

Powersports Technician Technical Standards

CONTENT STANDARD 1.0: BASIC SAFETY

Performance Standard 1.1: Workplace Safety

1.1.1	Describe general shop safety rules and procedures.
1.1.2	Utilize safe procedures for handling of tools and equipment.
1.1.3	Identify and use proper placement of floor jacks and jack stands.
1.1.4	Identify and use proper procedures for safe lift operation.
1.1.5	Utilize proper ventilation procedures for working within the lab/shop area.
1.1.6	Identify marked safety areas.
1.1.7	Identify the location and the types of fire extinguishers and other fire safety equipment.
1.1.8	Demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
1.1.9	Identify the location and use of eye wash stations.
1.1.10	Identify the location of the posted evacuation routes.
1.1.11	Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
1.1.12	Identify and wear appropriate clothing for lab/shop activities.
1.1.13	Secure hair and jewelry for lab/shop activities.
1.1.14	Locate and interpret safety data sheets (SDS).
1.1.15	Handle, store, and dispose of hazardous and flammable waste and materials.

CONTENT STANDARD 2.0: TOOLS

Performance Standard 2.1: Basic Tools

2.1.1	Identify basic hand tools and their proper usage.
2.1.2	Identify standard and metric tool designations.
2.1.3	Demonstrate proper cleaning, storage, and maintenance of hand tools.
2.1.4	Identify basic power tools (pneumatic and electric) and their proper usage.
2.1.5	Demonstrate proper cleaning, storage and maintenance of power tools.

CONTENT STANDARD 3.0: FASTENERS

Performance Standard 3.1: Proper Use of Fasteners

3.1.1	Describe the four most important bolt dimensions.
3.1.2	Identify the different types of fasteners.
3.1.3	List the three basic types of threads used on fasteners
3.1.4	Determine and record bolt grade and tensile strength
3.1.5	Re-thread tapped holes.
3.1.6	Re-thread damaged fasteners.
3.1.7	Remove seized fasteners.
3.1.8	Repair internal threads with thread insert (heli-coil).
3.1.9	Demonstrate proper fastener torque methods.

CONTENT STANDARD 4.0: MEASUREMENT

Performance Standard 4.1: Precision Measuring Instruments

4.1.1	Define measuring terminology.
4.1.2	Identify various measuring instruments.
4.1.3	Determine the measuring steps required for accurate readings.
4.1.4	Demonstrate the proper use of precision measuring tools.

CONTENT STANDARD 5.0: ENGINE REPAIR

Performance Standard 5.1: Basic Engine Principles and Design

5.1.1	Describe characteristics of reciprocating engines
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5.1.2	Identify the differences between a two-stroke engine and a four-stroke engine.
5.1.3	Identify how engines are rated.
5.1.4	Identify the primary components found in two-stroke and four-stroke engines.
5.1.5	Describe the different engine configurations found on powersports equipment.
5.1.6	Explain the physical laws associated with motorcycle and ATV engines.
5.1.7	Describe the operation of an internal-combustion engine.
5.1.8	Explain how fuel and air are used to make an engine operate.
5.1.9	Identify the component parts used in a four-stroke engine.
5.1.10	Describe the theory of operation for a four-stroke engine.
5.1.11	Identify the component parts used in a two-stroke engine.
5.1.12	Describe the theory of operation for a two-stroke engine.
5.1.13	Describe the different induction systems used on the two-stroke engine.
5.1.14	Describe how a two-stroke engine physically differs from a four-stroke engine.
5.1.15	Describe both the advantages and the disadvantages of both the two-stroke and four-stroke engines.
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	Explain why bearings, bushings, and seals are needed in an engine.
5.2.4	Identify the different types of bearings used in powersports equipment.
5.2.5	State the purpose of both two-stroke and four-stroke engine lubrication systems.
5.2.6	Identify the different types of lubrication systems used in two-stroke and four-stroke engines.
5.2.7	Describe how cooling systems work and why they are used.
5.2.8	Identify the different cooling systems used on powersports equipment.
5.2.9	Identify the components of powersport equipment cooling systems.
5.2.10	Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, and galley plugs; determine needed action.
5.2.11	Identify causes of engine overheating.
5.2.12	Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.
5.2.13	Inspect, remove, and replace water pump.
5.2.14	Remove and replace radiator.
5.2.15	Remove, inspect, and replace thermostat and gasket/seal.
5.2.16	Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.
5.2.17	Perform engine oil and filter change; use proper fluid type per manufacturer specification.
5.2.18	Inspect auxiliary coolers; determine needed action.
5.2.19	Inspect, test, and replace oil temperature and pressure switches and sensors.
Performance Standard 5.3: 2-Stroke & 4-Stroke Engine Inspection & Repair	
5.3.1	Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins
5.3.2	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.
5.3.3	Install engine covers using gaskets, seals, and sealers as required.
5.3.4	Verify engine mechanical timing.
5.3.5	Inspect, remove and/or replace engine mounts.
5.3.6	Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.
5.3.7	Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.
5.3.8	Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.

