



GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. GOP-532.05
Revision No, Date 6 21.05.13
Effective Date 01.08.11
Page 1 of 36

Compiled by

Approved by

Chief Examiner

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OPERATIONS – SEAFARER CERTIFICATION

GUIDANCE NOTE

SA MARITIME QUALIFICATIONS CODE

Engineer: Engineering Knowledge

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **2 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
MODULE 1			
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system</p> <p>Maintain a safe engineering watch</p> <p>Operate main and auxiliary</p>	<p>Watchkeeping practice:</p> <ol style="list-style-type: none"> 1. Routine associated with taking over and accepting a watch: responsibility of the watchkeeper, procedure for taking over a watch, precise nature of the log book check. 2. Routine of handing over a watch: responsibility to the new watch keeper, aspects of double checking, advise of changes during watch or abnormalities, advice of incomplete work. 3. Compilation of machinery space log book: understanding of essential operating parameters, the upper and lower bounds, recording or incidents during the watch, changes in recording during stand-by periods, the legal implications of the log books. 4. Routine duties undertaken during a watch: routine inspections of all machinery spaces use of all senses during rounds, specific watch responsibilities, UMS operational differences. 5. Unusual conditions in machinery spaces: action in case of auxiliary machinery failure or black-out, action in case of fire, observation of leaks, pipe bursts, oil spills etc., sudden main engine failure. 6. Preparing to proceed to sea: secure of all loose equipment, starting air, fuel, lubricating oil and circulating water, warming through, turning over main and auxiliary engines, testing of alarms, telegraph and steering gear, prepare main engine, prime, 	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p> <p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge or, .1 approved simulator assessment.</p>	<p>Demonstrate a clear understanding of marine engineering knowledge.</p> <p>Resources are allocated and assigned as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously given and received.</p> <p>Questionable decisions and/or actions result in appropriate challenge and response.</p> <p>Effective leadership behaviors are identified.</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **3 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>machinery and associated control systems</p> <p>Operate electrical, electronic and control systems</p>	<p>turning gear out, etc.</p> <p>7. Preparing for arrival in port: slowing down procedures, testing of telegraph, start stand-by auxiliaries, check air reservoirs, call out stand-by watch.</p> <p>Engine-room resource management</p> <p>Knowledge of engine-room resource management principles, including:</p> <p>.1 allocation, assignment, and prioritization of resources</p> <p>.2 effective communication</p> <p>.3 assertiveness and leadership</p> <p>.4 obtaining and maintaining situational awareness</p> <p>.5 consideration of team experience</p> <p>Basic construction and operation principles of machinery systems, including:</p> <p>.1 marine diesel engine</p> <p>.2 marine steam turbine</p> <p>.3 marine gas turbine</p> <p>.4 marine boiler</p> <p>.5 shafting installations, including propeller</p> <p>.6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems</p> <p>.7 steering gear</p> <p>.8 automatic control systems</p> <p>.9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems</p> <p>.10 deck machinery</p> <p>Safety and emergency procedures for operation of propulsion plant machinery, including control systems</p> <p>Instrumentation and control:</p> <p>Only instruments currently in use on board the ship must be dealt with. Cover operational principles and constructional details</p> <p>1. Pressure measurement, barometers, manometers:- U-tube, well, single limb, steel with float. Bourdon tubes: - C, spiral and</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p> <p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p> <p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>Team member(s) share accurate understanding of current and predicted engine-room and associated systems state, and of external environment</p> <p>Construction and operating mechanisms can be understood and explained with drawings/instructions</p> <p>1. Demonstrate a clear understanding of marine engineering knowledge.</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **4 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
Maintenance and repair of electrical and electronic equipment	<p>helical tubes. Electric types: strain gauges, piezo electric gauges.</p> <p>Diaphragm and bellows type gauges.</p> <p>Differential pressure cells.</p> <p>2. Temperature measurement: liquid-in-glass, liquid-in-steel, vapour and gas filled systems. Bimetal thermometers, thermo couples, resistance thermometers-thermostats.</p> <p>3. Flow measurement: positive displacement meters: rotor and gear type meters. Rate of flow meters: orifice, venturi, electro-magnetic type meters.</p> <p>Basic configuration and operation principles of the following electrical, electronic and control equipment:</p> <p>.1 Electrical equipment:</p> <p>.a generator and distribution systems</p> <p>.b preparing, starting, paralleling and changing over generators</p> <p>.c electrical motors including starting methodologies</p> <p>.d high-voltage installations</p> <p>.e sequential control circuits and associated system devices</p> <p>.2 Electronic equipment:</p> <p>.a characteristics of basic electronic circuit elements</p> <p>.b flowchart for automatic and control systems</p> <p>.c functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls</p> <p>3 Control systems:</p> <p>.a various automatic control methodologies and characteristics</p> <p>.b Proportional-Integral-Derivative (PID) control characteristics and associated system devices for process control</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p> <p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge and approved workshop skills training</p> <p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>Safety measures for working are appropriate</p> <p>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate</p> <p>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice</p> <p>Reassembling and performance testing is in accordance with manuals and good practice</p> <p>Identification of important parameters for fabrication of typical ship-related components is appropriate</p> <p>Selection of materials is appropriate</p> <p>Fabrication is to designated tolerances</p> <p>Use of equipment and hand tools, machine tools and measuring instruments is appropriate and safe</p> <p>Safety procedures followed are appropriate</p> <p>Selection of tools and spare gear is appropriate</p>
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board			

