LPCB®

Loss Prevention Standard

LPS 1239: Issue 1.2

Requirements and testing procedures for the LPCB approval and listing of diesel engines for sprinkler pump sets

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PARTICIPATING ORGANISATIONS

This standard was prepared by Expert Group C and approved by the LPC Fire and Security Board of BRE Global Ltd. The following organisations participated in the preparation of this standard:-

Association of British Insurers
Association of Chief Police Officers
Association for Specialist Fire Protection
BRE (FRS)
British Automatic Sprinkler Association
British Fire Protection Systems Association
British Security Industry Association
Confederation of British Industry
Chief & Assistant Chief Fire Officers' Association
Door & Shutter Manufacturers' Association
Electrical Contractors Association
Fire Sprinkler Association
Health & Safety Executive
International Fire Sprinkler Association
London Fire and Civil Defence Authority
Local Government Association
National Fire Sprinkler Association
Office of the Deputy Prime Minister
Risk Engineers Data Exchange Group
Royal Institution of Chartered Surveyors

REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards will be revised by issue of revised editions or amendments. Details will be posted on our website at www.redbooklive.com

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments. (See amendments table on page 22)

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

USERS OF LOSS PREVENTION STANDARDS SHOULD ENSURE THAT THEY POSSESS THE LATEST ISSUE AND ALL AMENDMENTS.

FOREWORD

This standard identifies the evaluation and testing practices for the LPCB approval and listing of products. LPCB Listing of life safety and security products for inclusion in the "Red Book" is based on the following

i. Satisfactory product performance during testing and audit testing
ii. Satisfactory product construction
iii. Satisfactory manufacturing processes
iv. Satisfactory product service experience.

NOTES

Compliance with this LPS does not of itself confer immunity from legal obligations. Users of LPSs should ensure that they possess the latest issue and all amendments.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to "the Technical Director" at enquiries@breglobal.co.uk.

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1 SCOPE

This Loss Prevention Standard specifies the requirements for LPCB Approval of Diesel Engines for fire sprinkler pump sets. LPCB Approved Diesel Engines covered by this Standard are to be used in stationary fire sprinkler pump sets which conform to the LPC Rules for Automatic Sprinkler Installations.

2 REQUIREMENTS

2.1 General

2.1 Diesel engines for sprinkler pump sets are expected to perform reliably under normal application conditions. These engines shall be used for fire protection only and shall be designed so that they can be tested each week for 30 minutes to ensure reliability. To allow for unforeseen site conditions and normal performance deterioration over the life of the engine these engines have power output capability 10% greater than the power output rating as approved by the LPCB and shown on the nameplate. This additional capability shall not to be considered when selecting an engine to match the pump requirements, or when calculating engine performance for site conditions.

2.2 The engine shall be the compression ignition type, commonly referred to as “diesel”. Diesel engines have proven to provide the greatest reliability and therefore are the only type of internal combustion engine acceptable for this standard. The engine shall operate on diesel fuel in accordance with BS 2869 class A2 or equivalent. (Specification for fuel oils for agricultural, domestic and industrial engines and boilers.)

3 INSTRUMENTATION AND CONTROLS

3.1 An instrument panel shall be securely mounted to the engine by the engine manufacturer in a location that does not subject operating personnel to unreasonable hazard from hot surfaces or moving parts (e.g. pump, fan belts, or power transmission equipment) of the engine. Mounting shall be such as to protect the instrumentation from the effects of vibration, heat or mechanical damage.

The panel housing shall be of a non-combustible material and provide protection to at least IP 54, in accordance with BS EN 60529: 1992. (Specification for degrees of protection provided by enclosures)

3.1.1 A magnetic pick up shall be fitted to the engine providing a signal directly into the pump set control panel.

3.1.2 The engine manufacturer shall provide the electrical values of the magnetic pick up to the pump set control panel manufacturer for co-ordination of the speed switch.

