# Pumps and Pump Sets

## Testing and Approval Standards

## *Standards we will be covering in this presentation*

***EN 12845* – Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance**

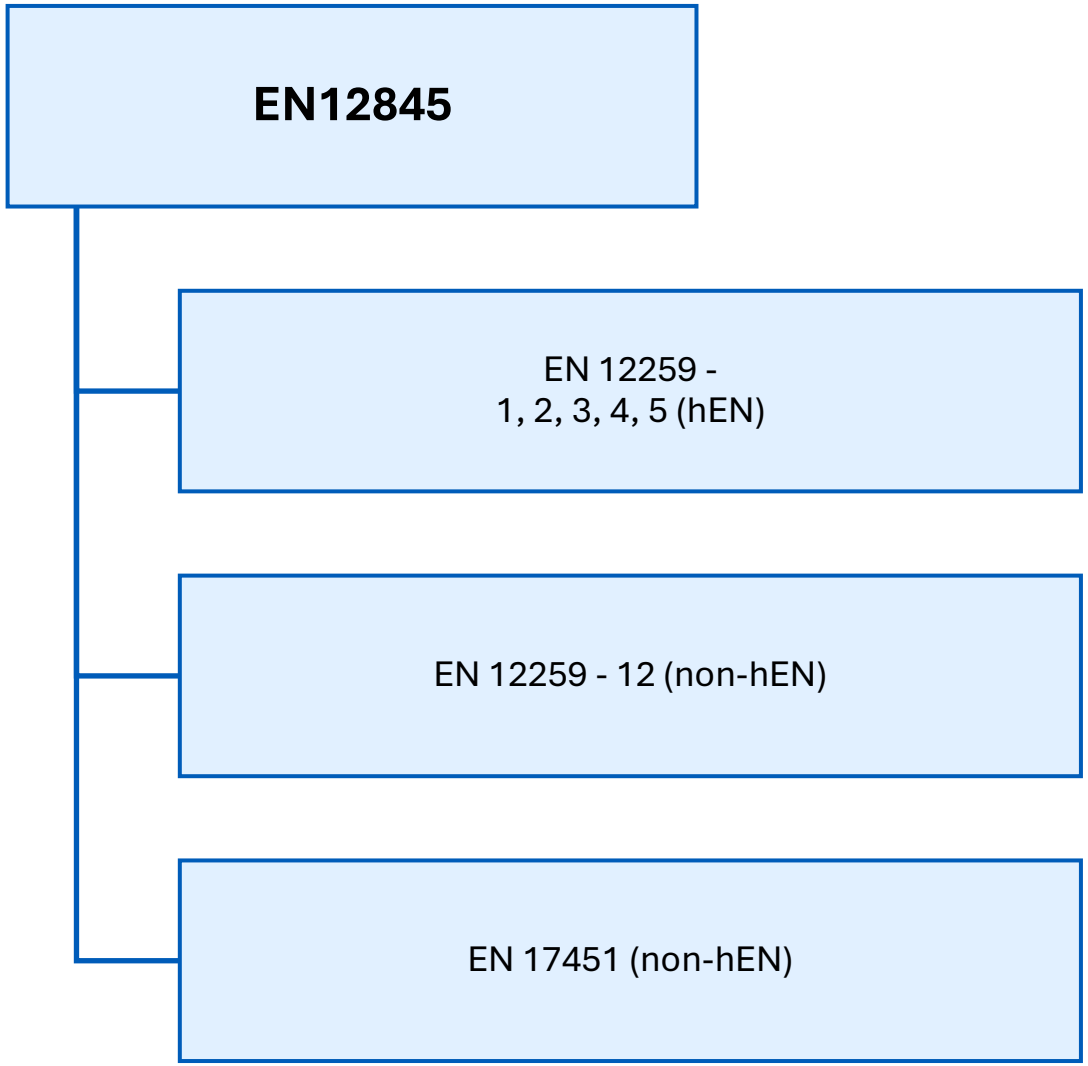
- The current EN12845 - 2015 rules we are using specifies many of the design and performance requirements of the pump set package

***EN 17451* – Fixed firefighting systems. Automatic sprinkler systems. Design, assembly, installation and commissioning of pump sets**.

- EN17451 covers *the design and performance guide for sprinkler pumpsets used in the forthcoming EN12845 rules*

