2024 POWERSPORTS AND OUTDOOR POWER EQUIPMENT

Program Standards

CONTENT STANDARD 1.0: PROFESSIONAL ORGANIZATIONS AND LEADERSHIP	
Performance Standard 1.1: Student Leadership in Career Technical Student Organizations (CTSO) and Professional Associations	
1.1.1	Explore the role of professional organizations and/or associations in the Powersports and Outdoor Power Equipment Industry.
1.1.2	Define the value, role, and opportunities provided through career technical student organizations.
1.1.3	Engage in career exploration and leadership development.
CONTENT STANDARD 2.0: BASIC SAFETY	
Performance Standard 2.1: Workplace Safety	
2.1.1	Describe general shop safety rules and procedures.
2.1.2	Describe common shop hazards and housekeeping duties.
2.1.3	Handle tools and equipment, observing manufacturer guidelines and safety features.
2.1.4	Demonstrate safe lifting procedures, lift operation, and use of support equipment (e.g., jacks and jack stand placements, lifts, cribbing, hoists, rigging).
2.1.5	Check for proper ventilation to meet work requirements and procedures within the lab/shop area.
2.1.6	Identify marked safety areas.
2.1.7	Identify the location and the types of fire extinguishers and other fire safety equipment.
2.1.8	Demonstrate procedures for using fire extinguishers and other fire safety equipment.
2.1.9	Identify the location and use of eye wash stations and first aid kits.
2.1.10	Describe the location of and the necessity for posted evacuation routes.
2.1.11	Wear required safety glasses, ear protection, gloves, and shoes during lab/shop activities.
2.1.12	Wear appropriate clothing for lab/shop activities.
2.1.13	Secure hair and jewelry for lab/shop activities.
2.1.14	Describe the information on safety data sheets (SDS) and how to access them.
2.1.15	Handle, store, and dispose of hazardous and flammable waste and materials.
2.1.16	Describe the requirements for reporting workplace safety incidents.
CONTENT STANDARD 3.0: TOOLS, EQUIPMENT, AND FASTENERS	
Performance Standard 3.1: Tools and Equipment	
3.1.1	Identify basic hand tools and their functions.
3.1.2	Identify standard and metric tool designations.
3.1.3	Clean, store, and maintain hand tools.
3.1.4	Identify handheld power tools (e.g., pneumatic, electric) and their functions.
3.1.5	Identify shop equipment (e.g., oxy-acetylene torch, arc welding equipment, bench grinder, hydraulic press, parts washers, pressure washers) and their functions.
3.1.6	Clean, store, and maintain power tools.
Performance Standard 3.2: Precision Measuring Instruments	
3.2.1	Define measuring terminology (i.e., units of measurement).
3.2.2	Identify measuring instruments (e.g., micrometers, dial calipers, dial gauges, feeler gauge, torque wrench) and their functions.
3.2.3	Describe the procedures for yielding accurate readings.