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **5 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>Maintenance and repair of shipboard machinery and equipment</p> <p>Maintenance and repair of shipboard machinery and equipment <i>(continued)</i></p> <p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system</p>	<p>Safety requirements for working on shipboard</p> <p>Electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment</p> <p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment</p> <p>Detection of electric malfunction, location of faults and measures to prevent damage</p> <p>Construction and operation of electrical testing and measuring equipment</p> <p>Function and performance tests of the following equipment and their configuration: .1 monitoring systems .2 automatic control devices .3 protective devices The interpretation of electrical and simple electronic diagrams</p> <p>Characteristics and limitations of materials used in construction and repair of ships and equipment</p> <p>Characteristics and limitations of processes used for fabrication and repair</p> <p>Properties and parameters considered in the fabrication and repair of systems and components</p> <p>Methods for carrying out safe emergency/temporary repairs</p> <p>Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments</p> <p>Use of hand tools, machine</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p> <p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and</p>	<p>Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practice</p> <p>Re-commissioning and performance testing is in accordance with manuals and good practice</p> <p>Selection of materials and parts is appropriate</p> <p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **6 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system</p>	<p>tools and measuring instruments</p> <p>Use of various types of sealants and packings</p> <p>Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment</p> <p>Appropriate basic mechanical knowledge and skills</p> <p>Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment</p> <p>The use of appropriate specialized tools and measuring instruments</p> <p>Design characteristics and selection of materials in construction of equipment</p> <p>Interpretation of machinery drawings and handbooks</p> <p>The interpretation of piping, hydraulic and pneumatic diagrams</p> <p>Materials:</p> <p>1. Production of iron and steel: emphasis is on the quality of the material coming out of the various furnaces. Blast furnace, cupola, puddling within a furnace.</p> <p>2. Bessemer, oxygen-blown, open-hearth, electric-arc and electric high frequency processes, vacuum melting and casting.</p> <p>3. The properties of iron and steel: hardness, strength, ductility, elasticity.</p>	<p>associated practical knowledge.</p> <p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge.</p> <p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **7 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical</p>	<p>4. Tensile test, compression test, impact test, fatigue test</p> <p>5. Toughness, brittleness.</p> <p>6. Manufacturing processes and treatments: casting, forging, rolling, spinning, drawing, extrusion.</p> <p>7. Hardening, tempering, toughening, annealing, normalising, stress relieving, stabilising, surface hardening, carburising.</p> <p>8. Alloying and effect on properties; alloying elements, manganese, nickel, chromium, tungsten, molybdenum, vanadium, silicon, copper, lead, cobalt, boron, titanium.</p> <p>9. Non-ferrous metals currently used on board ships, aluminium, copper, lead, platinum, tin, zinc, common brasses and bronzes, cupro nickel and aluminium-nickel bronzes, white metal and other bearing metals.</p> <p>10. Suitability of above metals to withstand corrosion, fatigue, heat, erosion, creep and cavitation.</p> <p>11. Castability and repairability of these metals.</p> <p>12. Non-metallic materials used on board ships: plastics and other man-made materials, carbon, rubber, asbestos, ceramics.</p> <p>13. Properties and application of the above materials.</p> <p>14. The general effects of the various treatments on the physical properties of materials used in the construction of engines and boilers. The mechanical test to which these materials are normally subjected.</p> <p>15. The correction of defects due to faults in material or accident.</p> <p>16. Temporary or permanent repairs in the event of derangement or total breakdown.</p> <p>Steam plant and auxiliary systems:</p> <p>1. Boilers: marine boilers of various modern designs, types of</p>	<p>1. Written examination and</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **9 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>sources of contamination, precautions and action</p> <p>Power transmission systems:</p> <p>1. Construction and operation: thrust bearing, shaft bearing, shafting stern tube, water and oil lubricated types, stern tube seals, propellers, fixed blade, built up and controllable pitch, Schottel and podded propulsion power systems.</p> <p>Pumps and pumping systems:</p> <p>1. Pumps types: reciprocating, single and double acting, gear, screw, vane, lobe pumps, discharge pressure control, centrifugal pumps, air pumps for s</p> <p>2. Pumping systems describe by means of sketches: bilge systems, oily water separators, emergency bilge pumping arrangements, ballast system, precautions against flooding, domestic cold water system, fresh water generators, domestic hot water system, calorifiers, sanitary water, sewage and sludge system.</p> <p>3. The use and management of valves, pipes, connections and safety devices employed</p> <p>Marine electrical equipment and systems:</p> <p>1. Preparing, starting and running of diesel and steam turbines.</p> <p>2. Sequences of paralleling alternators and generators</p> <p>3. Operation of shaft generators</p> <p>Refrigeration systems:</p> <p>1. Constructional arrangement, details and working of refrigerating machinery and auxiliary machinery on board ship: compressors, condensers, evaporators, expansion valves, liquid receivers, stop valves, refrigerants, danger of refrigerants, lubricants, oil separators, danger of entering cool spaces, CO2 gas.</p> <p>2. Describe refrigeration cycle</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **10 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>by means of sketch.</p> <p>Ship handling and manoeuvring equipment:</p> <ol style="list-style-type: none"> 1. Steering gear: types of steering gear, construction, watch keeping practice, pre-sea checks, routine checks, and emergency operation of steering gears. 2. Bow thrusters 3. Stabilizers 4. Manoeuvring arrangements and the various operations connected therewith <p>Ship safety and safety equipment:</p> <ol style="list-style-type: none"> 1. Fire: fire prevention and precautions, types of fires and methods of extinguishing, fire detection methods, patrols, alarm circuits, fixed installation systems. 2. Dangers of leakage from oil tanks, pipes, gas products and vaporizers, particularly in bilges and other unventilated spaces. 3. Precautions against fire or explosions due to oil or gas. 4. Flash point. 5. Explosive properties of gas or vapour given off by fuel or lubricating oils when mixed with air. 6. The action of wire gauze diaphragms and the places in which such devices should be fitted <p>Fuel and lubricants:</p> <ol style="list-style-type: none"> 1. Fuel oil: production of fuel oil, properties of fuel oil: density, viscosity, flash point, etc. Methods of storing, tank fittings, wire gauze diaphragms, danger of oil spilling, leakage and contamination. Precautions to be taken during routine pumping operations. Precautions when working in oil tanks. Purification, clarification, filters. 2. Lubricating oil: animal, vegetable, mineral and compound oils. Methods of storing, filters and strainers, lubrication fundamentals. Boundary and hydrodynamic lubrication. Lubricating oil additives, lubricating oil tests. 		