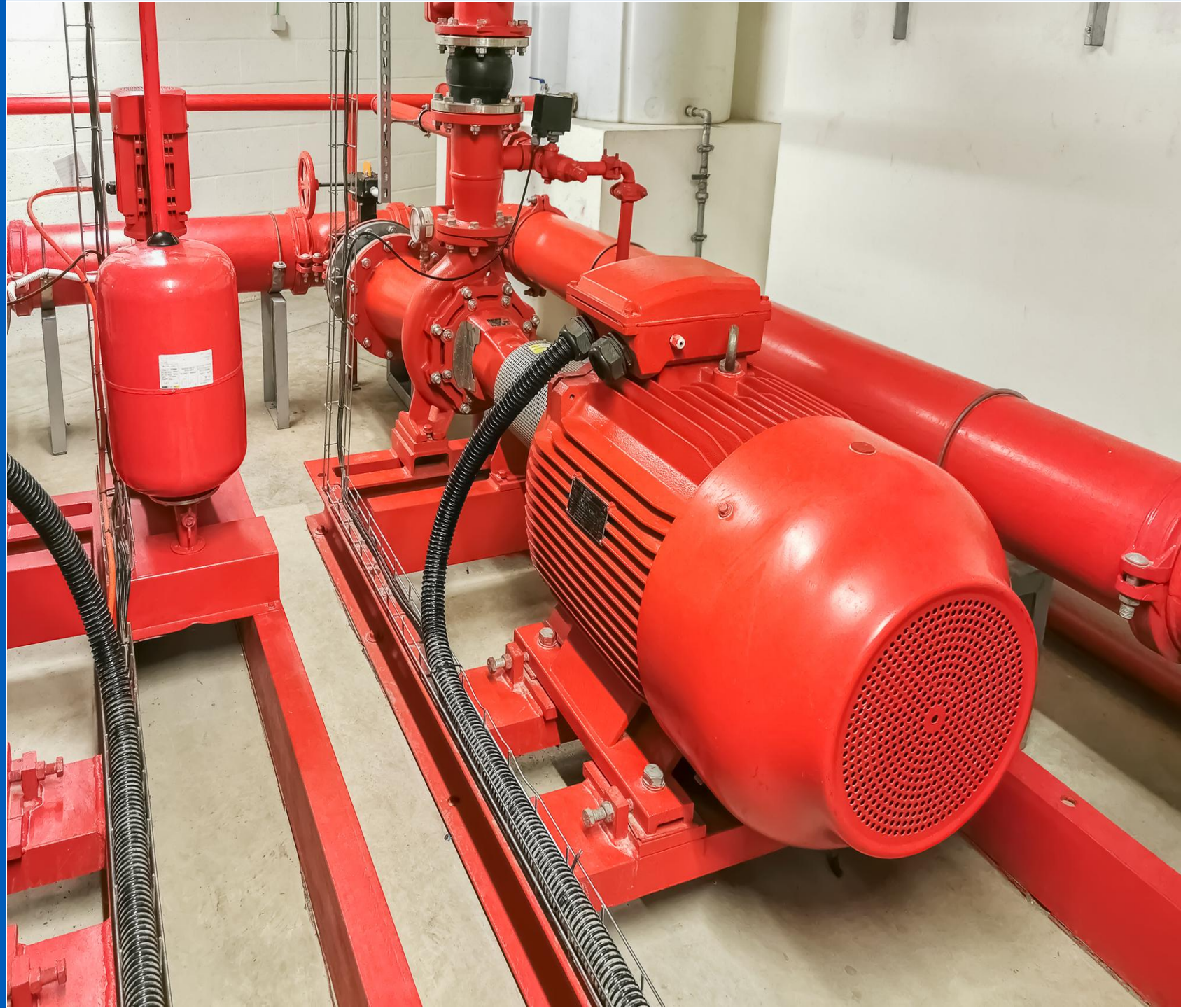
***EN 12259 Series - Fixed firefighting systems. Components for sprinkler and water spray systems***

- *EN 12259-1 – Sprinkler Heads harmonised*
- *EN 12259-12 – bare shaft pumps. Non harmonised but a requirement of EN17451*