3.2.4	Store and maintain precision measuring tools.
Performance Standard 3.3: Fasteners	
3.3.1	Identify types of fasteners and their dimensions.
3.3.2	Identify thread pitch on fasteners using the thread pitch tool.
3.3.3	Record bolt grade and tensile strength.
3.3.4	Re-thread tapped holes.
3.3.5	Re-thread damaged fasteners.
3.3.6	Remove seized fasteners.
3.3.7	Describe the application and installation of thread inserts (e.g., heli-coil, time-sert).
3.3.8	Demonstrate fastener torque patterns and procedures.
3.3.9	Demonstrate fastener retention procedures (e.g., Loctite, lock washers, lock nuts, retainers.
CONTENT STANDARD 4.0: IDENTIFICATION	
Performance Standard 4.1: Unit, Equipment, and Component Identification	
4.1.1	Locate equipment VIN, HIN, serial number, production data code, model number, and spec number.
4.1.2	Identify additional equipment (e.g., tires, emissions, engines, transmissions) information labels.
4.1.3	Access service and parts identification resources (e.g., service manuals, parts diagrams).
4.1.4	Identify power and fuel sources (e.g., battery, diesel, gas, propane) and associated hazards.
4.1.5	Describe the safe operation and use of powersports and outdoor power equipment (e.g., handheld equipment, powersports vehicles, marine applications, lawn care equipment).
CONTENT STANDARD 5.0: ENGINE REPAIR, LUBRICATION, AND COOLING	
Performance Standard 5.1: Engine Principles and Design	
5.1.1	Describe the theory of operation and functions of two-stroke and four-stroke engines and their relative advantages and disadvantages.
5.1.2	Describe how engines are rated (e.g., displacement, horsepower, torque).
5.1.3	Describe the engine configurations found on powersports and outdoor power equipment.
5.1.4	Identify the component parts used in a four-stroke engine.
Performance Standard 5.2: Lubrication and Cooling Systems	
5.2.1	Define the four key purposes of lubrication.
5.2.2	Describe the types of oil and how oil is classified.
5.2.3	Describe the lubrication systems used in two-stroke and four-stroke engines.
5.2.4	Perform engine oil and filter change using proper fluid type per manufacturer specification.
5.2.5	Describe the function of cooling systems and their operation.
5.2.6	Describe the types of coolants and how coolants are classified.
5.2.7	Describe the cooling systems (e.g., air, oil, water) and components used on powersports, marine, and outdoor power equipment.
5.2.8	Perform a cooling system pressure test.
5.2.9	Identify causes of engine overheating.
5.2.10	Inspect and/or test coolant.
5.2.11	Drain and recover coolant, flush and refill the cooling system, use the proper fluid type per manufacturer specification, and blow air as required.
5.2.12	Describe the operation of marine cooling system components (e.g., circulation and raw water pumps, thermostats, heat exchangers).
5.2.13	Inspect the radiator for damage and proper function.
5.2.14	Remove, inspect, and replace the thermostat and gasket/seal.

5.2.15	Inspect and test the electrical or mechanical fan, fan shroud, and air dams, determining needed action.
5.2.16	Inspect auxiliary coolers, determining needed action.
5.2.17	Inspect and test cooling system electrical components (e.g., temperature sensor, fan switch, oil temperature sensor).
Performance Standard 5.3: Two-Stroke and Four-Stroke Engine Inspection and Repair	
5.3.1	Access and interpret vehicle service information.
5.3.2	Verify customer complaints (e.g., lack of power, hard starting, oil leak, oil consumption, overheating) to determine the course of action.
5.3.3	Inspect engine assembly for fuel, oil, coolant, and other leaks, determining needed action.
5.3.4	Inspect the bearings, bushings, and seals used in an engine.
5.3.5	Verify engine mechanical timing.
5.3.6	Inspect engine mounts and alignment procedures.
5.3.7	Remove, disassemble, and inspect the cylinder head according to the manufacturer's specifications and procedures.
5.3.8	Inspect and adjust valve train components according to manufacturer’s specifications.
5.3.9	Inspect and measure cylinder walls/sleeves for damage, wear, and ridges, determining needed action.
5.3.10	Inspect and measure piston skirts and ring lands, determining needed action.
5.3.11	Identify piston-to-bore clearance.
5.3.12	Inspect, measure, and install piston rings.
5.3.13	Disassemble and inspect the engine block, cleaning and preparing components for reassembly.
5.3.14	Inspect and measure the crankshaft, connecting rods, and bearings for reuse according to the manufacturer’s specifications.
5.3.15	Inspect the auxiliary shaft and support bearings (e.g., balance shaft, intermediate shaft, idler shaft, counterbalance shaft/gear) for damage and wear.
5.3.16	Reassemble the complete engine according to the manufacturer’s specifications.
CONTENT STANDARD 6.0: ELECTRICAL/ELECTRONIC SYSTEMS	
Performance Standard 6.1: Electricity Fundamentals	
6.1.1	Describe the importance of safety procedures when working with electrical systems.
6.1.2	List electrical circuits' types and basic components (e.g., source, conductor, load, protection devices, switches).
6.1.3	Define the terms voltage, current, and resistance.
6.1.4	Describe the principles of magnetism and magnetic fields.
6.1.5	Calculate voltage, current, and resistance for series and parallel circuits using Ohm's law.
6.1.6	Identify electrical and electronic components (e.g., conductors, fuses, circuit breakers, resistors, diodes).
6.1.7	Describe schematics, their purpose, and how to read a wiring diagram.
Performance Standard 6.2: Battery Charging and Starting	
6.2.1	Describe the various types of batteries used in powersports, marine, and outdoor power equipment.
6.2.2	Verify battery capacity for the vehicle application by performing state of charge and battery capacity and load tests and determining the needed action.
6.2.3	Service battery (i.e., fill battery cells, check battery cables, connectors, clamps, hold-downs, charge battery), according to manufacturer’s recommendations.
6.2.4	Jump-start vehicle, using jumper cables and a booster battery or an auxiliary power supply.