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **11 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>3. Precautions against fire or explosions due to oil or gas; explosive properties of gas or vapour given off by fuel or lubricating oils when mixed with air.</p> <p>Auxiliary equipment design & maintenance:</p> <p>1. Constructional arrangement, details and working of steering-engines and gears, refrigerating machinery, hydraulic machinery, and such steam and internal combustion engines as are used for emergency and auxiliary machinery on board ship.</p> <p>2. Constructional details and management of auxiliary machinery.</p> <p>3. The operation and maintenance of various parts of machinery.</p> <p>4. Constructional details and working of air compressors.</p> <p>Ship maintenance & management:</p> <p>1. Machinery and hull surveys: reasons for survey, compare statutory and Class surveys, preparing for surveys.</p> <p>2. Inspection techniques: inspection before dismantling, recording relevant facts, unusual measurement.</p> <p>3. Condition and performance monitoring: interpreting changes in instrument readings on machines, vibration monitoring techniques</p> <p>4. Statutory responsibility of the chief engineer, second engineer and engineer officer in charge of an engineering watch.</p> <p>5. Temporary or permanent repairs in the event of breakdown.</p> <p>6. The methods of dealing with wear and tear of machinery and boilers.</p>		

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. GOP-532.05
Revision No, Date 6 21.05.13
Effective Date 01.08.11
Page 12 of 36