5.3.9	Adjust valves (mechanical or hydraulic lifters).
5.3.10	Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.
5.3.11	Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine needed action.
5.3.12	Inspect valve guides for wear; check valve stem-to-guide clearance; determine needed action.
5.3.13	Inspect valves and valve seats; determine needed action.
5.3.14	Inspect valve lifters; determine needed action.
5.3.15	Inspect and/or measure camshaft for runout, journal wear and lobe wear.
5.3.16	Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine needed action.
5.3.17	Disassemble engine block; clean and prepare components for inspection and reassembly.
5.3.18	Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine needed action.
5.3.19	Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine needed action.
5.3.20	Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; determine needed action.
5.3.21	Inspect main and connecting rod bearings for damage and wear; determine needed action.
5.3.22	Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine needed action.
5.3.23	Inspect and measure piston skirts and ring lands; determine needed action.
5.3.24	Determine piston-to-bore clearance.
5.3.25	Inspect, measure, and install piston rings.
5.3.26	Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance and/or silencer); inspect shaft(s) and support bearings for damage and wear; determine needed action; reinstall and time.
5.3.27	Assemble engine block.

CONTENT STANDARD 6.0: Electrical/Electronic Systems

Performance Standard 6.1: Basic Fundamentals of Electricity

6.1.1	Describe the importance of proper safety procedures when working with electrical systems.
6.1.2	Explain the two basic theories of electricity.
6.1.3	List the types and basic components of electrical circuits.
6.1.4	Explain the terms voltage, current, and resistance.
6.1.5	Describe the principles of magnetism and magnetic fields.
6.1.6	Calculate voltage, current, and resistance using Ohm's Law.
6.1.7	Describe how to use a multimeter to measure voltage, resistance and current.
6.1.8	Identify electrical and electronic components.
6.1.9	Explain the term schematic and how to read a simple wiring diagram.

Performance Standard 6.2: Battery, Charging and Starting

6.2.1	Identify and describe the various types of batteries used in powersports equipment.
6.2.2	Perform battery state-of-charge test; determine needed action.
6.2.3	Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine needed action.
6.2.4	Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.
6.2.5	Perform slow/fast battery charge according to manufacturer's recommendations.
6.2.6	Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.
6.2.7	Explain the theory of charging systems and why they are needed.
6.2.8	Identify the components in an AC charging system.
6.2.9	Describe the operation of permanent magnet and electromagnet alternators.

6.2.10	Describe how a charging system changes alternating current into direct current.
6.2.11	Perform charging system output test; determine needed action.
6.2.12	Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.
6.2.13	Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.
6.2.14	Remove, inspect, and/or replace generator (alternator).
6.2.15	Perform charging circuit voltage drop tests; determine needed action.
6.2.16	Describe kick-start mechanisms.
6.2.17	Identify the components of a kick-start system.
6.2.18	Explain the operation of an electric start system.
6.2.19	Identify the components in an electric start system.
6.2.20	Describe the operation of an electric starter.
6.2.21	Perform starter current draw tests; determine needed action.
6.2.22	Perform starter circuit voltage drop tests; determine needed action.
6.2.23	Inspect and test starter relays and solenoids; determine needed action.
6.2.24	Remove and install a starter.
6.2.25	Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.
6.2.26	Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.

