Marine Service Technology I. Demonstrate general shop practices. Tasks Instructions: Each number to the right refers to a single student/candidate (1-10). Place a check ($\sqrt{}$) in the respective column for the appropriate student/candidate 2 3 5 7 8 10 number (1-10) if the skills listed below are observed as stated. Leave blank if 1 4 6 9 not observed. Student/candidate will only get credit for the skills they have demonstrated. Establish proper shop safety tool and equipment procedures Apply MSDS and procedures specific to the workplace environment Recognize and utilize proper personal protection related to marine service and repair procedures Follow HAZMAT storage and disposal requirements Safety and infection control are adhered to during all aspects of this task. The student completed task within the time limited. **Points earned** Total possible points (6) II. Utilize marine engine components and theory of operation. Tasks Instructions: 1 2 3 5 7 8 10 4 6 9 Apply knowledge of four-cycle gasoline-fueled engines Demonstrate the principles of operation of a four-stroke gasoline-fueled engine

Identify internal components of a typical marine four-cycle gasoline-fueled										
engine										
Explain how the components interact during the four cycles										
Differentiate between the diesel and gasoline-fueled four-cycle engine										
Explain the Difference between compression ignitions and spark ignitions										
Perform valve adjustment procedures on overhead valve and pushrod engine										
Perform valve adjustment on overhead cam engine										
Utilize precision measuring instruments such as micrometers, dial indicators,										
vernier calipers and feeler gauges										
Demonstrate principles of operation of a two-stroke outboard engine										
Identify internal components of a typical two-stroke outboard engine and										
describe how the components interact with each other to achieve proper										
engine operation										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (13)										
III. Display knowledge of American Boat and Yacht Council (ABYC) standard	ds re	elate	d to	eng	ine i	nsta	llatio	ons a	and	
recommended by the U.S. Code of Federal Regulations (CFR's).										
Tasks Instructions:										
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Identify the standards as they apply to engine control systems										
Identify the standards as they apply to belt guards and oil sump design										
Identify the standards as they apply to fuel and exhaust system requirements										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										

Points earned										
Total possible points (5)										
IV. Exhibit knowledge of marine electrical systems.										
Tasks Instructions:										
	1	2	3	4	5	6	7	8	9	10
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Apply basic electrical theory, circuit design and application										
Use a digital multi-meter (DMM) to perform electrical troubleshooting										
procedures such as voltage and amperage measurements										
Test for electrical continuity and measure electrical resistance values										
Follow electrical system installation requirements as recommended by the										
ABYC and mandated by the U.S. coast Guard's CFR specific to recreational										
boats for battery installation, over-current protection requirements, ignition										
protection requirements and accepted wire sizing techniques for both AC and										
DC marine systems										
Terminate wire connections using the proper techniques										
Demonstrate knowledge of ABYC requirements for proper wire support and										
chafe protection										
Demonstrate circuit troubleshooting procedures for engine starting systems										
Assess battery condition										
Monitor engine ignition system and check battery charging system										
Read and utilize wiring diagrams and follow troubleshooting flow charts to										
diagnose electrical system problems										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (12)										

V. Utilize knowledge of marine fuel system services.										
Tasks Instructions:										
	-		1		1	1	1		1	<u> </u>
	1	2	3	4	5	6	7	8	9	10
Disassemble, clean and replace, and adjust standard carburetor internal										
components associated with an overhaul										
Perform fuel system pressure tests on both carbureted and fuel injected fuel										
systems										
Properly mix fuel stabilization additives and prepare fuel systems for extended										
lay-up										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (5)										
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VI. Demonstrate knowledge of marine cooling systems.										
Tasks Instructions:										
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	1	2	3	4	5	6	7	8	9	10
Access water pump assemblies on outboard and inboard/outboard engines										
Remove service and install water pumps on outboard and inboard/outboard										
engines										
Overhaul a conventional raw water pump on an inboard engine assembly										
Identify the need for sacrificial anodes in raw water cooling systems										
Identify correct procedures for cooling system anode selection and							1	1		

replacement										
Determine engine coolant and condition and freeze level protection level										
Differentiate between ethylene glycol and propylene glycol antifreeze and										
where each must be used										
Identify heat exchanger design and service procedures										
Replace and properly adjust engine drive belts, both v and serpentine types										
Determine proper thermostat operation and replacement if required										
Utilize an infrared heat sensing gun to track coolant flow through engine and										
heat exchangers and explain temperature readings as they relate to the										
cooling system's condition										
Pressure test cooling systems and coolant recovery container caps to locate										
potential leaks and proper pressure rating of container caps										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (14)										
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VII. Apply knowledge of lubrication systems.										
Tasks Instructions:										
		1		1	1	1	1			
Classify engine oil ratings as established by the American Petroleum Institute	1	2	3	4	5	6	7	8	9	10
(API)										
Determine engine oil quantity and type recommended using engine workshop										
manuals										
Change engine oil and filter following manufacturer's recommendations for the										
Change engine oil and filter following manufacturer's recommendations for the engine										
Change engine oil and filter following manufacturer's recommendations for the engine Determine maintenance interval adjustments or excessive component wear by										