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **13 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
MODULE 2			
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Watchkeeping practice:</p> <p>1. Periodically unattended machinery, techniques and work practices. Additional fire detection equipment. Alarm monitoring and recording equipment. H.P. fuel pipes oil leakage prevention systems. Automatic bilge pumping. Duplication of pumping systems, automatic starting. Securing of unmanned spaces</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	
<p>Manage the operation of propulsion plant machinery</p>	<p>Design features, and operative mechanism of the following machinery and associated auxiliaries:</p> <p>.1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>Explanation and understanding of design features and operating mechanisms are appropriate</p>
<p>Plan and schedule operations</p>	<p><i>Theoretical knowledge</i></p> <p>Thermodynamics and heat transmission Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption</p> <p>Heat cycle, thermal efficiency and heat balance of the following: .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler</p> <p>Refrigerators and refrigeration cycle Physical and chemical properties of fuels and lubricants Technology of materials Naval architecture and ship construction, including damage control</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>The planning and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **14 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery</p>	<p>Practical knowledge</p> <p>Start up and shut down main propulsion and auxiliary machinery, including associated systems</p> <p>Operating limits of propulsion plant</p> <p>The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery</p> <p>Functions and mechanism of automatic control for main engine</p> <p>Functions and mechanism of automatic control for auxiliary machinery including but not limited to:</p> <ul style="list-style-type: none"> .1 generator distribution systems .2 steam boilers 3 oil purifier .4 refrigeration system .5 pumping and piping systems .6 steering gear system .7 cargo-handling equipment and deck machinery 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>The methods of preparing for the start-up and of making available fuels, lubricants, cooling water and air are the most appropriate</p> <p>Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with technical specifications and agreed work plans</p> <p>Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions</p> <p>The methods of preparing the shutdown, and of supervising the cooling down of the engine are the most appropriate</p> <p>The methods of measuring the load capacity of the engines are in accordance with technical specifications</p> <p>Performance is checked against bridge orders</p> <p>Performance levels are in accordance with technical specifications</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **15 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Materials:</p> <ol style="list-style-type: none"> 1. Material treatments: influence of heat treatment on crystal structure. 2. Manufacturing processes: structure and properties of cast metals, typical defects, property changes taking place due to cold or hot working, oxidation, residual stresses and cracking, effect of welding on structure and properties of parent metal. 3. Corrosion: mechanism of corrosion of metals, methods used to reduce corrosion, composition of metal, cathodic protection and protective coatings. 4. Material testing: fatigue testing, surface cracks, penetrants and magnetic particle tests, sonic and ultra sonic tests, radiographic tests, X-ray and gamma ray tests, metal thickness tests. 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **16 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Instrumentation and control:</p> <ol style="list-style-type: none"> 1. The determination of shaft power 2. Control systems, automation and instrumentation. 3. Analysis and interpretation of information gained from monitoring equipment. 4. Vibration measurement: piezo electric crystal and spring type Instruments. 5. Chemical composition instruments: oxygen in feed water. PH of feed water, flue gas analysis, relative humidity meter. 6. Photo-electric cells: hold fire detection, funnel smoke-density monitor, oily water separator operation monitor, oily mist detector. 7. Instrument errors, calibration and testing: pressure measurement, zero, range, ambient temperature, hysteresis, backlash errors. <p>Temperature measurement, freezing and boiling points.</p> <ol style="list-style-type: none"> 8. Telemetry: pneumatic, flapper and nozzle. Position balance and force balance systems. Electrical, variable resistance, inductance and capacitance transducers. Bridge and potentiometer circuits. 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **17 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>9. Control system principles: reasons for automatic control, advantages and disadvantages. Feedback, negative, positive, gain, stability. Feed forward. Modes of control, two step, proportional, integral and derivative control actions. Two and three term controllers. Methods of generating these actions.</p> <p>10. Control system elements: pneumatic control elements, relays, ratio controllers. Actuators, diaphragm control valve, power piston, wax element control valve. Positioners, volume boosters. Valves, single and double seated, three way, butterfly, ball, rotary cylinder and Saunders valves. Electric control elements, relays, amplifiers, servo-motors.</p> <p>11. Control systems: I.C. Engines; jacket water cooling, lube oil cooling, fuel valve cooling, fuel oil viscosity and speed control.</p> <p>Auxiliaries; control air pressure, oil purifying, waste heat boiler feed and pressure control.</p> <p>Boilers; pressure and combustion, fuel oil viscosity, steam superheats temperature and boiler level control.</p> <p>Turbines; gland steam pressure, lube oil temperature and speed control. Steam auxiliaries; condenser circulating water temperature, exhaust range pressure control. Refrigeration; brine and chamber temperature control.</p> <p>12. Electronics: semiconductor devices, diodes, transistors, thyristors.</p> <p>Basic circuits for amplifiers, rectifiers, filters, voltage stabilisers, oscillators, multi vibrators. Integrated circuits. Very large scale integrated circuits.</p> <p>Microprocessors, programmable controllers, practical examples of systems presently in use on board the ships. Logics and logic circuits.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering Knowledge.</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **18 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system</p>	<p>Internal combustion engines & auxiliary systems:</p> <ol style="list-style-type: none"> 1. Safe and efficient operations of compression ignition engines. 2. Application of the indicator equipment. 3. Interpretation of indicator cards. 4. The recognition of irregularity in the performance of machinery and plant. 5. Construction: construction details of engine components. General requirements concerning oil fuel systems. General requirements concerning lubricating oil systems. General requirements concerning cooling systems. Starting air systems, air compressors. Scavenge air systems, turbo blowers 	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>Demonstrate a clear understanding of marine engineering knowledge.</p>
	<p>Steam plant and auxiliary systems:</p> <ol style="list-style-type: none"> 1. Boiler construction: construction details of boilers and boiler mountings. Allowing for expansion when hot; sliding feet, steam pipe loops and hangers, U-tubes. Uptake; sliding joints and corrugated sections. Attention required. 2. Boiler auxiliaries: constructional details, operation and maintenance of: Uptakes, fans, pre-heaters, soot-blowers and soot-collectors. Pollution control equipment. Combustion equipment; furnaces, furnace fronts, pumps, filters and heaters. Efficient combustion practices. Feed water systems; feed pumps, feed pump governor, water level controllers. Auxiliary feed line. Feed chemical dosage equipment. Blow down arrangements. 3. Boiler operation: maintaining steam pressure and temperature. Water level. Feed water chemical treatment, dosage equipment. Tests. Control of corrosion and scale. Blow densities. Combustion control; efficient operation, pollution. 4. Boiler maintenance: routine internal and external cleaning; drums, tubes, furnaces, fans, pre-heaters and soot-collectors. Opening up for repairs and surveys. Blow down. Temporary and permanent repairs; boilers, auxiliaries, combustion equipment and uptakes. Management of maintenance schedules, survey requirements. 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **19 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>5. Turbines; constructional details of components. Operation of turbines. Attention required by individual parts. Safety equipment; bulkhead stop valve, lube oil pressure, bearing failure, rotor shift, over speed, low vacuum, emergency cut-out. Maintenance; opening up for repair and survey. Emergency operation with one turbine out of action.</p> <p>6. Condensers and auxiliary equipment: constructional details, attachment to low pressure turbine and hull, allowing for expansion under working conditions. Sea water circulating system; control of circulating water inlet temperature. Routine cleaning. Extraction pump; control of water level in condenser. Air extraction; suction section cooling, air ejectors. Closed feed system; drain coolers, heaters, hot well.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **20 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Power transmission systems:</p> <p>1. Couplings, clutches and bearings: flange, muff and hydraulic compression sleeve couplings.</p> <p>Flexible couplings; claw, gear and Bibby couplings. Coupling bolts; fitted hydraulic tensioned bolts.</p> <p>Electro-mechanical and hydraulic fluid type couplings. Mechanical type clutches; plate and cone.</p> <p>Bearings; fully metallised, bottom half metallised, tilted pad and concentrically metallised bearings. Alignment of shafting and bearing loading.</p> <p>2. Stern tube: stern tubes; lignum vitae, plastic, rubber, white metal. Lubrication; high and low level header tanks, forced lubrication. Glands, inboard and outboard.</p> <p>3. Propellers: fixed pitch; solid and built up types. Materials. Controllable pitch; methods of control, advantages and disadvantages. Operation and maintenance. Methods of securing propellers; keys, hydraulic pressure on boss and hydraulic nuts. Removing propellers. Dry dock inspections, records.</p> <p>4. Schottel and podded propulsion power systems.</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	
Manage fuel, lubrication and ballast operations	Operation and maintenance of machinery, including pumps and piping systems	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	Fuel and ballast operations meet operational requirements and are carried out so as to prevent pollution of the marine environment