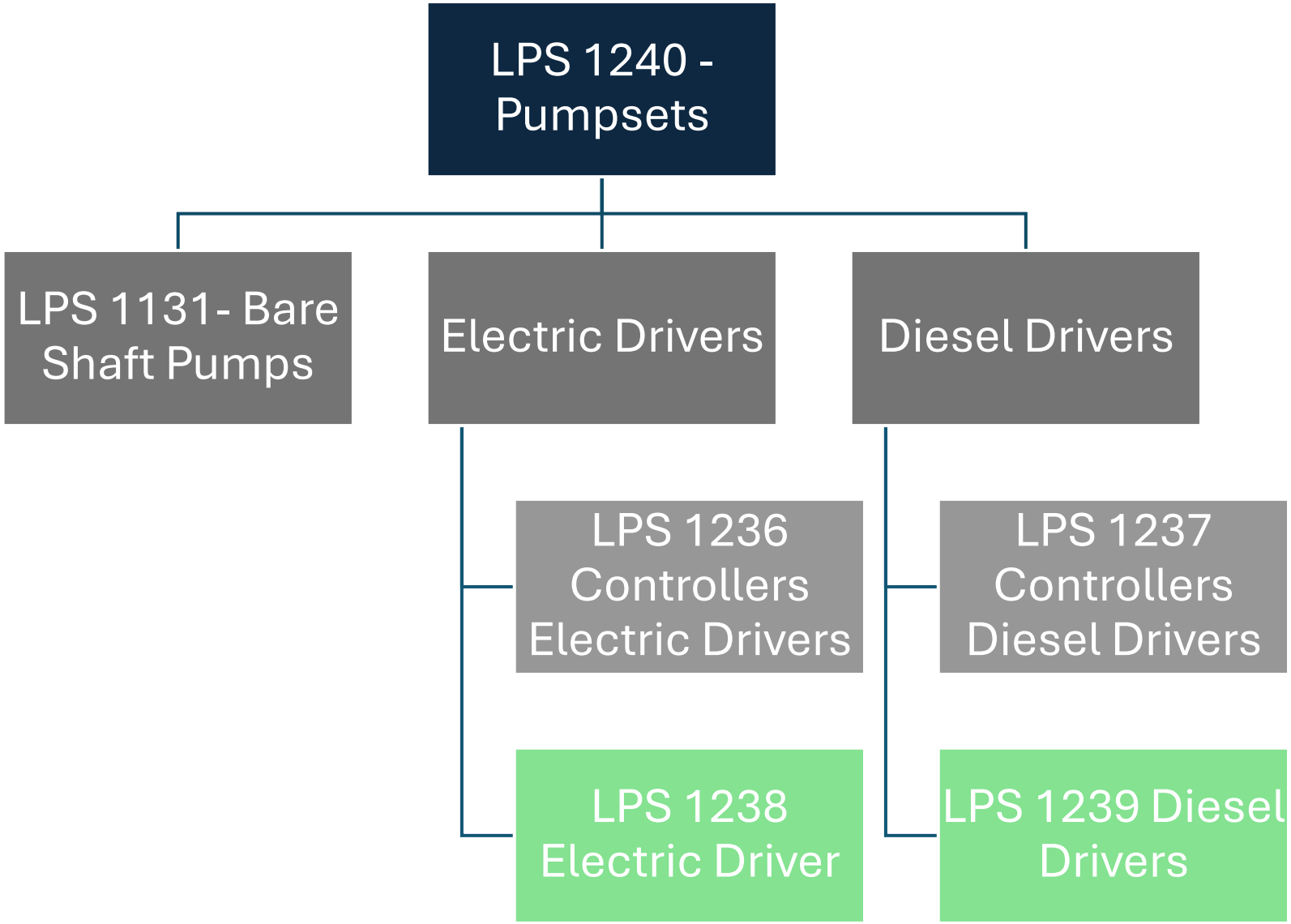
# LPCB Pump Set Approvals

- LPS 1240 *LPS Standard for Sprinkler Pump sets*
- Updated to reflect the development of EN17451