6.2.5	Describe the theory of charging systems and types of charging systems (e.g., permanent magnet, electromagnet).
6.2.6	Identify the components in a charging system (e.g., source, alternator, regulator, rectifier) and their functions.
6.2.7	Perform a charging system output test to determine the needed action.
6.2.8	Diagnose (troubleshoot) the charging system for undercharge, no-charge, or overcharge conditions.
6.2.9	Remove, inspect, and/or replace the alternator.
6.2.10	Identify the components of manual start systems (e.g., kick start, pull start, crank start).
6.2.11	Describe the components and operation of an electric start system.
Performance Standard 6.3: Electrical/Electronic Systems Diagnosis and Repair	
6.3.1	Determine and verify proper operation of system/circuit according to manufacturer's specifications.
6.3.2	Measure source voltage, voltage drop, current flow, and resistance using a multimeter.
6.3.3	Describe shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
6.3.4	Test an electrical circuit using a test light.
6.3.5	Perform starter current draw tests, determining needed action.
6.3.6	Compare electrical and engine mechanical problems resulting in slow or no-crank conditions.
6.3.7	Check the operation of electrical circuits using fused jumper wires.
6.3.8	Diagnose (troubleshoot) electrical/electronic circuit problems using wiring diagrams.
6.3.9	Diagnose the cause(s) of excessive key-off battery drain (e.g., parasitic draw) and determine the needed action.
6.3.10	Inspect and test fusible links, circuit breakers, and fuses, determining needed action.
6.3.11	Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, switches, and wiring in electrical/electronic systems, including necessary solder repairs.
6.3.12	Inspect and test gauges and gauge sending units (e.g., speedometers, fuel gauges, voltmeter) for causes of abnormal readings, determining needed action.
CONTENT STANDARD 7.0: FUEL, IGNITION, AND ENGINE MANAGEMENT SYSTEMS	
Performance Standard 7.1: Fuel Systems	
7.1.1	Describe fuel requirements by type (e.g., octane ratings and factors that affect these ratings, additives, and ethanol percentage).
7.1.2	Describe the operation of a fuel system.
7.1.3	Describe the theory and operation of a carburetor and its circuits.
7.1.4	Identify components/circuits of a carbureted fuel system.
7.1.5	Perform carburetor repair and adjustment.
7.1.6	Describe the theory and operation of electronic fuel injection.
7.1.7	Identify the components of electronic fuel injection.
7.1.8	Inspect and test the fuel pump(s) and pump control system for pressure, regulation, and volume, determining what action is needed.
7.1.9	Replace fuel filter(s) where applicable.
7.1.10	Inspect, service, or replace air filters, filter housings, and intake ductwork.
7.1.11	Inspect the throttle body, air induction system, intake manifold, and gaskets for vacuum leaks and/or unmetered air.
7.1.12	Inspect, test, service, and/or replace the positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses, determining the needed action.
Performance Standard 7.2: Ignition Systems	
7.2.1	Describe the common components found in all types of ignition systems.
7.2.2	Describe the operation of battery-powered, magneto-powered, and electronic ignition systems.