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **21 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Pumps and pumping systems:</p> <ol style="list-style-type: none"> 1. General requirements concerning: fuel oil systems and lubricating oil systems. 2. Pumps: operation, inspection and maintenance. Automatic control of pumps; starting, stopping, control of pressure. Fault diagnosis; lack of suction, pressure, output. 3. Bilge systems: bilge system; pumping system and sizing of bilge pipes. Pipelines through bulkheads, tanks and duct keels. Emergency arrangements; emergency bilge pump, bilge injection valve, rules for size of valve and pump. Extended spindles. Sounding pipes. Air extraction pumps; reciprocating, liquid ring, central priming systems. 4. Ballast systems: sea water chest valves, separation of pipe lines. Interconnection with bilge system. Emergency cross flooding arrangements. Trimming tanks. 5. Fuel oil systems: bunkers, bunker fittings, overflow pipes, overflow tanks, alarms. Drain cocks, oily bilges. Taking on fuel oil. Sounding systems. Steam heating, observation tanks. Fuel oil transfer arrangements. Dump valves. Settling tanks, fittings. Purifiers and clarifiers. U.M.S. ships, enclosed separate oil auxiliaries room. 6. Domestic pumping systems. <i>Operation and maintenance of the following systems:-</i> Domestic hot and cold fresh water systems, sanitary water and Sewerage system, fire main and wash down system. 	<ol style="list-style-type: none"> 1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge. 	<ol style="list-style-type: none"> 1. Demonstrate a clear understanding of marine engineering knowledge.

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **22 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
Manage operation of electrical and electronic control equipment	<p><i>Theoretical knowledge</i></p> <p>Marine electro technology, electronics, power electronics, automatic control engineering and safety devices</p> <p>Design features and system configurations of automatic control equipment and safety devices for the following:</p> <ul style="list-style-type: none"> .1 main engine .2 generator and distribution system .3 steam boiler <p>Design features and system configurations of operational control equipment for electrical motors</p> <p>Design features of high-voltage installations</p> <p>Features of hydraulic and pneumatic control equipment</p>	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	
Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition	<p>Practical knowledge</p> <p>Troubleshooting of electrical and electronic control equipment</p> <p>Function test of electrical, electronic control equipment and safety devices</p> <p>Troubleshooting of monitoring systems</p> <p>Software version control</p>	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	<p>Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications</p> <p>Inspection, testing and troubleshooting of equipment are appropriate</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **23 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Marine electrical equipment and systems:</p> <ol style="list-style-type: none"> 1. Safe and efficient operation of electrical machines and systems. 2. Constructional details: details of motors, alternators and shaft generators. Distribution equipment, main and sub switchboards. Protective equipment, circuit breakers, preferential tripping, overload, reverse power relays, fuses. Details of voltmeters, watt meters, frequency meters, synchrosopes, voltage and current transformers. Details of static and rotary voltage regulators. 3. Operation and maintenance: parallel running of alternators. Motor starters including remote and automatic starting. Planned maintenance of electrical equipment. Fault diagnosis, insulation resistance, continuity and short circuit tests on machines. Emergency operation, temporary cables, hazards. 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **24 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Refrigeration systems:</p> <p>1. Operation: the vapour-compression cycle, pressures and temperatures. Refrigerants, properties, dangers. Refrigerating effect. Constructional details of refrigerating machines, spaces.</p> <p>Efficient operation of system. Coefficient of performance. Brine and brine circuits. Hold ventilation systems. Container cooling systems.</p> <p>Automatic control. Direct expansion systems, advantages and disadvantages.</p> <p>2. Air conditioning: air conditioning circuit. Heat pumps. Humidity, partial pressures, Dalton's Laws, dew point. Dry bulb and wet bulb temperatures, psychometric charts. Humidifiers, dehumidifiers. Filters</p> <p>Ship handling and manoeuvring equipment:</p> <p>1. Steering gear: constructional details of steering gears. Steering gear operation, maintenance, fault diagnosis. Constructional detail of rudders and rudder supports. Rudder maintenance, dry-dock inspections and records.</p> <p>2. Thrusters and stabilisers: thrusters, construction and maintenance. Stabilisers, construction and maintenance. Drydock inspections and records.</p> <p>3. Bridge control to engine room manoeuvring equipment.</p> <p>Pollution control:</p> <p>1. Regulations of effluent discharge contamination levels. Oily water separators. Discharge monitoring devices. Sludge systems, incinerators. Recordings. Sewage treatment plants. Discharge monitoring.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **25 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary</p>	<p>Ship safety and safety equipment:</p> <p>1. Precautions against fire or explosion: explosive mixtures, danger of oil leakage, source of ignition and safety devices.</p> <p>2. Principle of operation, application and maintenance of fire extinguishers, respirators, safety lamps.</p> <p>3. Toxic and other dangerous properties of substances used in marine practice.</p> <p>4. Maintenance of plant associated with the carriage of dangerous goods.</p> <p>5. Fixed fire detection and extinguishing arrangements for accommodation, cargo and machinery spaces.</p> <p>6. Fire: regulations: prevention, detection, equipment.</p> <p>7. Operation, application and maintenance of extinguishers. Breathing apparatus, safety lamps, and detectors.</p> <p>8. Machinery space emergency equipment: emergency generators, fire pumps, bilge pumps.</p> <p>Air compressors, hydraulic-inertia starters for cold start of power plant. Stopping of power plant from outside machinery space. CO2 and foam flooding arrangements in case of fire. Remote control of pumps, valves, quick shut-off valves, dumping valves for stability improvement. Remote control of fans, baffles, flaps. Remote control of watertight doors. Constructional details. Operating features</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge.</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **26 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
Manage safe and effective maintenance and repair procedures	Theoretical knowledge Marine engineering practice Practical knowledge Manage safe and effective maintenance and repair procedures Planning maintenance, including statutory and class verifications Planning repairs	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	Maintenance activities are correctly planned and carried out in accordance with technical, legislative, safety and procedural specifications Appropriate plans, specifications, materials and equipment are available for maintenance and repair Action taken leads to the restoration of plant by the most suitable method
Detect and identify the cause of machinery malfunctions and correct faults	Practical knowledge Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment Non-destructive examination	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	The methods of comparing actual operating conditions are in accordance with recommended practices and procedures Actions and decisions are in accordance with recommended operating specifications and limitations
Ensure safe working practices	Practical knowledge Safe working practices	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
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GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **27 of 36**