Performance Standard 6.3: Electrical/Electronic Systems Diagnosis & Repair

6.3.1	Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.
6.3.2	Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
6.3.3	Demonstrate proper use of a test light on an electrical circuit.
6.3.4	Use fused jumper wires to check operation of electrical circuits.
6.3.5	Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.
6.3.6	Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.
6.3.7	Inspect and test fusible links, circuit breakers, and fuses; determine needed action.
6.3.8	Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.
6.3.9	Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.
6.3.10	Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.
6.3.11	Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.

CONTENT STANDARD 7.0: Fuel, Ignition, & Engine Management Systems

Performance Standard 7.1: Fuel Systems

7.1.1	Define fuel octane ratings and state the factors that affect these ratings.
7.1.2	Identify the parts of a fuel system.
7.1.3	Explain the operation of the fuel system components.
7.1.4	Describe the operation of carburetor circuits.
7.1.5	Explain the concept of carburetor synchronization.
7.1.6	Perform fundamental carburetor services and repairs.
7.1.7	Explain the basic principles of electronic fuel injection.
7.1.8	Identify the component parts of electronic fuel injection.
7.1.10	Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; perform needed action.
7.1.11	Replace fuel filter(s) where applicable.

7.1.12	Inspect, service, or replace air filters, filter housings, and intake duct work.
7.1.13	Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
7.1.14	Inspect, test, and/or replace fuel injectors.
Performance Standard 7.2: Ignition Systems	
7.2.1	Describe the three major functions of an ignition system.
7.2.2	Describe the common components found in all types of ignition systems.
7.2.3	Name the two major electric circuits used in an ignition system and their common components.
7.2.4	Define centrifugal and electronic advance.
7.2.5	Describe the operation of battery-powered, magneto-powered and electronic ignition systems.
7.2.6	Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.
7.2.7	Inspect and test crankshaft and camshaft position sensor(s); determine needed action.
7.2.8	Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as r
7.2.9	Remove and replace spark plugs; inspect secondary ignition components for wear and damage.
Performance Standard 7.3: Exhaust, Emissions and Computer Controls	
7.3.1	Explain the functions of exhaust system components.
7.3.2	Explain what is meant by exhaust scavenging.
7.3.3	Describe procedures for inspecting and servicing exhaust systems.
7.3.4	Explain the function of a turbocharger.
7.3.5	Describe the different types of emission control systems.
7.3.6	Describe the operation of a catalytic converter.
7.3.7	Understand the uses of an exhaust gas analyzer.
7.3.8	Identify the 3 types of pollutants that engines create.
7.3.9	Describe the differences between sensors and actuators.
7.3.10	Identify various sensors and components used in computer controlled engines.
7.3.11	Retrieve and record diagnostic trouble codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable.
7.3.12	Access and use service information to perform step-by-step (troubleshooting) diagnosis.
7.3.13	Perform active tests of actuators using a scan tool; determine needed action.
7.3.14	Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes (DTC); obtain, graph, and interpret scan tool data.
7.3.15	Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform needed action.
7.3.16	Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.
7.3.17	Perform exhaust system back-pressure test; determine needed action.
7.3.18	Test the operation of turbocharger/supercharger systems; determine needed action.
7.3.19	Diagnose emission and driveability concerns caused by catalytic converter system; determine needed action.
7.3.20	Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.
7.3.21	Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform needed action.
CONTENT STANDARD 8.0: Drives, Clutches, Axles & Transmissions	
Performance Standard 8.1: Drives, Clutches, Axles & Transmissions	
8.1.1	Identify the different gears used in transmissions.
8.1.2	Calculate gear and drive ratios correctly.
8.1.3	Identify the functions of the primary drive system.
8.1.4	Identify the different components that make up the primary drive system.