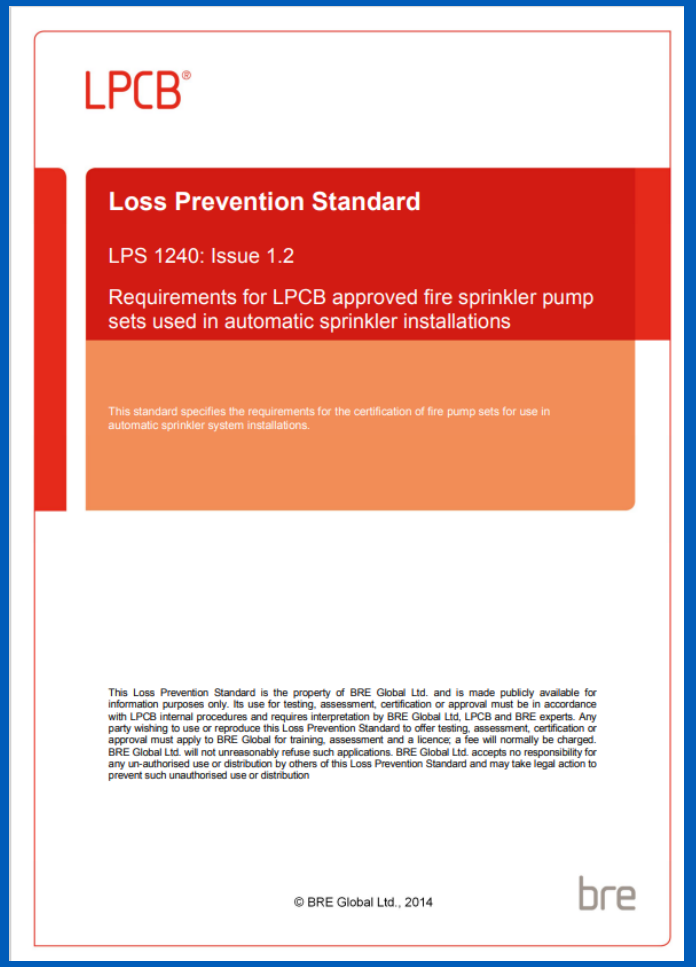


**LPS 1240**

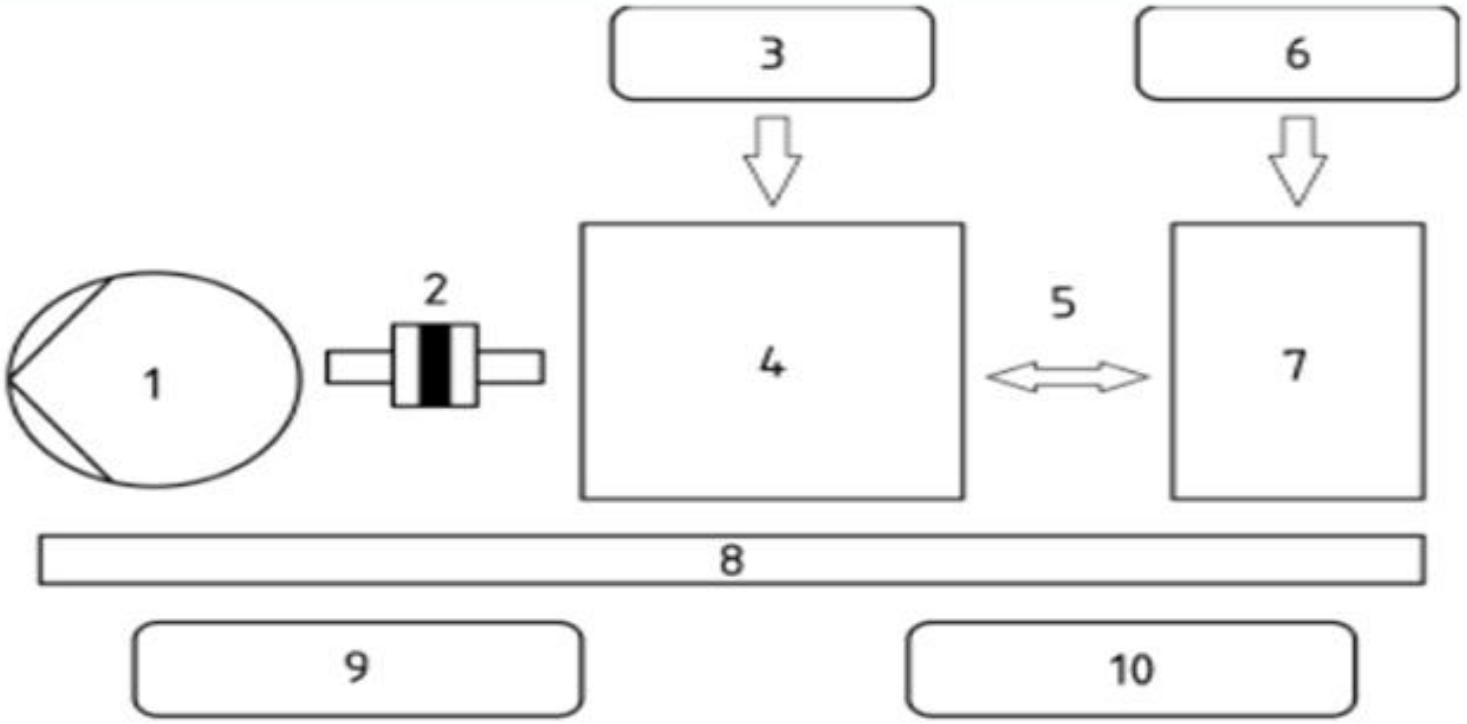
– Pumpset Approval



- LPS 1240 *LPS Standard for Pump sets*
- Updated to reflect the publication of EN 17451




# EN17451 Package Standard




Key

| | | | |
|---|---|---|---|
| 1 | pump | 6 | pressure loss detection |
| 2 | coupling | 7 | pump set control panel |
| 3 | fuel and fuel tank for diesel driver | 8 | frame |
| 4 | driver | 9 | test system |
| 5 | wiring | 10 | auxiliary items, e.g. exhaust and cooling pipe |

**Figure 1 — Example of a typical pump set assembly for a diesel driven unit**

## *EN 17451 : Main Requirements*

- Details the information that must be provided to the pump set manufacturer
- Requirements for determining
  - Pump and driver sizing
  - Rotation speed must be fixed.
- Pump set cooling system requirements
- Fuel tank design (min 4 hours. 4x required duration of operation)
- Couplings (types, sizing/loadings, and ‘fail safe’ design. No elastomeric couplings allowed)
- General guidance for mounting frame/chassis
- Control panel and operational parameters
- Pump start devices **pressure switches** or transducers
- Electrical: **Fuse protection**, circuit breaker protection, variable frequency drive
- Monitoring and visual indication requirements
- Batteries (type, location, capacity) and chargers
- Starter motor mechanism design (diesel pump sets)
- Pre-dispatch and onsite testing and performance verification
- Documentation

## *LPS1240 : Points adopted for LPC compliance*

Based on EN 17451 with the following additions:

- All pumps to EN 12259-12 as part of LPS 1131
- Fuse protection only
- ‘Direct-on-line’ or ‘star-delta’ starts only. Variable speed and soft start not allowed)
- Pressure switches only for starting signal
- Other engineering simplifications, as considered appropriate.

# Pump Controller Diesel drive

## Alarms and monitoring

## Indications on pump controller ( diesel drive )

| Conditions | Provision for onward transmission (see 7.4.1.2) |
|---|---|
| ready to operate (e.g. power supply available, in auto mode, no critical faults) (optional) | - |
| battery charger status | #1 |
| battery status | #1 |
| low jacket water temperature, or low engine temperature, or disconnection or failure of heaters (where heaters are installed) | #1 |
| engine running | - |
| pump running | #2 |
| start failure | #2 |

| Conditions | Provision for onward transmission (see 7.4.1.2) |
|---|---|
| pump on demand | #2 |
| low oil pressure | #1 |
| high water (engine coolant) temperature | #1 |
| low fuel level | #1 |
| Fuel valve closed | #1 |
| automatic mode off | #2 |
| hours run meter | - |
| tachometer | - |
| leak detection (where required) | #1 |
| test start (see 9.6.5) | - |
| engine overspeed (≥ 7,5 % overspeed) | #1 |
| ECM failure (see Annex E) | #1 |
| ECM alternate (initiate start) (see Annex E) | #1 |
| Pressure sensor (i.e. pump initiation devices and cabling) fault | #1 |

NOTE #1 Provide a common alarm volt free contact and #2 provide a dedicated volt free contact.

## Regulations within the new EN17451 standard to address coupling selection

All pumps and drivers shall be fitted with  failsafe couplings

The coupling between the drive and the pump shall be of a type which ensures that either can be removed independently.

The sizing of the coupling shall be based on the rating of the driver not the pump, taking account of the maximum available torque provided by the driver as specified by the manufacturer

## Regulations within the new EN17451 standard to address site issues

The pump can be inspected or removed and replaced without affecting suction or discharge piping and access to the impeller will be archived without removing the driver or pump body.