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
Machinery and ship propulsion system	<p>Ship maintenance & maintenance management:</p> <ol style="list-style-type: none"> 1. Maintenance of machinery: safe working practices: overhauling machinery, safety in workshop, protective equipment, lifting tackle, entering tanks. 2. Routine tasks; crankcase, gear and chain inspections. 3. Overhauling, changing and setting of fuel valves, fuel pumps and air start valves. 4. Alignment of machinery parts. 5. Correction of defects; temporary and permanent repairs. 6. Methods of dealing with wear and tear of engines. 7. Cylinder liner inspections, recording of condition of liner and rings. Methods to improve wear resistance and retention of cylinder lubricating oil. 8. Crankshaft wear down and alignment checks and recordings. Witness marks. Check for overheating and hot spots 	Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge	

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
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GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **28 of 36**

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Auxiliary equipment design & maintenance: <i>Construction detail, operation and maintenance of:</i></p> <p>1. Machinery spaces: air compressors and air systems, oil purifiers, clarifiers and filters. Distillation plant, treatment of potable water.</p> <p>2. Deck systems: H.P. and L.P. hydraulic power systems. Windlasses, mooring winches, winches, cranes and hoists. Hatch opening systems.</p> <p>Management:</p> <p>1. The administrative duties of a second engineer, i.e. the organisation and training of staff for both normal and emergency duties including the use of safety equipment, and the organisation of repairs and survey and associated reports.</p> <p>2. Knowledge of the appropriate statutes of concern to marine engineer officers.</p> <p>3. Surveys and dry docking: load line, safety construction, safety equipment surveys. Hull and machinery survey cycles.</p> <p>4. Inter-department communication: on board planning committees, operation and maintenance, utilisation of labour and time. On board safety committees, involvement of staff.</p> <p>5. Personnel management and development: Staff motivation, factors, influencing morale and attitudes. Responsibility of senior staff for effective training.</p> <p>6. Reports and records: routine reports to management. Plant performance, maintenance and repairs done on board and by shore-side labour, dry dock reports. Survey records. Reports on incidents. Importance of on board records in problem solving. Importance of accurate record keeping, log book, movement book, planned maintenance, repairs, surveys.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **29 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system</p>	<p>8. Bearing inspections. Modes of failure of bearings. Interaction between lube oil and bearing metal, compatibility, acidity, combustion products.</p> <p>9. Repair of damaged bearings, precautions, wear down.</p> <p>10. Routine cleaning of scavenge spaces and turbo blowers.</p> <p>11. Surveys. Planned maintenance. Condition monitoring.</p> <p>13. Engine performance: fuel, lube oil and cooling water consumption comparisons. Variations of exhaust, bearing, lube oil and cooling water temperatures. Indicator cards, power, draw, compression cards. Condition of lube oil, oxidation, wear particles, mass of solids from purifiers, filters. Change of sound and vibration from engine. Incidence of scavenge fires.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge</p>
	<p>Fuel and lubricants:</p> <p>1. Properties and characteristics of liquids, gasses and vapours used in machinery on board ship.</p> <p>2. Properties of fuel oil and tests: liquid fuels, crude oil distilling process. Density, viscosity, flashpoint, calorific value, pour point, carbon residue, fire point, octane number, cetane number, acidity, ash and water content. Analysis, anticipated contaminants, typical concentrations. Compare residual and distillate fuels. On board testing, filter paper spot test for compatibility. Tank cleaning; explosive mixtures, entering tanks. Gas free certificates. Precautions against fire and explosion.</p> <p>3. Combustion: measuring funnel gas constituents and the significance of carbon monoxide, carbon dioxide and excess oxygen. Ways of maintaining air/fuel ratio in boilers and I.C. engines. Influence of fuel temperature and pressure on combustion. Cetane rating, ignition delay and effect on timing. Effects of incomplete combustion on exhaust ports, -valves, - turbos and waste heat boilers.</p> <p>4. Lubricating oil: contamination; water, fuel and combustion products. Tests, sources, preventive measures. Biological degradation; source, effect and treatment, On board tests; alkalinity, blotting paper. Mobil floss stick, crackle test for water. Visual and smell. Cylinder lubrication; fuel quality and TBN values.</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **30 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
MODULE 3			
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Materials:</p> <p>1. Material selection: selection by using tables of mechanical and physical properties. Corrosion and corrosion protection, electro-plating and hot dipping. Bearing materials for different applications. Selecting paints for specific purposes.</p> <p>2. Modes of failure: Practical examples of, methods to identify and means of preventing the following types of failures; Tensile, shear and compressive failures. Creep. Fatigue. Brittle fracture. Transcrystalline and inter crystalline cracking. Creeping cracks. Stress raisers. Casting flaws. Casting strains. Welding failures. Heat cracks. Residual stresses. Fretting and fretting corrosion. Impingement. Erosion, cavitations', corrosion, friction, abrasive wear. Micro seizure. Common failures of white metal bearings, scoring, wiping, squeezing, fatigue cracking, corrosion, galvanic attack, misalignment, brinelling, electric current flow.</p> <p>3. Analysis of failures: Systematic examination of the nature of failure. Scope of analysis, service factors, human factors, related mechanisms, cost, time, safety, litigation. Evaluate alternatives, what explanations are certain, probable, possible, unlikely, impossible. Report, recommend improvements.</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge.</p>