3.2 The engine manufacturer shall install the following minimum instrumentation in a panel mounted on the engine for the purpose of engine servicing:

3.2.1 A tachometer shall be provided to indicate engine speed based upon the electrical values of the magnetic pick up in 3.1.2. (Signal derived from the pump set control panel).

3.2.2 A totalizing type hourmeter shall be provided to permanently record total run time. (Signal derived from the pump set control panel).

Comment:
The tachometer and hourmeter may be contained in one instrument.

3.2.3 An oil pressure gauge shall be provided to indicate engine lubricant pressure.

3.2.4 A temperature gauge shall be provided. Liquid-cooled engines shall be equipped with a temperature gauge to monitor the closed circuit coolant loop temperature. Air-cooled engines shall be equipped with a temperature gauge to monitor either the lubricant temperature or the engine's external surface temperature in the area nearest the point of combustion.

3.3 The engine shall be fitted with an electrical fuel shutoff actuator (energise to shutoff) linked to the fuel stop lever, with mechanical/manual override. Any device fitted to the engine or controller, which could prevent the engine starting automatically, shall return automatically to the normal position after manual application.

Comment
The electrical fuel shutoff actuator shall be connected to an Engine Stop button on the Pump Set Controller

3.3.1 The electrical fuel shutoff actuator shall be capable of being energized for a minimum of 60 seconds; or until the engine stops rotating plus 10 seconds; whichever is longer, without damage.

Note: Refer to Appendix A for information on requirements for engine protection during weekly test.

4 SPEED CONTROL

4.1 The maximum rated speed for which an engine shall be approved is 2960 rev/min.

4.2 Each approved engine shall be equipped with a mechanical type* speed control governor to maintain the engine speed within 5 percent of rated speed under any steady state condition of load up to the full load rating. The governor shall be pre-set by the engine manufacturer to provide the required regulation at the approved speed for which that particular engine is ordered.

* Electronic speed control governors may be considered for approval provided the following conditions are fulfilled:

a) During all local conditions, including on a ramp start-up to rated speed during start-up, the governor shall control the speed to within ±5% of rated speed.

b) Loss of power to or failure of the electronic actuator will return the engine to being fully under the control of the mechanical fuel pump/governor and shall not cause the engine to return to rest. The engine shall be fully functional during the loss of power to or failure of the electronic actuator, including; manual and automatic start-up, maintain rated speed during all load conditions within +10%, and engine shutdown.

c) Alarm circuitry shall be fitted which provides visual and audible alarms on the engine in the event of loss of power to the governor. 'Volt free' contacts shall be provided on the engine for connection to the controller for remote monitoring.

Comment
An electronic governor is an actuator connected to a mechanical fuel pump/governor for the purposes of providing speed regulation as required in 4.2.

4.3 An adjustable throttle shall be provided. It shall be designed to provide positive locking for any setting, such that tools are required either for access to the adjustment or to actually make the speed adjustment.

5 STARTING SYSTEM

5.1 The engine shall be of the direct injection type capable of starting without the use of any cold starting aids e.g. heater plugs at an engine room temperature of 4 °C.

5.2 The engine shall accept full load within 15 seconds of the initiation of the start signal.

5.3 The engine shall be fitted with one or more electric starter motor(s) incorporating a movable pinion which will engage automatically with the flywheel gear ring. The pinion shall be capable of preventing overspeed of the starting motor armature when the engine starts. To avoid shock loading, the system shall not apply full power to the starting motor until the pinion is fully engaged. The pinion shall not be ejected from engagement by spasmodic engine firing. There shall be a means to prevent attempted engagement when the engine is rotating.

5.4 When the engine starts automatically the starter motor pinion shall withdraw from the flywheel gear ring automatically. The pump set control panel shall de-energise the starter motor when the engine has achieved 700-1000 rpm.

