

Assessment Requirements

Unit MC07K – Knowledge of Diagnosis and Rectification of Motorcycle Engine Faults

Content:

Single cylinder and multi-cylinder fuel injection systems

- a. The operation and construction of injection systems including:
 - i. types of air flow/mass sensor
 - ii. fuel supply system
 - iii. fuel pump
 - iv. filter
 - v. fuel regulator
 - vi. injectors
 - vii. electronic control unit (ECU)
 - viii. injector pulse width
 - ix. sensors
- b. The operation of each system under various operating conditions including:
 - i. cold starting
 - ii. warm up
 - iii. hot starting
 - iv. acceleration
 - v. deceleration
 - vi. cruising
 - vii. full load
- c. Engine speed limiting and knock sensing.

Engine Management

- a. The function and purpose of engine management systems.
- b. The difference between analogue, digital, programmable and non-programmable systems.
- c. Open loop and closed loop control, types of input and output devices.
- d. The function and operation of digital components and systems.
- e. The operation of engine management systems under various conditions.

Valve Mechanisms

- a. The reasons for variable valve timing and multi-valve arrangements and the effect on performance.
- b. Layout of multi-valve arrangements, components, operation and drive arrangements.
- c. Construction features and operation of variable valve timing engines and electronic control.

Terms Associated with Combustion

- a. Flame travel, pre-ignition and detonation.
- b. Fuel properties:
 - i. octane rating
 - ii. flash point
 - iii. fire point
 - iv. volatility
 - v. composition of petrol fuels
 - vi. hydro-carbon content
- c. Composition of carbon fuels
- d. Combustion process for spark ignition engines:
 - i. air fuel ratio

- ii. lambda ratio
 - iii. stoichiometric ratio
- e. The by-products of combustion for different engine conditions and fuel mixtures:
 - i. CO
 - ii. CO₂
 - iii. O
 - iv. N
 - v. H₂O
 - vi. NO_x
- f. Describe the legal requirements for exhaust emissions;
 - i. MOT requirements
 - ii. EURO regulations

Assessment, Repair and Restoration of Mechanical Engine Components

- a. How engine mechanical components are assessed and measured for wear and serviceability:
 - i. cylinder bores
 - ii. cylinder heads
 - iii. crankshaft journals
 - iv. valve faces
 - v. valve guides
 - vi. valve seats
 - vii. camshafts
- b. The methods used for the repair and restoration of engine components.

Symptoms and Faults in Engine Mechanical Systems and Components

- a. Symptoms and faults related to:
 - i. worn cylinders
 - ii. cylinder liners
 - iii. pistons
 - iv. piston rings
 - v. crankshaft
 - vi. camshaft
 - vii. bearings
 - viii. cylinder head and gasket
 - ix. valves
 - x. valve seats and valve guides
 - xi. cambelts tensioned and pulleys
 - xii. cam chains tension systems and guides
 - xiii. lubrication system and components
 - xiv. oil pump
 - xv. relief valve
 - xvi. filter
 - xvii.

Diagnosis of Faults in Engine Mechanical Systems and Components

- a. Interpret information for:
 - i. diagnostic tests
 - ii. manufacturer's motorcycle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. legal requirements
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Systematic assessment, testing and inspection of engine components and systems including:

- i. mechanical system & component condition
- ii. engine balance
- iii. power balance
- iv. performance and operation
- v. wear
- vi. run out
- vii. alignment
- d. Use of appropriate tools and equipment including:
 - i. compression gauges
 - ii. leakage testers
 - iii. cylinder balance tester
 - iv. pressure gauges
 - v. micrometers
 - vi. vernier gauges
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with motorcycle manufacturer's specifications and settings.
- g. The procedures for dismantling, components and systems and the use of appropriate equipment and procedures.
- h. Assess, examine and measure components including:
 - i. settings
 - ii. values
 - iii. condition
 - iv. wear and performance of components and systems
- i. Probable faults
 - i. malfunctions
 - ii. incorrect settings
 - iii. wear
- j. Rectification or replacement procedures.
Evaluate operation of components and systems following diagnosis and repair to confirm system performance.

