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. NOx
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

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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