-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **4250731** **-Session- 1991-92**
-Superclass- **TH**

-Title- **MECHANICAL SERVICES TECHNOLOGY: LOW PRESSURE HOT WATER HEATING SYSTEMS**

-DESCRIPTION-

Purpose

This module is designed to introduce the student to the basic equipment, procedures, layout and functions of low pressure hot water (LPHW) heating systems.

It is aimed at those following a career in Building Maintenance or having responsibilities with regard to Mechanical Services Maintenance within the workplace.

Preferred Entry Level

No formal entry requirements.

Outcomes

The student should:

1. outline the basic layouts and components of low pressure hot water (LPHW) heating systems using different heat emitters;

2. explain the operation of different LPHW heating systems;

3. explain the functions and positioning of components within a LPHW heating system;

4. outline the techniques of filling, venting, draining and balancing a LPHW heating system;

5. explain the reasons governing the positioning of the accelerator within a LPHW heating system.

Assessment Procedures

Acceptable performance in the module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

OUTCOME 1 **OUTLINE THE BASIC LAYOUTS AND COMPONENTS OF LOW PRESSURE HOT WATER (LPHW) HEATING SYSTEMS USING DIFFERENT HEAT EMITTERS**

PCs

(a) The pipework layouts outlined are correct in terms of:

(i) a one-pipe LPHW system;
(ii) a two-pipe LPHW system.

(b) The components identified are correct in terms of the main items in:

(i) a one-pipe LPHW system;
(ii) a two-pipe LPHW system.

(c) The outline is correct in terms of the positioning of the calorifier.
(d) The outline is in accordance with the relevant regulations.

IA Completion Exercise

The student will be set a completion exercise to test the knowledge required to outline basic pipework layouts of LPHW heating systems using different heat emitters.

The student will be given appropriate drawings of a two-storey building for: (i) a one-pipe LPHW system; (ii) a two pipe LPHW system; and required to complete the drawings, putting in pipelines to all major components and parts, and to label all the items.

Satisfactory achievement of the Outcome will be based on the student attaining all Performance Criteria.

OUTCOME 2 **EXPLAIN THE OPERATION OF DIFFERENT LPHW HEATING SYSTEMS**

PCs

(a) The explanation is correct in terms of differentiating between LPHW systems based on the following principles:

(i) gravity;
(ii) acceleration small-bore;
(iii) micro-bore.

IA Restricted Response

The student will be set a restricted response exercise to test the knowledge required to explain the operation of different LPHW heating systems.

The student will be set a restricted response exercise consisting of five questions allocated as follows:

(i) gravity - 1
(ii) acceleration/ small bore - 2
(iii) micro-bore - 2

Satisfactory achievement of the Outcome will be based on the student attaining all performance criteria.

OUTCOME 3 **EXPLAIN THE FUNCTIONS AND POSITIONING OF COMPONENTS WITHIN A LPHW HEATING SYSTEM**

PCs

(a) The explanation is correct in terms of the functions of the components listed.
(b) The explanation is correct in terms of specifying where the named components should be positioned in the system.
(c) The explanation is correct in terms of safety and the relevant regulations.

IA Restricted Response

The student will be set a restricted response exercise to test the knowledge required to explain the functions and positioning of components within a LPHW heating system.

The student will be given a list of ten major components and required to explain the function(s) of each, with reference to where each component is positioned within the system.

Satisfactory achievement of the Outcome will be based on the student attaining all Performance Criteria.

OUTCOME 4 **OUTLINE THE TECHNIQUES OF FILLING, VENTING, DRAINING AND BALANCING A LPHW HEATING SYSTEM**

PCs

(a) The outline is correct in terms of:

(i) the basic procedures necessary to fill a conventional LPHW heating system;
(ii) the methods used to vent a LPHW heating system.

(b) The outline is correct in terms of where drainage points are situated in LPHW heating systems.
(c) The outline is correct in terms of:

(i) why balancing is necessary;
(ii) where balancing may be carried out in a system and how it is achieved.

(d) The outline is correct in terms of the correct sequence of the operations.
(e) The outlined techniques are correct in terms of safety procedures.

IA Case Study

The student will be set a case study exercise to test the knowledge required to explain the techniques of filling, venting, draining and balancing a LPHW heating system.

The student will be given a short case study and required to produce a programme of operations to be carried out when:

(a) filling;
(b) venting;
(c) draining;
(d) balancing

the given LPHW heating system.

Satisfactory achievement of the Outcome will be based on the student attaining all Performance Criteria.

OUTCOME 5 **EXPLAIN THE REASONS GOVERNING THE POSITIONING OF THE ACCELERATOR WITHIN A LPHW HEATING SYSTEM**

PCs

(a) The explanation is correct in terms of the effects of:

(i) placing the pump on the return line with the cold feed pipe entering close to the negative side of the pump.

(ii) placing the pump on the return line with the cold feed entering close to the positive side of the pump.

(b) The explanation is correct in terms of the reasons for placing the pump on the flow line with the cold feed situated in the neutral point of the LPHW heating system.

IA Structured Questions

The student will be set an exercise consisting of structured questions to test the knowledge required to explain the reasons governing the positioning of the accelerator within a LPHW heating system.

The student will be given a drawing of a two-storey building with three possible pump positions in the system and will be required to produce a statement of the effects of the placement of the pump relative to the system for each position. The three positions are as follows:

(i) return position, negative feed;
(ii) return position, positive feed;
(iii) return position, neutral feed.

Satisfactory achievement of the Outcome will be based on the student attaining all Performance Criteria.

The following sections of the descriptor are offered as guidance. They are not mandatory.

CONTENT/CONTEXT

Corresponding to Outcomes 1-5:

1. One pipe LPHW small-bore heating systems.
   Two pipe LPHW small-bore heating systems.

   Microbore systems. Use of the indirect system. Operating temperatures for each type of system.

2. One-pipe LPHW systems, two-pipe LPHW systems; reverse - return circulation systems.

3. Feed and expansion tank; radiators/convectors; boiler; pipework; manual and thermostatic radiator valves; lockshield valves; accelerators, thermostats; divertor or mixer valves; frost stats; open vent pipes; automatic air eliminators; zoning valves; inhibitors, drain valves, calorifiers.

4. Feed and expansion cistern; cold water supply, control valves. Advantanges, disadvantages and economics of alternative positions of valves. Flushing out pipework and the use of temporary by-pass to protect pumps. Types, positioning and use of drainage points, corrosion inhibitors; their purpose and methods of induction into system. Principles of venting by manual, automatic and fixed methods. The effects of bad design, calculation, selection or installation on emitter output. The methods used to balance systems.

5. Fluid flow; turbulance, pressure changes due to velocity. Effects of pressure. Changes on ventilating and feed pipes. Air induction through defects in pipework and valves. Damage caused to systems by overpumping.

SUGGESTED LEARNING AND TEACHING APPROACHES

This module is a classroom based module but access to fully operational systems in the student's workplace would be desirable.

Packaged lecture notes should be available and could be supplemented by worksheets, manufacturers' catalogues and design guides such as CIBSE and I0P Publications.

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