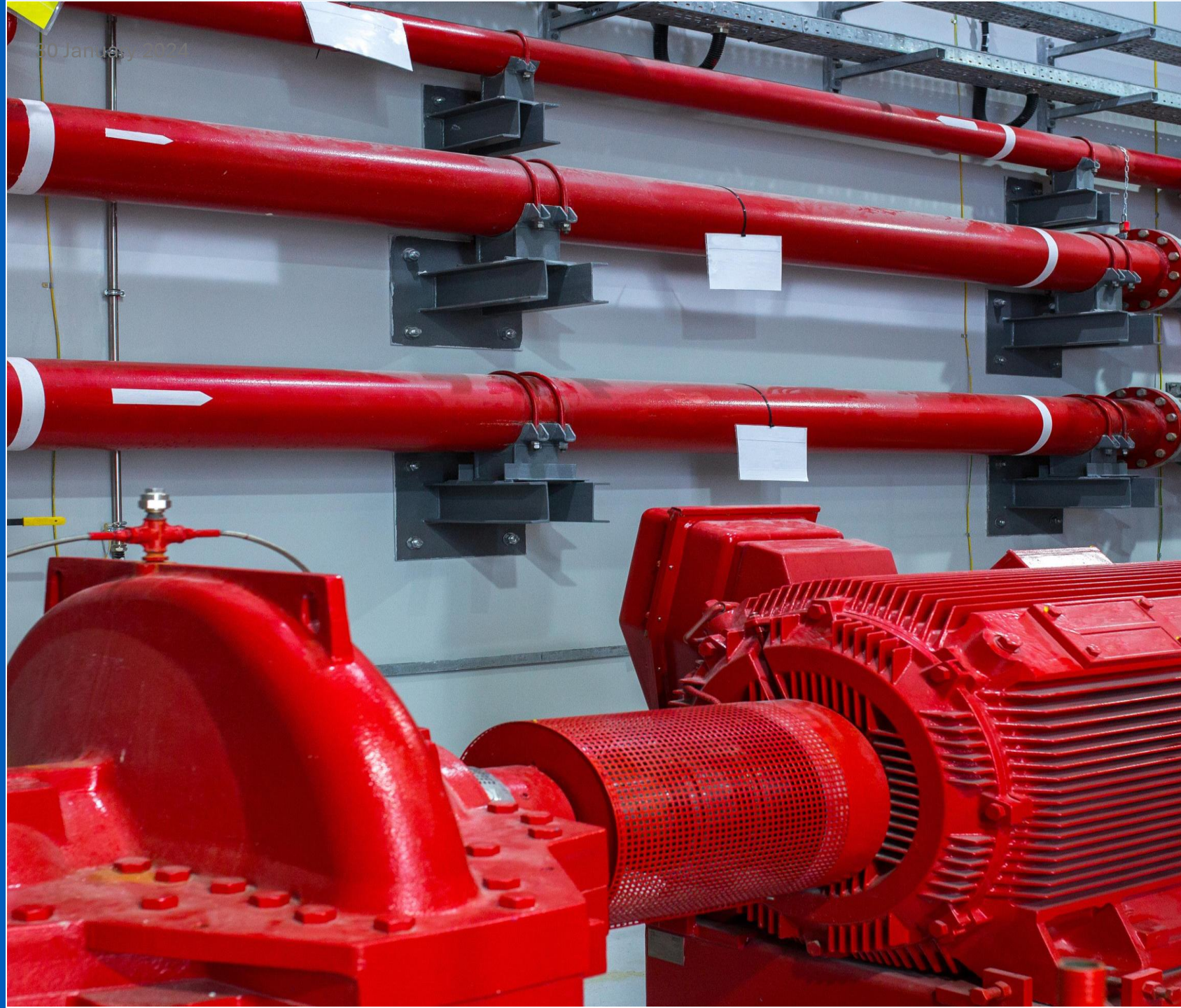
Final alignment shall be undertaken once the pump is fully installed on site.

EN 17451 Pump Set packaging standard.

