and discharge a capacitor.	
903	Demonstrate knowledge of capacitance and inductance circuits.	
904	Determine total capacitance of series and parallel circuits.	
905	Perform calculations for capacitive reactance.	
906	Analyze the effect of an inductor in a direct current and alternating current circuit.	
907	Connect an inductor in a direct current and alternating current circuit and monitor the results of current flow.	
1000	DEMONSTRATE KNOWLEDGE OF ALTERNATING CURRENT (A.C.) MOTORS	
1001	Explain the theory of operation of alternating current motors.	

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1002	Calculate the synchronous speed of an alternating current motor.	
1003	Describe operating characteristics of capacitor-start motors.	
1004	Connect and operate split-phase and capacitor-start motors.	
1005	Reverse the rotation of a split phase motor.	
1006	Describe the force between two magnetic fields.	
1007	Determine operating characteristics of universal motors.	
1008	Connect and operate a three-phase, squirrel cage motor.	
1009	Demonstrate how to reverse the rotation of a three-phase motor.	
1100	DEMONSTRATE KNOWLEDGE OF SERIES-PARALLEL CIRCUITS	
1101	Build and test a series circuit.	
1102	Build and test a parallel circuit.	
1103	Build and test a series/parallel circuit.	
1104	Troubleshoot series and parallel circuits.	
1105	Calculate voltage, current and resistance.	
1106	Measure voltage, current and resistance.	
1200	DEMONSTRATE KNOWLEDGE OF ELECTRIC MOTOR CONTROLS	
1201	Identify symbols and terms used in electro-mechanical motor control circuits.	
1202	Identify relays, contactors and motor starters.	
1203	Read schematic wiring diagrams of motors and their controls.	
1204	Wire a simple two- and three-wire motor control circuit.	
1205	Wire a reversing starter.	
1206	Wire multiple push button/jogging control circuits.	
1207	Wire sequential control circuits.	
1208	Wire and test electrical control circuits.	
1209	Perform preventive maintenance and troubleshooting on motor controls.	
1210	Identify and describe classes of wire insulation.	
1211	Describe conductor ampacity.	
1212	Describe how to select "wire size" and "wire type" for a specific wiring application.	
1213	Demonstrate procedures for the correct labeling of wires.	
1214	Interpret electrical diagrams.	

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1300	DEMONSTRATE KNOWLEDGE OF TRANSFORMERS	
1301	Connect and operate a transformer.	
1302	Calculate the voltage-and-turns ratio.	
1303	Connect a "step-up" and a "step-down" transformer in a circuit.	
1304	Identify transformer windings and related output voltages.	
1305	Determine on-load voltages and currents.	
1306	Measure single-phase transformer voltage and currents.	
1307	Measure series / parallel transformer voltages and currents.	
1308	Demonstrate knowledge of three-phase transformers.	
1309	Wire and analyze three-phase transformers.	
1400	DEMONSTRATE KNOWLEDGE OF SOLDERING TECHNIQUES	
1401	Describe proper care for soldering equipment.	
1402	Demonstrate proper soldering techniques for splicing conductors.	
1403	Demonstrate proper soldering techniques for terminals.	
1500	TROUBLESHOOT AND REPAIR ELECTRICAL DEVICES IN THE LABORATORY	
1501	Troubleshoot and repair motor controls.	
1502	Troubleshoot and replace relays.	
1503	Troubleshoot and replace sensors.	
1504	Troubleshoot and replace limit switches.	
1505	Troubleshoot and replace power supplies.	
1506	Troubleshoot and replace electronic sensors.	
1600	DEMONSTRATE KNOWLEDGE OF BASIC ELECTRONICS	
1601	Identify and explain electronic symbols shown on diagrams and schematics.	
1602	Describe and explain the function of diodes.	
1603	Explain the function of Zener diodes.	
1604	Explain the function of transistors.	
1605	Explain the function of power supplies.	
1606	Explain the function of filters.	

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1607	Explain the function of half-wave, full wave and three-phase rectifiers.	
1608	Explain the function of thyristors.	
1609	Explain the function of single-phase and three-phase inverters.	
1610	Connect and operate alternating current and direct-current variable speed drives.	
1611	Troubleshoot alternating current and direct current variable speed drives.	
1700	BASIC LOGIC FUNCTIONS	
1701	Demonstrate knowledge of number systems.	
1702	Convert binary and decimal number systems.	
1703	Convert BCD and decimal number systems.	
1704	Convert octal and decimal number systems.	
1705	Convert hexadecimal and decimal number systems.	
1706	Demonstrate knowledge of switch logic.	
1707	Identify characteristics of and, or, nand, nor, not logic.	
1708	Demonstrate knowledge of and, or, and, nor, not logic.	
1800	DEMONSTRATE KNOWLEDGE OF PROGRAMMABLE LOGIC CONTROLS (PLCs)	
1801	Explain where PLC networks may be used in the manufacturing process.	
1802	Identify the parts and operating principles of programmable logic controls.	
1803	Demonstrate knowledge of number systems and codes for PLCs.	
1804	Create a relay logic diagram.	
1805	Describe the PLC logic gate functions in PLCs.	
1806	Explain PLC logic and math functions.	
1807	Explain PLC timer and counter functions.	
1808	Describe PLC jump, compare and sub-routine functions.	
1809	Demonstrate procedures for editing PLC programs.	
1810	Troubleshoot a PLC system.	
1900	DEMONSTRATE KNOWLEDGE OF MECHANICAL POWER TRANSMISSION SYSTEMS IN INDUSTRY	
1901	Identify vocabulary words and terms associated with the fundamental principles of the transmission of mechanical power.	
1902	Construct simple machines and use them to illustrate mechanical principles.	
1903	Identify basic principles of lubrication of bearings.	