Comment
The speed sensing device for starter disconnect may be integral with the overspeed device

5.5 Engine starting solenoids shall have a 200% safety factor compared to the measured cranking current.

5.6 The rated voltage of the batteries and starter motor shall be either 12 or 24 volts.

5.7 The starter motor shall be capable of rotating the engine at 0 °C and 760 mm mercury atmospheric pressure for not less than 10 cycles each of not less than 15 seconds cranking and not more than 10 seconds rest. At the end of the energised part of each cycle the engine cranking speed shall be not less than 120 rev/min whilst power is applied.

5.8 For manual operation, at the engine, means shall be provided on the engine to energize the starting motor(s) to crank and start the engine in the event of circuit failure with-in the pump set control panel. This means shall allow for the utilization of either A or B battery separately or in parallel for emergency starting of the engine.

6 COOLING SYSTEM

6.1 The cooling system shall automatically maintain the engine within its desirable range operating temperatures. The manufacturer shall state the desired normal operating temperature range of the engine.

6.2 When a vee belt is used to drive a coolant circulating pump or air cooling fan, the drive shall include two or more belts. This does not preclude the use of single multiple-vee belt drives, provided the multiple-vee belt is sized for a minimum of 200% capacity.

6.3 Liquid Cooling

6.3.1 All liquid cooling systems shall have a closed circuit loop. The heat from the closed circuit loop shall be dissipated by a heat exchanger. An engine driven pump shall circulate the closed circuit coolant through the engine and heat exchanger. Thermostat(s) shall be provided in the closed circuit loop to regulate the engine temperature, and shall be readily replaceable. The system shall also be provided with an opening for replenishing coolant or checking the coolant level. An expansion reservoir shall be provided to prevent the loss of coolant due to thermal expansion and contraction.

6.3.2 The secondary side of the heat exchanger shall be cooled by sprinkler water (ref. Paragraph 6.3.4) or air (ref. Paragraph 6.3.5).

6.3.3 The engine manufacturer shall define the type and amount of coolant to be installed in the closed circuit loop for best cooling and engine protection, and the suggested interval for replacement.

Note: Refer to Appendix B for details relating to cooling water lines.

6.3.4 Liquid to Liquid Cooling. Sprinkler water is used to cool the heat exchanger.

6.3.4.1 The engine manufacturer shall provide a graph of required sprinkler water flow versus sprinkler water temperature for each engine at each speed Approved.

6.3.4.2 The sprinkler water side of the cooling system shall have a maximum working pressure of at least 2 bar, and shall be capable of withstanding 2 x working pressure as stated by the engine manufacturer for 10 minutes for approval. The sprinkler water inlet and outlet connections shall be pipe-thread. The sprinkler water outlet shall be at least one pipe size larger than the inlet.

6.3.4.3 Supplemental cooling devices such as lubricant and inlet air coolers will be allowed if they share sprinkler water supplies with the heat exchanger in Paragraph 6.3.4.2. These supplemental device(s) shall have sprinkler water connections and pressure ratings equal to the heat exchanger in Paragraph 6.3.4.2.

6.3.5 Liquid to Air Cooling. Atmosphere is used to cool the radiator.

6.3.5.1 Heat from the closed circuit loop shall be dissipated to the atmosphere by a radiator. The air shall be pushed down from the engine side through the radiator by an engine driven fan, then discharged. The radiator shall be designed to maintain normal engine operating temperatures, and not allow coolant boil-out, at an ambient air temperature of 50°C at the combustion air cleaner inlet.

Comment
A fixed place is required when attempting to identify ambient temperature. The radiator is not a good place because of the pre-heating the engine does to the air as it passes over it, and you can always find a wide variety of temperatures if you check the air at various places as it enters the radiator core. The air cleaner location is consistent with par. 6.5.2 and is common with calculations for power correction for ambient conditions.

6.3.5.2 The engine manufacture shall advise the minimum air flow required through the radiator.

6.3.5.3 A flange shall be provided on the radiator to attach a duct (of suitable non-combustible material) that will discharge air being exhausted outside the room in which the engine is installed. Air supply and discharge ventilators shall be in conformance with the requirements of the LPC Rules for Sprinkler Installations incorporating BS 5306: Part 2 Paragraph 17.4.5.4. (Fire extinguishing installations and equipment on premises. Specification for sprinkler systems)

6.3.5.4 Supplemental cooling devices such as lubricant and inlet air coolers will be allowed if they share cooling air supplies with the closed circuit engine cooling systems as defined in Paragraph 6.3.5.1.