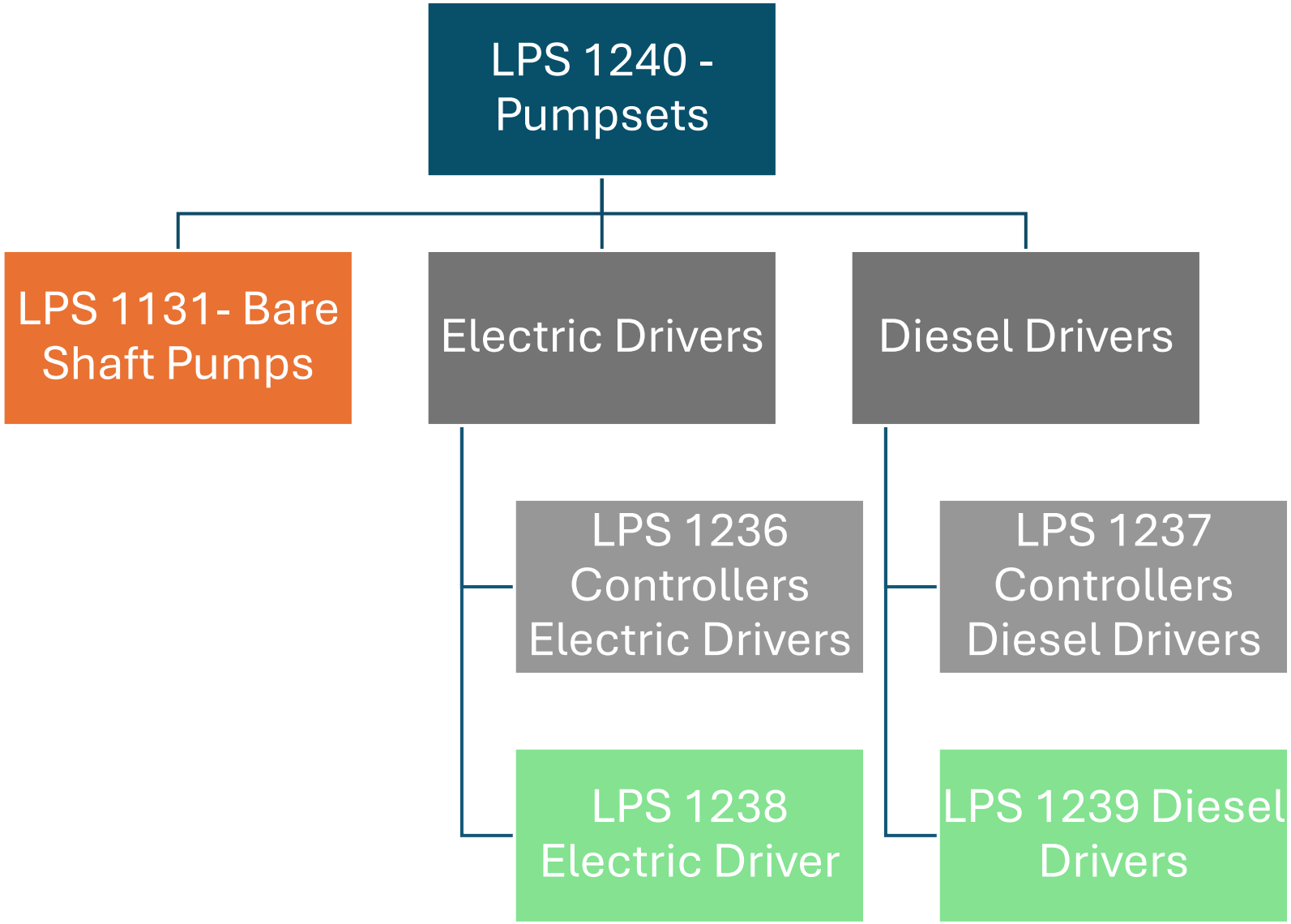
This is not a radical transformation, but it is a big advantage to us all, to have a single European standard, with all the requirements of how to design and build pump sets, we can supply our packages to conform with.

## Pump Approvals

- LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*
- Updated to reflect the publication of EN12259-12



# LPS 1240 – Pumpset Approval



# What differentiates a Fire Pump from an Industrial Pump

- Fire pump runs 20 to 30 minutes per week
- Pump runs each week against closed valve / no flow
- 90 minutes water supply when called into action.
- 6, 8, 10, 12 hours  fuel supply when running at duty
- Must perform to duty point as soon as possible

- On the face of it these issues seem small but there is a world of difference between the applications

# What differentiates a Fire Pump from an Industrial Pump

- The forces on the impeller at no flow are at their maximum resulting in shaft deflection
- Constant running at shut off has the highest load on the bearings.  This in time can be exacerbated and cause vibration, out of balance, misalignment, excess heat can result in premature shaft failure
- The pump has to react immediately and starting methods are direct, with no run up time placing extra stress on the shaft.
- Heat generated running at no flow with minimum flow lines results in heat generation contributing to premature failure

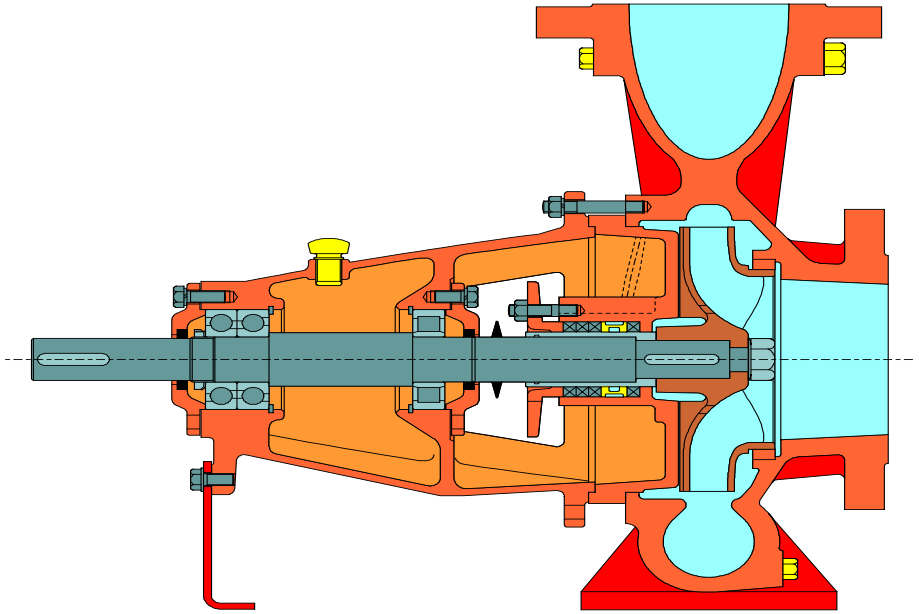
Pump must be designed to significantly reduce the chance of failure.