Interpret an oil analysis report and describe potential internal component faults										
to both engines and gear units										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (7)										
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VIII. Exhibit knowledge of gear drive systems, inboard and outboard.										
Tasks Instructions:										
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	1	2	3	4	5	6	7	8	9	10
Demonstrate knowledge of power flow through a manual inboard engine										
reverse gear assembly in both forward and reverse operation										
Explain why gear ratios vary from one installation to another										
Distinguish between gear and bearing types and the										
advantages/disadvantages of different types in torque and load handling										
capabilities										
Demonstrate knowledge of inboard engine propeller shaft alignment										
techniques and acceptable tolerances based on engine shaft sizes										
Relate knowledge of power flow through an outboard engine from power head										
to propeller										
Dissemble and reassemble an outboard engine lower unit/drive assembly										
using manufacturer-supplied special tools and manuals										
Take measurements using precision measurement tools such as dial										
indicators and micrometers according to manufacturer workshop manual										
instructions										
Contrast a power flow through a typical inboard/outboard upper and lower			L							
unit drive assembly										

Perform pressure and vacuum tests to an IO gear drive unit to determine seal										
integrity										
Dissemble and reassemble an IO drive assembly following correct										
manufacturer procedures and using manufacturer supplied special tools and										
manuals										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (12)										
IX. Service and repair boat and trailer rigging.										
Tasks Instructions:										
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	1	2	3	4	5	6	7	8	9	10
Properly wire boat trailer and connect to various vehicle types										
Establish trainer tongue weight and match to vehicle capacity										
Service trailer wheel bearings and ensure proper lubrication										
Service trailer braking systems										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (6)										
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X. Service and repair marine sanitation systems.										
Tasks Instructions:										
	1	2	3	4	5	6	7	8	9	10
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Identify marine sanitation system types and their application in accordance										
with EPA standards and regional laws										
Identify pump types used in marine sanitation systems and the advantages										
and disadvantages of each type for a specific application										
Disassemble and reassemble a typical marine head piston type pump system										
and replace key pump components as needed										
Demonstrate knowledge of typical type-3 marine sanitation system installation										
including all components such as through-hull valves, anti-siphon valves and										
holding tanks										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (6)										
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XI. Demonstrate knowledge of marine materials, composites, woodworking	and	met	alwo	orkin	g.					
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions:	and	met	alwo	orkin	g.					
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XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures	and 1	2	alwo	4	g.	6	7	8	9	10
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures Identify the characteristics of the various cloth materials used in laminate	and 1	2	3	4	g.	6	7	8	9	10
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures Identify the characteristics of the various cloth materials used in laminate construction and repair	and 1	2	3	4	g.	6	7	8	9	10
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures Identify the characteristics of the various cloth materials used in laminate construction and repair Distinguish between three primary resin types (polyester, vinylester, epoxy)	1	2	3	4	g.	6	7	8	9	10
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures Identify the characteristics of the various cloth materials used in laminate construction and repair Distinguish between three primary resin types (polyester, vinylester, epoxy) and the characteristics of each as they apply to specific applications	1	2	3	4	g.	6	7	8	9	10
XI. Demonstrate knowledge of marine materials, composites, woodworking Tasks Instructions: Identify modern composite materials used in boat construction and repair Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures Identify the characteristics of the various cloth materials used in laminate construction and repair Distinguish between three primary resin types (polyester, vinylester, epoxy) and the characteristics of each as they apply to specific applications Recognize catylization procedures for the various resin types and the use of	1	2	3 	4	g.	6	7	8	9	10

while working										
Identify core materials used in composite construction and the										
advantages/disadvantages of each type for a given application										
Recognize various marine woods used in marine construction and the										
characteristics of each type for a specific application										
Identify proper hand and power tools used to cut and shape marine woods, as										
well as safety practices specific to each of the tools commonly used such as										
table saws, band saws, jig saws and power sanding equipment										
Measure properly in order to build small wooden cabinets and shelving as is										
common to marine applications										
Identify safe and effective use of metal working equipment such as drill										
presses, band saws, hand drills and taps and die sets used for threading										
metal										
Demonstrate knowledge of marine metal applications and the susceptibility of										
common stainless steel, aluminum, mild steel bronze metals to various types										
of corrosion such as crevice, poultice, galvanic and stray current										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (13)										
XII. Model proper customer service/employability skills.										
Tasks Instructions:										
	1	2	3	4	5	6	7	8	9	10
Recognize proper boat care while conducting service procedures										
Demonstrate basic warranty procedures related to dealer installed equipment										
Complete a standard work order form and gather necessary service related										

information before work is performed					
Communicate effectively in written and verbal form with customers relative to					
service procedures either recommended or performed					
Demonstrate professionalism in appearance (proper attire) and work habits					
such as promptness and adhering to a schedule and deadlines					
Safety and infection control are adhered to during all aspects of this task.					
The student completed task within the time limited.					
Points earned					
Total possible points (7)					
Total points earned for all sections (A)					
Total possible points for all sections (B) 106					
Student/candidate score (divide A/B)					