6.4 Jacket Water Heater

6.4.1 All liquid-cooled engines shall be equipped with a jacket water heater capable of maintaining the engine core (area around the cylinders) at 50°C without Short Cycling or exceeding 85°C (185°F) heater outlet temperature. The element of the heater shall have a maximum watt density of 15 watts per square centimetre. The material used in the plumbing from the heater outlet to the engine shall be rated for the temperatures created by the heater.

6.4.2 The engine shall be fitted with a low temperature alarm switch (contacts to close at low temperature). Operation of the switch shall send a signal to the controller to provide an audible and visual alarm of heater failure.

6.5 Direct Air Cooling

6.5.1 The engine manufacturer shall provide a graph of the required air flow versus air temperature for each engine at each speed approved.

6.5.2 Heat from the engine shall be dissipated directly to the atmosphere. The air shall be moved over the engine by an engine driven fan, then discharged. The engine shall be designed to maintain normal engine operating temperatures with a minimum air temperature of 50°C at the combustion air cleaner inlet.

6.5.3 A flange shall be provided on the engine to attach a duct (of suitable non-combustible material) that will discharge air being exhausted outside the room in which the engine is installed. Air supply and discharge ventilators shall be in conformance with the requirements of the LPC Rules for Sprinkler Installations incorporating BS 5306: Part 2 Paragraph 17.4.5.4.

6.5.4 Supplemental cooling devices such as lubricant and inlet air coolers will be allowed if they share cooling air supplies with the engine cooling systems as defined in Paragraph 6.5.2.

6.5.5. All direct air cooled engines shall be equipped with a heater capable of maintaining the engine core (area around the cylinders) at 50°C.

7 WIRING

7.1 A junction box and terminal strip shall be provided on the engine for connection of all control devices which must be wired to the controller.

7.2 All wiring on the engine shall be stranded wire with insulation tolerant to the engine temperatures and fluids, harnessed and guarded as necessary to protect from damage.
Note: Terminal numbering for LPC Diesel Controllers for use with diesel engines in accordance with this specification, LPS 1239, is shown in Appendix C.

8 LUBRICATION SYSTEM

8.1 Engines shall be equipped with a pressure-type lubrication system comprised of an engine-driven pump, filter, distribution system and cooler if necessary to maintain lubricant temperature within the range recommended by the lubricant manufacturer and the engine manufacturer.

8.2 Engines fitted with a turbocharger(s) shall include as a minimum, a post-lube device for the turbochargers.

9 AIR SYSTEM

9.1 The combustion air-intake system shall be equipped with a suitable filter to prevent dust, foreign matter and water from overhead sprinklers from entering the engine.

Comment
The manufacturer's recommendations for cleaning and changing air filters shall be followed.

10 EXHAUST SYSTEM

10.1 The engine exhaust manifold, bellows and turbocharger (when provided) shall be water jacketed, blanketed or guarded as necessary to prevent fire hazards and personnel injury.

10.2 The engine shall be fitted with a bellows type flexible exhaust section. The bellows shall be no less than 0.3m in length and made of stainless steel.

Comment
Exhaust lagging should be provided to protect the first metre of exhaust pipe beyond the flexible exhaust section.

11 FUEL SYSTEM

11.1 The fuel system on the engine shall all be of metal piping and include a fuel filter with readily replaceable filter media. The fuel system shall be leak-free throughout all conditions of engine operation.

11.2 Suitable means such as screwed plugs shall be provided to bleed the entire fuel system of air. Air relief cocks shall not be used.

11.3 A flexible section in the fuel supply and return shall be provided to isolate vibration between the engine and the building plumbing. These sections shall be steel braid re-enforced hose. The hose material shall be independently approved as fire resistant.