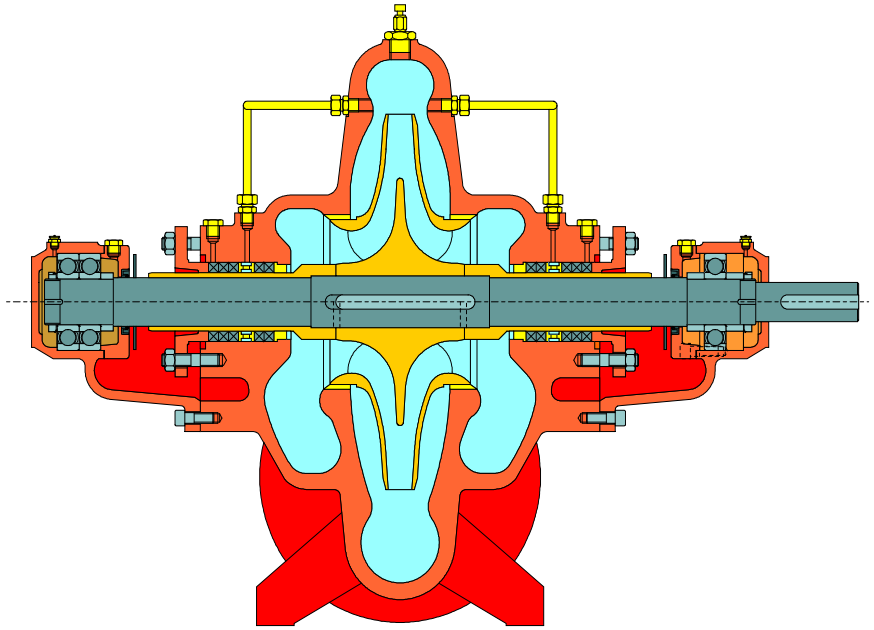
## Fire pump design must take into account :

Shaft diameter calculations due to prolonged rest periods then full load start requirements

Bearing selection due to driver loads when running at closed valve

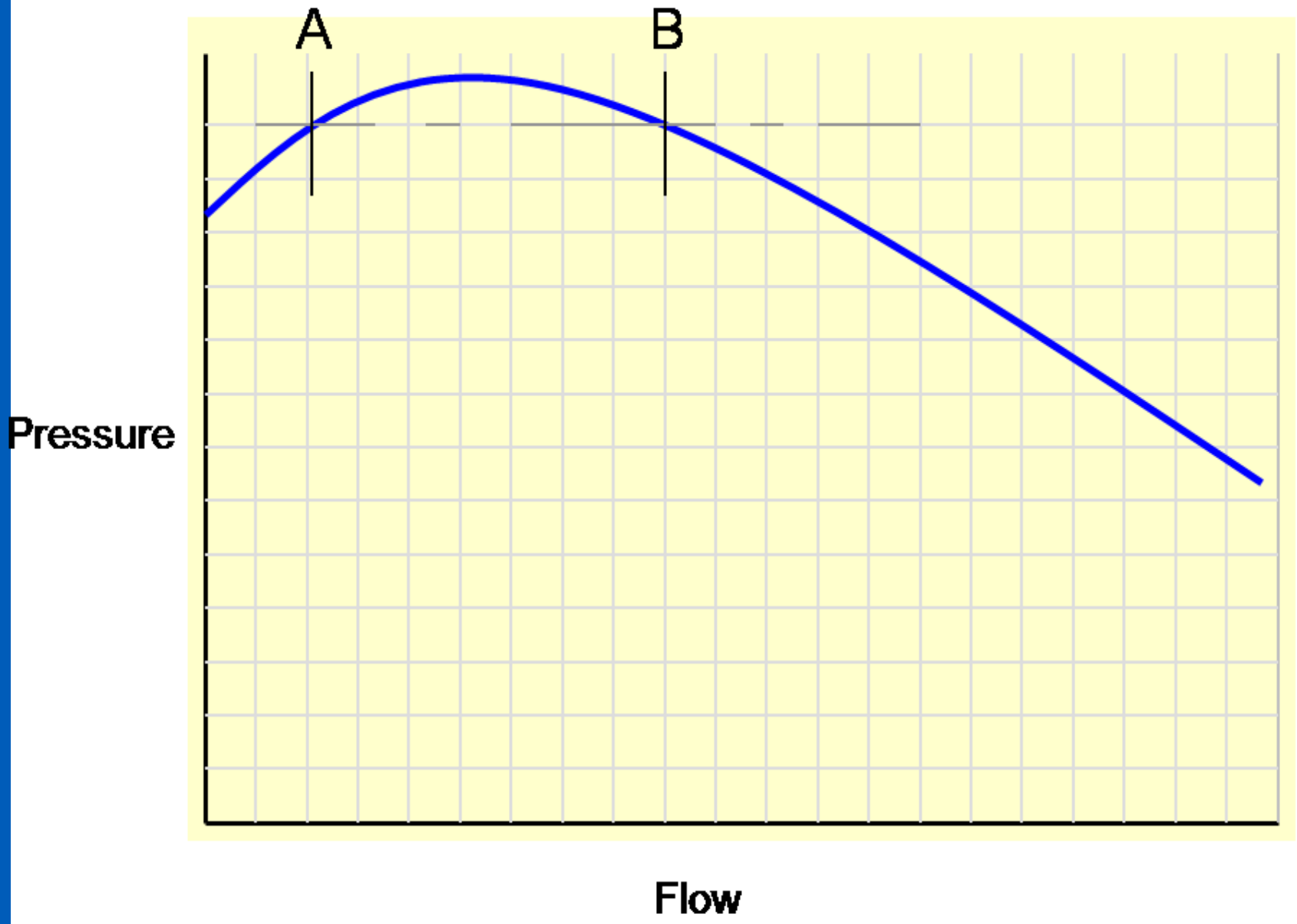
Curve shape to satisfy the fire water demands.