	<p>Instrumentation and control:</p> <p>1. Factors affecting instrument selection: accuracy, precision or repeatability. Sensitivity and range. Reliability. Cost. Response time. Environment, temperatures, vibration, corrosive atmosphere.</p> <p>2. System analysis: first and second order systems. Analogues. Block diagrams, transfer functions. Ramp, step and sinusoidal inputs. Transient response method of deriving optimum settings of controllers. The frequency response method of explaining control system operation. Adjusting controllers to plant.</p> <p>3. Microprocessor controlled systems: electronic active and passive components. Integrated circuits, large scale integrated circuits, very large scale integrated circuits. Microprocessors. Push buttons start up.</p> <p>4. Programmable controllers. Fauldiagnosis.</p> <p>5. Performance monitoring: data logger, sensors, scanning rate, off-limit conditions, alarms. Line printer. Ship-shore communication links. Performance analysis by shore-based computer.</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **31 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Internal combustion engines & auxiliary systems:</p> <ol style="list-style-type: none"> 1. Engine types: engine selection criteria, ship types, service, speed, manoeuvrability, manning, maintenance, costs. 2. Advantages and disadvantages of slow, medium and high speed engines, in-line and V engines. 3. Direct drive, multiple or single engine geared drives. Reversible, on-reversible engines, controllable pitch propellers. 4. Engine performance: performance monitoring and optimisation. Engine component failure analysis. Damage assessment and Reconditioning methods. Balance and vibration problems, vibration analysis methods. Engine survey and inspection techniques. <p>Steam plant and auxiliary systems:</p> <ol style="list-style-type: none"> 1. Construction details and operation of: turbines, gearing, boilers, ancillary feed water/steam plant and combustion equipment; auxiliary boilers and steam plant. 2. Boiler and turbine types: boiler selection criteria, type, shape, Size, pressure, superheat temperature, reheat. 3. Turbine selection criteria, HP, IP, LP configurations astern turbine. Impulse, reaction, Impulse-reaction turbines. 4. Condensers, single and double pass, pump and scoop circulation. 4. Closed feed system, selection of components. 5. Steam plant performance: performance monitoring and optimisation. 6. Steam plant failure analysis. 7. Steam plant survey and inspection techniques. 	<ol style="list-style-type: none"> 1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge. 	<ol style="list-style-type: none"> 1. Demonstrate a clear understanding of marine engineering knowledge.

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **32 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Power transmission systems:</p> <p>1. Gears and gear boxes: gearbox configuration, single and double reduction, interleaved, tandem, locked gear trains, quill shafts. Epicyclic gears. Horizontal and vertical offset shafts. Construction of gears; solid, spiders, rims, materials. Heat treatment; induction hardening, case hardening, carburising, manufacturing methods.</p> <p>2. Shafts, clutches and couplings: shafting rules, allowance for sea water contact. Vibration, resonant conditions, critical speeds, whirling of shafts. Transverse, axial and torsional vibration; methods to reduce vibration, stays, dampers, de-tuners. Clutches, types, selection. Couplings, types, selection. Stern gear, typical problems, surveys.</p> <p>Pumps and pumping systems:</p> <p>1. Pump: plump characteristics. Losses. Pump types, description and selection for specific duties. Surveys, inspections, maintenance. Cavitation.</p> <p>2. Pumping systems: class rules of bilge, ballast and oil pumping systems. Pipe arrangements. Separation of fuel and ballast lines. Heat exchangers, central cooling systems, central priming system, modular systems. Control of hydraulic systems.</p>	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **33 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Marine electrical equipment and systems:</p> <p>1. Power system: overview, alternating-current plants, direct-current plants, tolerances, system configuration, system protection.</p> <p>2. Power sources and conversion: generator sets, steam turbine generators, diesel generators, gas turbine generators, emergency generator sets, speed governors, generators, voltage regulators storage batteries</p> <p>3. Power distribution: distribution concept, ship-service power distribution features, emergency power distribution, switchboards, switchboard construction, panel boards, power distribution circuits. Breakers, transformers, shore supply connection. Insulated and earthed neutral systems, significance of earth faults, circuit protection.</p> <p>4. Electric plant control: automation; automatic start-up of generator sets, automatic synchronizing, automatic load shedding, automatic shutdown and securing of generator sets.</p> <p>5. Degaussing: purpose, methods of degaussing, shipboard degaussing installation for steel-hull surface ships. Power source, control equipment.</p> <p>6. Ships electrical systems, safety and maintenance.</p> <p>7. Special electrical practice for oil, gas and chemical tankers</p>	<p>1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge.</p>	<p>1. Demonstrate a clear understanding of marine engineering knowledge.</p>