12 PERFORMANCE RATINGS

12.1 Power outputs shall be adjusted to standard conditions BS 5514:1996 (Reciprocating internal combustion engines. Performance) (100.0 kPa atmospheric pressure and 20°C temperature). To compensate for changes in atmospheric conditions in the test cell use the following formula:

$$Psc = \frac{5.916xPt}{p(kPa)} x\sqrt{T(°C) + 273.2}$$

$$Psc = \frac{Ptx100.0(kPa)}{p(kPa)} x\sqrt{\frac{T(°C) + 273.2}{20.0(°C) + 273.2}}$$

Psc = Actual Power at 152 m above sea level, standard atmospheric conditions of 20.0°C and 100.0 kPa.

Pt = Power obtained in testing under atmospheric conditions of p and T.

p = Ambient pressure in kPa

T = Ambient temperature in degrees Centigrade

12.2 The Actual Power, Psc, of an engine is 110% of the Approved Power Rating,

i.e. Approved Power Rating = $\frac{Psc}{1.1}$

12.3 The approved power ratings of LPCB approved diesel engines will be listed in the "List of Approved Fire and Security Products and Services".

12.3.1 Engines with a power rating at only one speed will be limited to applications at that speed.

12.3.2 Engines with power ratings at two or more speeds can be applied at any one of the specific speeds at the approved rating.

12.3.3 Engines with power ratings at two or more speeds can be applied at any specific intermediate speed between the approved rated speeds. The allowed power rating for the intermediate speed application is determined by straight line interpolation between the two adjacent approved ratings referenced in 12.3.2.

13 EVALUATION AND TEST REQUIREMENTS

13.1 All examinations and tests performed in evaluation to this Standard shall use calibrated measuring instruments traceable and certified to national standards.

13.2 The diesel engine(s) shall conform to the manufacturer's drawings and specifications and to LPCB requirements.

13.3 The manufacturer shall supply, at a minimum, the following information for each new engine model submitted for LPCB approval:

a) Model number(s) and speed(s) for which LPCB approval is requested;
b) Power output versus speed test data with all fire pump driver accessories required;
c) Instrument Panel drawing;
d) Nameplate and starting instruction plate drawings;
e) Dimensional drawing indicating all connections, size and mounting dimensions;
f) Cooling system flow schematic;
g) Dimensional drawing of engine heater detailing the surface area of element, and calculations to verify watt density.
h) Turbocharger lubrication schematic;
i) Electrical schematic drawing;
j) Current ratings from the manufacturer of the starting solenoids;
k) List of all specifications and materials used in construction of the engine;
l) Installation and Operation Manual;
m) List of part numbers of components used to assemble to engine, including all service replacement parts such as filters, gaskets, and thermostatic elements. Minimum list shall include:

- Cooling system major components and pressure rating
- Lubricant filter
- Air filter
- Fuel filters
- Alternator
- Starter
- Major components of fuel injection system
- Thermostatic element
- Oil pressure switch
- Temperature switch
- Instruments
- Batteries Requirements
- Main Battery Contactor(s)
- Turbocharger (when used)
- Aftercooler (when used)
- Governor
- Flywheel
- Stub Shaft (when used)
- Exhaust System requirements
- Turbocharger lubrication

13.4 Performance tests

The tolerances shall be ±5% unless otherwise stated. All the components assembled to the engine(s) on test shall be recorded.

For the performance tests, the engine shall be supplied with substitute (sprinkler) cooling water where applicable.

13.4.1 The diesel engine shall be subjected to the following tests, in approximately this order, except 7) & 8) which may be done with additional engine(s):

1) Initial Starting…….	par. 13.4.2
2) Power Test…….	par. 13.4.4.a
3) Hot Starting……	par. 13.4.5
4) Governor Stability……	par. 13.4.6
5) Power Test…….	par. 13.4.4.b
6) Governor Stability……	par. 13.4.6
7) Repeated Cranking Test….	par. 13.4.3
8) Jacket Water Heater Test...	par. 13.4.7
9) Cold Starting…….	par. 13.4.8

13.4.2 Initial Starting

The engine shall, after remaining un-operated (including cranking test) and with any coolant heaters inoperative for at least eight hours in the test room, be started and stopped three times at full load. After the 1st and 2nd starts, the engine shall be stopped when it reaches rated rpm. During the first two starts, the engine shall smoothly accelerate. On the third start the engine shall smoothly accelerate to its pre-set speed and operate at the full rated power output for that speed. The ambient temperature shall be recorded.