8.1.5	Identify and describe the different types of clutches used in powersports equipment.
8.1.6	Identify the different clutch release mechanisms.
8.1.7	Identify the different types of transmission and shifting components.
8.1.8	Identify and describe the different types of final drive systems.
8.1.9	Define the major parts of a primary drive, transmission and final drive assembly.
8.1.10	Explain the operating principles of a primary drive, clutch, transmission and final drive.
8.1.11	Trace power flow through a primary drive, transmission and final drive to the rear wheel(s).
8.1.12	Diagnose fluid loss and condition concerns in a transmission; determine needed action.
8.1.13	Check fluid level in a transmission equipped with/without a dip-stick.
8.1.14	Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.
8.1.15	Inspect for leakage; replace external seals, gaskets, and bushings.
8.1.16	Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.
8.1.17	Inspect, replace and align powertrain mounts.
8.1.18	Remove and reinstall transmission.
8.1.19	Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.
8.1.20	Describe the operational characteristics of a continuously variable transmission (CVT).
8.1.21	Disassemble, clean, and inspect transmission/transaxle.
8.1.22	Assemble transmission/transaxle.
8.1.23	Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.
8.1.24	Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.
8.1.25	Inspect clutch linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action.
8.1.26	Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).
8.1.27	Bleed clutch hydraulic system.
8.1.28	Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.
8.1.29	Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action.
8.1.30	Diagnose universal joint noise and vibration concerns; perform needed action.
8.1.31	Clean and inspect differential case; check for leaks; inspect housing vent.
8.1.32	Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.
8.1.33	Drain and refill differential case; use proper fluid type per manufacturer specification .
8.1.34	Inspect and replace drive axle wheel studs.
8.1.35	Remove and replace drive axle shafts.

CONTENT STANDARD 9.0: Brakes, Wheels & Tires

Performance Standard 9.1: Brakes, Wheels and Tires

9.1.1	Explain the operating principles of mechanical and hydraulic powersports vehicle brake systems.
9.1.2	Identify the different brake system components used on powersports vehicles.
9.1.3	Describe ABS and linked motorcycle systems.
9.1.4	Explain the operation of linked braking systems.
9.1.5	Explain the operation of anti-lock brake systems.
9.1.6	Describe the types of wheels used on modern powersports vehicles.
9.1.7	Identify the differences between tube and tubeless tires.
9.1.8	Identify the different types of tire construction used on powersports vehicles.
9.1.9	Describe the differences between radial and non-radial tires.

9.1.10	Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label.
9.1.11	Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.
9.1.12	Rotate tires according to manufacturer's recommendation
9.1.13	Measure wheel, tire, axle flange, and hub runout; determine needed action.
9.1.14	Diagnose tire pull problems; determine needed action.
9.1.15	Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly.
9.1.16	Inspect tire and wheel assembly for air loss; perform needed action.
9.1.17	Repair tire following vehicle manufacturer approved procedure.
9.1.18	Install wheel and torque lug nuts.
9.1.19	Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS).
9.1.20	Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).
9.1.21	Check master cylinder for internal/external leaks and proper operation; determine needed action.
9.1.22	Remove, bench bleed, and reinstall master cylinder.
9.1.23	Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; and loose fittings/supports; determine needed action.
9.1.24	Replace brake lines, hoses, fittings, and supports.
9.1.25	Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).
9.1.26	Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.
9.1.27	Test brake fluid for contamination.
9.1.28	Bleed and/or flush brake system.
9.1.29	Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.
9.1.30	Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
9.1.31	Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
9.1.32	Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.
9.1.33	Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.
9.1.34	Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action.
9.1.35	Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.
9.1.36	Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks.
9.1.37	Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.
9.1.38	Remove and reinstall/replace rotor.
9.1.39	Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.

CONTENT STANDARD 10.0: Frames, Suspension & Steering Systems

Performance Standard 10.1: Frames, Suspension & Steering Systems

10.1.1	Describe the types of frames used on today's powersports vehicles.
10.1.2	Explain the action of front and rear suspension systems.
10.1.3	Remove, clean, inspect and replace fork fluid.
10.1.4	Service steering head bearings.
10.1.5	Describe the procedure for rebuilding a front fork assembly.
10.1.6	Explain rear swingarm and shock absorber construction.
10.1.7	Describe ATV suspension systems.
10.1.8	compare different types of suspension systems.
10.1.9	Inspect a frame and suspension system for signs of trouble.

10.1.10	Identify and interpret suspension and steering system concerns; determine needed action.
10.1.11	Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.
10.1.12	Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.
10.1.13	Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).
10.1.14	Inspect, remove, and/or replace steering knuckle assemblies.
10.1.15	Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
10.1.16	Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.
10.1.17	Remove, inspect, service and/or replace front and rear wheel bearings.
10.1.18	Perform prealignment inspection; measure vehicle ride height; determine needed action.
10.1.19	Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required; center steering wheel.