-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

Hanover House
24 Douglas Street
GLASGOW G2 7NQ

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **0084405** **-Session-1988-89**
-Superclass- **XS**

-Title- **SPARK IGNITION ENGINE: FUEL SYSTEMS 1 ($x^1/_2$)**

-DESCRIPTION-

Purpose

This module is designed to develop the skills and knowledge required to service the fuel system fitted to the general range of spark ignition engines. The module is suitable for a wide range of vocational areas e.g. agricultural engineers, industrial and marine engineers, transport engineers and is particularly appropriate for those following a career associated with mobile plant maintenance.

Preferred Entry Level

64020 Assembly Skills
74415 Prime Movers
64730 Fastening and Joining: Non-Thermal Methods

Learning Outcomes

The student should:

1. know the combustion process in a spark ignition engine;
2. know the causes of combustion faults;
3. know the location, function and operation of fuel and air system components;
4. use service procedures to dismantle, assemble and adjust carburettors.

Content/ Context

Safety regulations and safe working practices and procedures should be observed at all times.

<u>Corresponding to Learning Outcomes 1-4:

1. Chemical action of combustion of hydrocarbon fuels; normal combustion process and resultant products of combustion.

2. Combustion faults:
(a) detonation
(b) pre-ignition
(c) running-on (diesel effect) Causes; fuels, engine system faults, incorrect engine settings.

3. Details of the location, function, construction and operation of mechanically and electrically operated low pressure petrol feed pumps; effects of common faults. Construction of constant venturi and variable venturi, single and twin choke carburettors. Operation of carburettors; cold start systems including automatic choke/enrichment; idling, power, acceleration, economy and anti-run-on systems; exhaust emission control features. Construction of inlet manifolds for single and multi-carburettors; construction of air cleaners, intake silencers and air intake heating systems. Description of liquefied petroleum gas system.

4. Use of manufacturers' service information. Dismantling and assembling procedures; fault inspections and tests. Carburettor adjustments to specifications using tachometer, vacuum gauge and exhaust gas analyser.

Suggested Learning and Teaching Approaches

This module should be undertaken in a service workshop with an adequate range of running engines equipped with the fuel systems to be covered.
Students should have full access to relevant service publications, special tools and test equipment. The necessary theory should be fitted into practical work where appropriate and the use of visual aids, audio visual materials and text books is highly recommended. Students would be expected to maintain a folio of information from formal and participative directed learning experiences.

Assessment Procedures

Acceptable performance in the module will be satisfactory achievement of the performance criteria specified for each Learning Outcome.

The following abbreviations are used below:

LO Learning Outcome
IA Instrument of Assessment
PC Performance criteria

LO1 KNOW THE COMBUSTION PROCESS IN A SPARK IGNITION ENGINE

PC The student:

(a) correctly names the principal elements of a refined petrol fuel and expresses their proportion in percentage, by mass;
(b) explains the combination of petrol and air in correct proportions to achieve:
  (I) complete combustion;
  (ii) engine conditions of starting, full power and economy cruising;
(c) clearly explains the need for vaporisation of fuel before combustion;
(d) accurately describes initiation of combustion and effect of mixture ratio on rate of flame travel;
(e) lists the principal products emitted from the exhaust of an engine supplied with a chemically correct petrol air mixture.

IA Short Answer Questions

The student will be presented with questions which test recall of knowledge related to the process of combustion in a spark ignition engine.

The test will consist of 17 questions allocated as follows:

(a) elements of petrol 4
(b) air: fuel ratios 4
(c) vaporisation requirements 2
(d) combustion initiation and mixture ratio effects 3
(e) exhaust products 4

Satisfactory achievement of the Learning Outcome will be demonstrated by the student producing the following correct responses: 3 from each of (a), (b) and (e); 2 from (d); and 1 from (c).

LO2 KNOW THE CAUSES OF COMBUSTION FAULTS

PC The student:

(a) clearly defines the characteristics of detonation, pre-ignition and running-on;
(b) list possible causes of detonation, pre-ignition and running-on.

IA Short Answer Questions

The student will be presented with questions which test the recall of knowledge related to the causes of combustion faults.

The test will consist of 6 questions allocated as follows:

(a)	definition of the three characteristics	3
(b)	causes of combustion faults	3

Satisfactory achievement of the learning Outcome will be demonstrated by the student producing 2 correct responses to each of (a) and (b).

LO3 KNOW THE LOCATION, FUNCTION AND OPERATION OF FUEL AND AIR SYSTEM COMPONENTS

PC The student:

(a) correctly identifies low pressure mechanical and electrical petrol pumps by inspection of unit appearance and location;
(b) explains the operating principles of mechanical and electrical feed pumps, describing the induction and discharge phases, pressure feed value and regulation;
(c) correctly identifies constant venturi, variable venturi carburettors and their respective components;
(d) outlines the operation of constant and variable venturi carburettors with inclusion of coldstart, idle, power, acceleration, economy, and anti-run-on systems.

IA Restricted Response Questions

The student will be presented with questions and diagrams which will test recall of knowledge related to location, function and operation of fuel and air system components.

The test will consist of 20 questions allocated as follows:

(a)	location and identification of pumps	2
(b)	operating principles of pumps	6
(c)	carburettor and component identification	6
(d)	operation of carburettors	6

Satisfactory achievement of the Learning Outcome will be demonstrated by the student producing the following correct responses: 1 from (a); and 5 from each of (b), (c) and (d).

LO4 USE SERVICE PROCEDURES TO DISMANTLE, ASSEMBLE AND ADJUST CARBURETTORS

PC The student:

(a) accurately interprets service information for a given carburettor;
(b) follows correct procedure for dismantling, inspecting and assembling constant and variable venturi carburettors;
(c) carries out carburettor adjustments for engine speed, performance and exhaust emission to manufacturers' specifications using tachometer vacuum gauge and exhaust gas analyser;
(d) follows safe working practices relevant to the task.

IA Practical Exercise

The student will complete a practical exercise set under workshop conditions to demonstrate the application of knowledge and skills required to dismantle, assemble and adjust carburettors.

The practical test will be carried out on 1 constant venturi and 1 variable venturi carburettor from given instructions, using data sheets, specialist tools and equipment, and supported by the use of a checklist to specify the required skills and record the student's performance.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student gaining all 10 essential items (E) plus at least 2 desirable items (D) from the following checklist.

CHECKLIST

<u>Interprets service information</u>

1. Select correct data sheet E
2. Interprets and records information appropriate to carburettor E

<u>Dismantles and assembles constant venturi carburettor</u>

3. Dismantles carburettor E
4. Reports on condition D
5. Assembles carburettor E

<u>Dismantles and assembles variable venturi carburettor</u>

6. Dismantles carburettor E
7. Reports on condition D
8. Assembles carburettor E

Carries out adjustments

9.	Checks engine temperature	D
10.	Adjusts for carbon monoxide and records reading	E
11.	Adjusts idle speed	E
12.	Measures engine vacuum and records reading	D
13.	Tests engine run-up	D

Safety requirement

14.	Observes safety procedures associated with fuel systems and running engines	E
15.	Observes statutory regulations	E