During all 3 starts the engine shall achieve full speed within 15 seconds of the initiation of the start signal.

13.4.3 Repeated Cranking Test

A cranking test of a starting sequence of 10 cycles consisting of 15 seconds cranking, each starting attempt followed by 10 seconds rest between each cranking shall be applied to the engine. For this test the engine shall have been conditioned at 0ºC, un-operated, and with any coolant heaters inoperative, for at least eight hours. During this test the fuel supply to the engine shall be isolated, to prevent the engine from starting. The amperes required for cranking shall be measured and recorded.
At the end of the energized part of each cycle the cranking speed shall not be less than 120 rev/minute whilst the power is applied.

This sequence shall be successfully completed without interruption.

Note: An additional engine, to the engine used for the initial starting and power test, may be used for this test.

13.4.4 Power Test

Exception to the tolerance requirements of 13.4: Engine power output shall be minus 0% during the test.

a) The engine shall be run continuously for a minimum of four hours at the highest speed and maximum power (110% of desired rating)

b) Additionally, the engine shall be run continuously for one hour at each other speed, if any, at maximum power (110% of desired rating) for which approval is requested.

c) During the power testing of para. 13.4.4a & b, the following data shall be recorded at 15 minute intervals:

- barometric pressure;
- ambient air temperature;
- observed power output (HP or KW);
- corrected power (to standard conditions);
- speed (RPM)
  (--fuel consumption rate;)
- cooling (sprinkler) water inlet and outlet temperatures and flow rate, where applicable.
- engine outlet coolant temperature;
- lubrication oil pressure;
- governor stability
- exhaust gas temperature

d) The maximum sustainable power output outlet, corrected for ambient air pressure and temperature, shall be determined for each speed by examination of the data for the appropriate four or one-hour run.

e) The minimum corrected maximum sustainable power output for each speed shall be at least 110 percent of the rating for that speed which will be included in the listing information for an approved engine.

f) The word "sustainable", in 13.4.4.e) refers to the power output available under conditions of stable or decreasing coolant temperature, lubricant temperature, and fuel consumption and stable or increasing lubricant pressure while the engine is being tested in 13.4.4.e).

g) Coolant temperatures shall remain within the manufacturer's specified range throughout this test with no manual adjustment to the cooling system.

h) The power output data shall be corrected for ambient air pressure and temperature.

i) The corrected power output for the engine shall be tabulated as a function of engine rotational speed.

13.4.5 Hot starting

The engine shall be shut down immediately after the conclusion of the testing described in 13.4.4a) while still under load and without cool down. The engine shall be restarted three times, produce full power and immediately shut down again Three restart attempts at full load shall be made at varying intervals from immediately after to five minutes after hot shutdown stops. The engine shall respond as required in 13.4.2. Upon completion of these hot starts, any test required for 13.4.4.b shall be performed.

13.4.6 Governor stability

a) The governor shall control the speed within ±5% of rated speed, during the tests in Paragraphs b and c below.

b) The governor of the engine shall be set to maintain rated speed at 100 percent of rated load.

c) At each speed, the load shall be increased from 25 percent rated load to full load in 25 percent increments. The load shall be dropped rapidly from each increment of load to No load confirming the governor's repeatability.