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **34 of 36**

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Electric propulsion drives:</p> <ol style="list-style-type: none"> 1. Basic consideration: significant features, electric-drive application, types of electric-drive applications, types of electric-drive systems, power generation and conversion, system voltage selection, control and regulating systems, generators for electric drives, transformations for electric-drives, power system harmonics and filtering, grounding. 2. Direct-current propulsion-drive systems: system characteristics, power converters for direct-current drives, physical characteristics for DC drives, power converters for alternating-current drives, motors for AC drives. 3. Ship applications. <p>Refrigeration systems:</p> <ol style="list-style-type: none"> 1. Construction details, principles involved of refrigeration machinery. 2. Operation: refrigeration system, settings for optimum running. 3. Survey of refrigeration system. 4. Control of comfort levels in air conditioning. 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	

GUIDANCE NOTE
SAMSA Code: Engineer
Engineering Knowledge

Document No. **GOP-532.05**
Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **35 of 36**

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COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
<p>1. Understand the theoretical principles of marine engineering knowledge.</p> <p>2. Understand the working and operation of onboard auxiliary machinery and ship propulsion system.</p>	<p>Fuel and lubricants:</p> <ol style="list-style-type: none"> 1. Fuel analysis and related problems: storage problems, incompatible fuels, sludging, biological degradation. 2. Treatment problems, removal of solid and liquid contaminants. High specific gravity and efficiency of purification. 3. Pre-combustion problems, effect of solids and metal particles on filters, I.C. engine fuel systems and boiler burners. Post-combustion problems, effects of sulphur, vanadium, sodium, aluminium and silicon in the fuel. 4. Chemical treatment to counteract these problems. 5. Burn ability, fouling of fuel injectors, after burning, ignition delay, uneven burning, ignition pressure gradient. 6. Combustion gas analysis. Methods, results, action. 7. Lubricating oil: lubricating oil specifications for various duties. Selection of lubricants for specific applications. Synthetic lubricants, application and selection. Additives in lubricating oil, performance additives, surface and lubricant protective additives. Cylinder lub oil, TBN values related to fuel quality. 	<ol style="list-style-type: none"> 1. Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge. 	<ol style="list-style-type: none"> 1. Demonstrate a clear understanding of marine engineering knowledge.

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Revision No, Date **6 21.05.13**
Effective Date **01.08.11**
Page **36 of 36**

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COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING COMPETENCE
	<p>Gas turbines:</p> <ol style="list-style-type: none"> 1. Basic consideration, gas turbine engine schematic, single-spool and multi-spool gas turbines, effect of ambient conditions and duct losses on performance, combined cycle, bleed air, quick starting, fuels and fuel treatment, installation, operation and maintenance. 2. Arrangement and structural details: General arrangements, air intake, exhaust uptake, intercoolers and recuperators, reduction gearing and reversing considerations. 3. Accessories: auxiliary pumps and drives, fuel system, starting devices, inlet air filters, inlet and exhaust silencers. 4. Controls: control: operational control, safety control, monitoring 5. Compressor design: centrifugal compressor, centrifugal impeller design, diffuser design, rotor design. The axial-flow compressor: 6. Turbine design and construction: types of turbines, nozzle design and construction, rotor design. 7. Combustion systems: combustion chamber configuration, mechanical details and construction, fuel nozzle, ignition system. 8. Bearings, seals and lubrication: bearing types, antifriction bearings, sleeve bearings, thrust bearings, shaft seals, lubrication <p>Ship maintenance & maintenance management:</p> <ol style="list-style-type: none"> 1. Reports and records: routine reports to shore management. Incident reports. Insurance and damage claims. 2. Survey reports. <p>3. Staff performance and attitude report.</p> <p>Shipboard safety and safety equipment:</p> <ol style="list-style-type: none"> 1. Regulations: SOLAS, MARPOL requirements, surveys. 2. Flag state requirements, inspections. 3. Classification society surveys. 4. Similarities, differences and the role of class and statutory surveys. 5. Organisation: Fire drills, accommodation, hold, engine room spaces, CO2 flooding, re-entry of engine room after flooding. Safety committee meetings. Safety training 	<p>Written examination and assessment of evidence obtained from theoretical instruction, display diagrams and associated practical knowledge</p>	