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1904	Identify basic principles of installing and adjusting V-belts.	
1905	Demonstrate knowledge of the uses of brakes and clutches for mechanical power transmission.	
1906	Demonstrate knowledge of the uses of centrifugal pumps.	
2000	TROUBLESHOOT /REPAIR MECHANICAL POWER TRANSMISSION SYSTEMS	
2001	Set and adjust mechanical stops.	
2002	Install and maintain linkages.	
2003	Install and maintain gear trains.	
2004	Conduct routine preventive maintenance on hydraulic equipment in accordance with manufacturer's instructions.	
2005	Determine speed and torque rates of mechanical equipment components.	
2006	Troubleshoot and repair or replace A.C. pump motors.	
2007	Troubleshoot and repair or replace speed-reduction units.	
2008	Troubleshoot and repair or replace clutches.	
2009	Troubleshoot and repair or replace mechanical drives for feedback systems.	
2010	Troubleshoot and repair or replace sensors for flow control.	
2100	DEMONSTRATE KNOWLEDGE OF FLUID POWER SYSTEMS	
2101	Identify electrical symbols and schematics for hydraulic systems.	
2102	Describe electric and electronic control circuits, devices, and feedback as they relate to hydraulics.	
2103	Demonstrate knowledge of the fundamentals of hydraulics.	
2104	Examine characteristics of hydraulic pumps.	
2105	Explain the transmission and conditioning of hydraulic fluid.	
2106	Measure oil flow and oil pressure.	
2107	Demonstrate the operation of manual and pilot directional control valves.	
2108	Describe and explain hydraulic actuators.	
2109	Operate hydraulic actuator circuits.	
2110	Construct, test and troubleshoot hydraulic control circuits.	
2111	Apply knowledge of basic electricity in analyzing hydraulic circuits.	
2112	Explain where electronic switches and sensors may be found in hydraulic systems.	
2113	Identify and use proper size hydraulic lines.	
2114	Describe the relationship between hydraulic pressure and flow.	
2115	Troubleshoot and replace hydraulic lines.	

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2116	Troubleshoot and replace hydraulic pumps.	
2117	Troubleshoot and replace hydraulic gauges.	
2118	Troubleshoot and replace hydraulic filters.	
2119	Troubleshoot and replace hydraulic directional control valves.	
2120	Troubleshoot and replace hydraulic pressure control valves.	
2121	Perform adjustments to control oil temperature and pressure.	
2122	Conduct routine preventive maintenance on hydraulic equipment in accordance with manufacturer's instructions.	
2123	Identify electrical symbols/schematics for pneumatics.	
2124	Demonstrate knowledge of the fundamental principles of pneumatics.	
2125	Describe the characteristics of air compressors.	
2126	Explain systems used for the distribution and conditioning of air.	
2127	Measure and control air flow and air pressure.	
2128	Demonstrate knowledge of pneumatic actuators.	
2129	Operate and explain mechanical devices that operate on air pressure.	
2130	Construct, test, and troubleshoot a pneumatic circuit.	
2131	Apply knowledge of basic electricity in analyzing pneumatic circuits.	
2132	Explain where electronic switches and sensors may be found in pneumatic systems.	
2133	Demonstrate knowledge of electric control circuits and devices in pneumatic systems.	
2200	TROUBLESHOOT / REPAIR FLUID POWER SYSTEMS AND THEIR COMPONENTS	
2201	Sketch flow path symbols and air logic schematics.	
2202	Interpret flow path symbols and air logic schematics.	
2203	Select and use properly sized pneumatic piping.	
2204	Maintain pressure regulators.	
2205	Install and adjust airlines.	
2206	Install and adjust pumps.	
2207	Install and adjust gauges.	
2208	Install and adjust cylinders.	
2209	Install and replace filters.	
2210	Install and adjust control valves.	
2211	Install, adjust and repair actuators.	
2212	Install and adjust pressure switches.	

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2213	Install and adjust relays.	
2214	Adjust a pneumatic sensor temperature controller to a specified mixed air temperature.	
2215	Properly use dampers, thermostats, switches, pneumatic positioners, linkage assemblies and accessories in pneumatic systems.	
2216	Conduct routine preventive maintenance on pneumatic equipment in accordance with manufacturer's instructions.	
2300	DEMONSTRATE KNOWLEDGE OF ROBOTICS	
2301	Demonstrate knowledge of safety rules and regulations for working around robots.	
2302	Use vocabulary words and terms specific to robotics.	
2303	Identify major systems of a robot.	
2304	Identify a robot's "work envelope" in a manufacturing cell.	
2305	Explain how robots are used in American manufacturing industries.	
2306	Describe the operation of a robot's drive system.	
2307	Describe the mobility of an industrial robot.	
2308	Demonstrate the procedure for programming a robot.	
2309	Describe industrial applications for robotics.	
2400	DEMONSTRATE KNOWLEDGE OF WORK CELLS IN A MANUFACTURING SYSTEM	
2401	Demonstrate knowledge of the fundamental operating principles used in flexible manufacturing systems.	
2402	Assemble and test a fluid power work-cell using PLC sensors.	