13.4.7 Jacket water heater reliability test.

a) The engine shall be put into a temperature controlled environment regulated to 5°C (40°F) for no less than 24 hours. The engine heater and thermostat shall be energized during this time to maintain the engine temperature as specified. The heater shall not short cycle and the heater outlet temperature shall not exceed 85ºC (185ºF). (Short Cycle is defined as the heater shutting Off, then back On, before the engine has reached the desired temperature.)

b) The engine shall be put into a temperature controlled environment at a minimum of 40°C (104°F) for no less than 8 hours. The engine heater and thermostat shall be energized during this time to maintain the engine temperature as specified. The heater shall not short cycle and the heater outlet temperature shall not exceed 95ºC (203ºF). (Short Cycle is defined as the heater shutting Off, then back On, before the engine has reached the desired temperature.)

c) During the testing in a) and b) the following shall be recorded on a strip chart at no more than 60 second intervals;

- ambient temperature
- engine core temperature (representing the combustion chamber temperature)
- heater outlet temperature

Note: An additional engine to the engine used for the initial starting and power test, may be used for this test.

13.4.8 Cold Starting

The engine shall, after conditioning at no more than 4ºC (and with any coolant heaters inoperative) for at least 8 hours, be started without the use of any cold starting aids e.g. Heater plugs.

14 PRODUCTION TESTS

All instruments shall be calibrated.

14.1 The manufacturer shall test each production engine to verify compliance with this standard before applying the LPCB approval mark. The test shall include at the minimum the following;

- minimum one hour maximum power run with no problems (including warm-up, run-in and a minimum of 15 minutes at 110% of nameplate maximum power rating;

- governor stability verification;

- electrical components and circuits performance verification in accordance with manufacturer's procedures.

- record the following minimum data;
- barometric pressure;
- ambient air temperature;
- observed power (HP or KW);
- (corrected power (to standard conditions);)
- speed (RPM)
- (- fuel consumption;)
- cooling (sprinkler) water flow rate and inlet and outlet temperatures;
- closed circuit coolant temperature;
- lubrication oil pressure;
- governor stability
- records of all test and data shall maintained for reference and audit by engine serial number.

15 PUBLICATIONS REFERRED TO

BS 2869	(1998) Specification for fuel oils for agricultural, domestic and industrial engines and boilers.
BS EN 60529 (1992)	Specification for degrees of protection provided by enclosures.
BS 5306:2 (1990)	Fire extinguishing installations and equipment on premises. Specification for sprinkler systems.
BS 5514 (1996)	Reciprocating internal combustion engines – Performance.

APPENDIX A – for information

The following requirements for the protection of diesel engines during the weekly test were developed to ensure that diesel engines would not be damaged during the routine weekly test. An engine would be protected during the weekly test by shutting down if it experienced overspeed, low oil pressure or high coolant temperature. Engine shutdown and alarm would be initiated by the pump set controller during weekly test only (and not at any other time).

In a fire, it is important that the pump set controller isolates the protection circuitry and does not shut down the engine. There was concern that this could only be assured when the use of LPCB approved controllers in fire pump sets was a requirement, so the weekly test protection requirements were removed to Appendix A, for information.

The following requirements would be implemented only in conjunction with the introduction of LPCB approved controllers for diesel engine fire pump sets.

3.4 Protection of the diesel engine during the weekly test

The engine shall be fitted with protective devices as specified in 3.4.1-3.4.4. below, to be operative **only during the weekly test of the pump set.**

During the weekly test only, the protective devices shall operate when the limiting conditions are reached, and send a signal to the controller to:

a) shut down the engine, and
b) provide an audible and visual alarm.

Note: It is the responsibility of the pump set controller, as defined in LPS1236, to differentiate between weekly test and emergency operation.

The protective devices are:

3.4.1 An overspeed shutdown facility to shut down the engine if it exceeds its speed rating by 15 percent. This condition shall require manual re-setting prior to re-starting the diesel engine
Note: The signal from the magetic pick-up (Ref. 3.1.2) shall facilitate an overspeed shutdown device in the pump set controller.

3.4.2 A lubricant oil low pressure switch arranged to operate at a lubricant pressure level which indicates inadequate engine lubrication. (Contacts close to alarm).