7.2.3	Diagnose (troubleshoot) ignition system-related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns, determining needed action.
7.2.4	Remove and replace spark plugs, inspecting secondary ignition components for wear and damage.
Performance Standard 7.3: Exhaust, Emissions and Computer Controls	
7.3.1	Describe the functions of exhaust system components.
7.3.2	Describe procedures for inspecting and servicing exhaust systems.
7.3.3	Describe the function of a turbocharger.
7.3.4	Describe the different types of emission control systems (e.g., catalytic converter).
7.3.5	Identify the types of pollutants that engines create.
7.3.6	Describe the various sensors and components used in computer-controlled engines.
7.3.7	Interpret diagnostic trouble codes (DTC).
7.3.8	Access service information to perform step-by-step (troubleshooting) diagnosis.
7.3.9	Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields, determining needed action.
7.3.10	Describe the operation of turbocharger/supercharger systems.
CONTENT STANDARD 8.0: DRIVES, CLUTCHES, AXLES, AND TRANSMISSION SYSTEMS	
Performance Standard 8.1: Drives, Clutches, Axles, and Transmissions Components and Repair	
8.1.1	Identify the components and their functions within the primary drive system of powersports, marine, and outdoor power equipment.
8.1.2	Describe the types of clutches used in powersports and outdoor power equipment.
8.1.3	Describe the types of final drive systems.
8.1.4	Identify the major parts of a primary drive, transmission, and final drive assembly.
8.1.5	Describe the operating principles of a primary drive, clutch, transmission, and final drive.
8.1.6	Trace power flow through a primary drive, transmission, and final drive.
8.1.7	Check fluid level in a transmission equipped with/without a dip-stick.
8.1.8	Inspect and adjust external shift linkage/cable and transmission range sensor/switch (e.g., neutral, park, gear position sensor).
8.1.9	Inspect for leakage, replacing external seals, gaskets, and bushings as needed.
8.1.10	Drain and replace fluid and filter(s), using proper fluid type, per manufacturer specification.
8.1.11	Inspect powertrain mounts.
8.1.12	Describe the operational characteristics of a continuously variable transmission (CVT).
8.1.13	Drain and refill manual transmission/transaxle and final drive unit, using proper fluid type, per manufacturer specification.
8.1.14	Diagnose clutch noise, binding, slippage, pulsation, and chatter, determining needed action.
8.1.15	Inspect clutch linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs, determining needed action.
8.1.16	Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, and linkage.
8.1.17	Check for leaks, adjust, and bleed clutch master cylinder, refilling with proper fluid type, per manufacturer specification, as needed.
8.1.18	Diagnose constant-velocity (CV) and universal joint noise and vibration concerns, determining needed action.
8.1.19	Check and adjust differential case fluid level, checking for leaks, inspecting housing vent, and using proper fluid type, per manufacturer specification.
8.1.20	Drain and refill differential case, using proper fluid type, per manufacturer specification.
8.1.21	Inspect and replace drive axle wheel studs.

8.1.22 Remove and replace drive axle shafts.

CONTENT STANDARD 9.0: WHEELS, TIRES, AND BRAKE SYSTEMS

Performance Standard 9.1: Wheels and Tires

9.1.1 Describe the operating principles of mechanical, electrical, and hydraulic brake systems.
9.1.2 Identify the brake system components used on powersports vehicles.
9.1.3 Describe ABS and linked systems.
9.1.4 Describe the types of wheels used on modern powersports vehicles.
9.1.5 Identify the types of tire construction used on powersports and outdoor power equipment.
9.1.6 Inspect tire condition; identify tire wear patterns; check for the correct tire size, application (e.g., load ratings, speed ratings), and air pressure, as listed on the tire information placard/label.
9.1.7 Diagnose wheel/tire vibration, shimmy, air loss, pull, and noise, determining needed action.
9.1.8 Rotate tires according to the manufacturer's recommendation.
9.1.9 Measure wheel, tire, axle flange, and hub runout, determining needed action.
9.1.10 Dismount, inspect, and remount the tire on the wheel, balancing wheel, and tire assembly.
9.1.11 Install wheel and torque lug nuts.