Faults and Symptoms in Ignition Systems

- a. Ignition system failure or malfunctions including:
 - i. no spark
 - ii. misfiring
 - iii. backfiring
 - iv. cold or hot starting problems
 - v. poor performance
 - vi. pre-ignition
 - vii. detonation
 - viii. exhaust emission levels
 - ix. fuel consumption
 - x. low power
 - xi. unstable idle speed

Faults and Symptoms in Electronic Petrol Injection Systems

- a. Petrol injection system failures or malfunctions including:
 - i. cold or hot starting problems
 - ii. poor performance
 - iii. exhaust emissions
 - iv. high fuel consumption
 - v. erratic running
 - vi. low power
 - vii. unstable idle speed

Faults and Symptoms in Petrol Carburetion Systems

- i. cold or hot starting problems
- ii. poor performance
- iii. exhaust emissions
- iv. high fuel consumption
- v. erratic running
- vi. low power
- vii. unstable idle speed

Faults and Symptoms in Engine Management Systems

- a. Engine management system failure or malfunctions including:
 - i. misfiring
 - ii. backfiring
 - iii. cold or hot starting problems
 - iv. poor performance
 - v. pre-ignition
 - vi. detonation
 - vii. exhaust emission levels
 - viii. fuel consumption
 - ix. low power
 - x. unstable idle speed

Diagnosis of Faults in Electronic Engine Management Systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. manufacturer's vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Conduct systematic assessment, testing of engine systems including:
 - i. component condition and performance
 - ii. component settings
 - iii. component values
 - iv. electrical and electronic values
 - v. system performance and operation
 - vi. use of appropriate tools and equipment including gauges
 - vii. multi-meter
 - viii. breakout box
 - ix. oscilloscope
 - x. diagnostic tester
 - xi. manufacturer's dedicated equipment
 - xii. exhaust gas analyser
 - xiii. pressure gauges
- d. Evaluate and interpret test results from diagnostic testing.
- e. Compare test result, values and fault codes with motorcycle manufacturer's specifications and settings.
- f. The procedures for dismantling, components and systems using appropriate equipment.
- g. Assess, examine and measure components including:
 - i. settings
 - ii. input and output values

- iii. voltages
- iv. current consumption
- v. resistance
- vi. output patterns with oscilloscope
- vii. condition
- viii. wear and performance of components and systems
- h. Identify probable faults and indications of:
 - i. faults
 - ii. malfunctions
 - iii. incorrect settings
 - iv. wear
 - v. values
 - vi. inputs and outputs
 - vii. fault codes
- i. Rectification or replacement procedures.
- j. Evaluation and the operation of components and systems following diagnosis and repair to confirm system performance.
 - i. speed controls
 - ii. control systems
- k. Use of appropriate tools and equipment including:
 - i. pressure gauges
 - ii. multi-meter
 - iii. breakout box
 - iv. oscilloscope
 - v. diagnostic tester
 - vi. manufacturer's dedicated equipment
 - vii. flow meter
- l. Evaluate and interpret test results from diagnostic testing.
- m. Compare test result, values and fault codes with motorcycle manufacturer's specifications and settings
- n. How to dismantle, components and systems using appropriate equipment and procedures
- o. How to assess, examine and measure components including: settings, input and output values, voltages, current consumption, resistance, output patterns with oscilloscope, pressures, condition, wear and performance of components and systems
- p. Identification of probable faults and indications of faults, malfunctions, incorrect settings, wear, values, inputs and outputs, fault codes, pressures and leaks
- q. Rectification or replacement procedures
- r. Evaluation and operation of components and systems following diagnosis and repair to confirm system performance

Construction and operation of motorcycle engine systems to include:-

- a. engine mechanical
- b. lubrication systems
- c. fuel systems
- d. ignition systems
- e. cooling system
- f. air and exhaust systems
- g. engine management

Engineering principles that are related to motorcycle engine systems

- a. volumetric efficiency
- b. flame travel, pre ignition and detonation
- c. fuel properties
- d. composition of carbon fuels
- e. combustion process

- f. legal requirements for exhaust emissions

Symptoms and causes of faults found in motorcycle engine systems to include:

- a. engine mechanical
- b. lubrication systems
- c. fuel systems
- d. ignition systems
- e. cooling system
- f. air and exhaust systems
- g. Engine management

Examine, measure and make suitable adjustments to the components including:

- a. settings
- b. input and output values
- c. voltages
- d. current consumption
- e. resistance
- f. output patterns with oscilloscope
- g. pressures
- h. condition
- i. wear and performance