3.4.3 A coolant high temperature switch, to monitor one of the temperatures specified in Paragraph 3.2.4. This temperature switch shall be arranged to operate at a temperature level indicating inadequate engine cooling. (Contacts close to alarm).

3.5 All engine mounted control devices shall be securely fastened to the engine, readily accessible, and wired to the junction box.

APPENDIX B – for information

The following requirement is due to be transferred to the Pump Set Standard LPS 1240

Cooling Water Lines – Heat Exchanger Cooling

Cooling water lines to the heat exchanger to be a minimum 15mm nominal bore copper taken the discharge side of the pump prior to the pump discharge valves and incorporate a flushing type strainer, pressure regulator (if required), pressure gauges and automatic flow valve.

In the direction of flow shall include a manual shut-off valve, flushing type strainer, pressure gauge, manual shut-off valve, automatic flow valve, pressure regulator (if required) and pressure gauge,. Surrounding the flushing type strainer and manual shut-off valves shall be a full sized by-pass line fitted with a manual shut-off valve.

In normal operation cooling water flow shall be via the flushing type strainer with the by-pass line secured closed. This strainer shall be capable, by type or use of unions, of being easily removed for maintenance, during which time the by-pass line shall be opened.

APPENDIX C

The following requirement is due to be transferred to the Controller Standard for Diesel Driver Pump Sets, LPS 1236

TERMINAL NUMBERING FOR LPC DIESEL CONTROLLERS FOR USE WITH ENGINES TO SPECIFICATION LPS 1239

Engine & Controller Term. No	**Engine Mounted Device**
1	Electronic Governor +VE Supply hours run counter
2	Magnetic Pick UP
3	Magnetic Pick UP (0 Volt)
4	Oil Pressure Switch Close at Low Pressure (Earth Return)
5	Water Temperature Switch Close at High Temperature (Earth Return)
6	Battery A Positive supply
7	Not Used
8	Battery B Positive supply
9	Start Solenoid from Battery A
10	Start Solenoid from Battery B
11	Common Negative / Earth. Both terminals linked
12	Fuel Solenoid Energised to Stop
13	Not Used
14	Not Used
15	Low Coolant Temp Switch
16	Low Coolant Temp Switch (Insulated Return)
17	Not Used
18	Governor Supply Failure Monitor (Positive)
19	Governor Supply Failure Monitor (Negative)
20	Signal to Engine Mounted Tachometer / Hours Run Indicator.

Controller Term No	**Field Mounted Device**
21	Remote Start / Low Water Start
22	Remote Start / Low Water Start
23	Pressure Switch Start (Open to Start)
24	Pressure Switch Start (Open to Start)

Numbering for Fans, Louvers and Alarm contacts as per individual manufacturer's standard

APPENDIX D

Units of Measurements

LENGTH: mm – “millimetres”, (in.-“inches”)
mm=in. x 25.4

m – “metres”, (ft – “feet”)
m=ft x 0.3408

PRESSURE: kPa – “kilopascals”, (psi – “pounds per square inch”)
kPa=psi x 6.895

TEMPERATURE: °C – “degrees Celsius”, (°F – “degrees Fahrenheit”)
°C=(°F-32) x 0.556

FLOW: L/min – “litre per min”, (gal/min – “gallons per minute”)
L/min=gal/min x 4.55

MASS WEIGHT: kg – “kilograms”, (lb – “pounds”)
kg=lb x .4535

TORQUE: N/m – “Newton-meters”, (lb•ft – “pound feet”)
N/m=lb•ft x 1.356

FREQUENCY: Hz – Hertz

Amendments Issued Since Publication

DOCUMENT NO.	AMENDMENT DETAILS	SIGNATURE	DATE
LPS 1239-1.1	Change to copyright information	CJA	20/09/05
LPS 1239-1.2	1. New front cover 2. Title added to header 3. Contents page moved to Page 1 4. Web address updated on Page 2 5. Notes amended on Page 3 6. Repagination 7. Further change to copyright	DC	Jan.2014