Performance Standard 9.2: Brake Systems

9.2.1 Describe the operating principles of mechanical, electrical, and hydraulic brake systems.
9.2.2 Identify the brake system components used on powersports vehicles.
9.2.3 Describe ABS and linked systems.
9.2.4 Describe the types of wheels used on modern powersports vehicles.
9.2.5 Identify the types of tire construction used on powersports and outdoor power equipment.
9.2.6 Inspect tire condition; identify tire wear patterns; check for the correct tire size, application (e.g., load ratings, speed ratings), and air pressure, as listed on the tire information placard/label.
9.2.7 Diagnose wheel/tire vibration, shimmy, air loss, pull, and noise, determining needed action.
9.2.8 Rotate tires according to the manufacturer's recommendation.
9.2.9 Measure wheel, tire, axle flange, and hub runout, determining needed action.
9.2.10 Dismount, inspect, and remount the tire on the wheel, balancing wheel, and tire assembly.
9.2.11 Install wheel and torque lug nuts.
9.2.12 Clean and inspect the rotor and mounting surface, measuring the rotor thickness, thickness variation, and lateral runout and determining the needed action.
9.2.13 Remove and reinstall/replace the rotor.
9.2.14 Describe the importance of operating the vehicle to burnish/break-in replacement brake pads, per the manufacturer's recommendations.

CONTENT STANDARD 10.0: CHASSIS, SUSPENSION, AND STEERING SYSTEMS

Performance Standard 10.1: Chassis, Suspension, and Steering Components and Repair

10.1.1 Describe the types, functions, and components of front and rear suspension systems.
10.1.2 Inspect suspension components for leaks, determining needed action.
10.1.3 Inspect chassis bearings (e.g., steering head, swing arm, wheel) for wear and play.
10.1.4 Describe the procedures for rebuilding a front fork assembly and shock absorber.
10.1.5 Interpret suspension and steering system concerns (e.g., ride height, sway, noises) to determine the needed action.

10.1.6	Inspect upper and lower control arms, bushings, shafts, and rebound bumpers.
10.1.7	Inspect upper and/or lower ball joints with or without wear indicators.
10.1.8	Inspect steering knuckle assemblies.
10.1.9	Inspect, remove, and/or replace shock absorbers, inspecting mounts and bushings.
10.1.10	Remove, inspect, service, and/or replace front and rear wheel bearings.
10.1.11	Inspect steering alignment per manufacturer's specification.
10.1.12	Describe the effects of camber, caster, and toe on handling, performance, and ride quality.
10.1.13	Inspect steering systems and components (e.g., electric assist, hydraulic assist, hydrostatic, cable, rack, and pinion).

CONTENT STANDARD 11.0: HYDRAULIC SYSTEMS

Performance Standard 11.1: Hydraulics Components and Repair

11.1.1	Describe fundamental features and principles of hydraulics using hydraulics terminology.
11.1.2	Identify safety concerns and procedures specific to hydraulic systems.
11.1.3	Describe the function of the primary hydraulic system components.
11.1.4	Describe open-center and closed-center hydraulic systems and their operating principles.
11.1.5	Describe the types and functions of hydraulic fluid.
11.1.6	Describe the types and functions of hydraulic reservoirs and cooling systems.
11.1.7	Describe the types of hydraulic pumps and their principles of operation.
11.1.8	Describe the types and functions of hydraulic control valves and valve actuating systems.
11.1.9	Describe the types and functions of hydraulic actuators.
11.1.10	Describe the types and applications of hydraulic fittings, hoses, and lines.
11.1.11	Interpret hydraulic symbols from a hydraulic schematic.
11.1.12	Compare a hydraulic drive system and a hydrostatic drive system.
11.1.13	Calculate hydraulic cylinder force and cycle times based on pump pressure and flow using Pascal's law.
11.1.14	Disassemble, inspect and repair hydraulic control valves.
11.1.15	Disassemble, inspect and repair hydraulic pumps.
11.1.16	Disassemble, inspect and repair hydraulic actuators.
11.1.17	Describe the operation of a hydrostatic transmission.
11.1.18	Replace hydraulic hose, line, and seal.
11.1.19	Perform hydraulic system pressure and flow tests.
11.1.20	Diagnose and suggest solutions for hydraulic system problems.

IDCTE Document Control Information

Program Standard Revision: TI Powersports & Outdoor Power Equipment

Date	Standard #	Original	Summary of Change	Revised By	Approved By