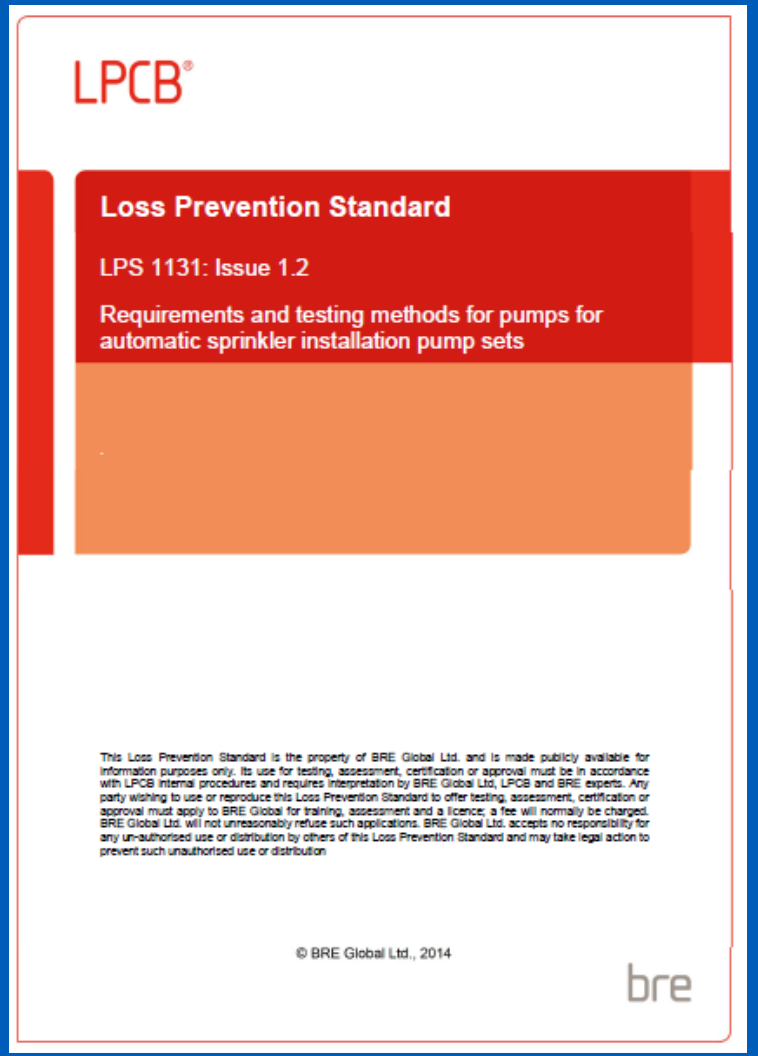


Unstable Curves (like this one) means that there is no predictable operating point Pump can run at point A or point B as they satisfy the same pressure. There are 2 flow possibilities QA or QB.

Pump can oscillate or “hunt” between flows QA and QB Stable curves are essential for pumps operating in parallel. A pump operating at the top of the hump can hold the check valve of the second pump closed



- LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*
- Updated to reflect the publication of EN12259-12




## EN 12259-12; summary of key requirements

- Maximum rotational speed
- Characteristic curve
  - Uncertainty range limit (ISO 9906 “2B”)
  - Max head at zero flow (-5% tol), head declines with flow
  - 140 % of Qr flow at no less than 70 % of pressure at Qr.
  - *Flow, power consumption, NPSHr, total differential head of the pump in accordance with EN ISO 9906*
  - *Non-overloading power characteristic or a flow corresponding to at least NPSHr of 16 m.*
- Inlet/outlet thread specification
- Closed-valve (zero flow) cooling test *[so pump can run at closed-head]*
- Materials: cast iron, cast steel, stainless steel, bronze or aluminium bronze
- Pump casing strength *[at least 10 bar]*
- Leakage test
- *Shaft stress calculations (+5%) safety margin* *[not a huge safety margin…?]*
- Marking & Documentation

## LPS 1131; summary of key requirements

- (=) Maximum rotational speed
- Characteristic curve
  - Uncertainty range limit (ISO 9006 “1U” or “2U”) [tighter, unilateral tolerance]
  - Max head at zero flow (-2.5% tol), head declines with flow
  - Flow, Power requirement, TDH, NPSHr all covered in EN12845 2015
- (=) Inlet/outlet thread specification
- (=) Closed-valve (zero flow) cooling test
- (=) Materials
- (+) Pump casing strength [simplified method 2x WP]
- (=) Leakage test [simplified method 1.5x WP]
- (=) Marking & Documentation

LPS 1131; summary of key requirements

- (+) Shaft and sleeve requirements; shaft stress requirements
- (+) Maximum working pressure
- (+) Disassembly requirements
- (+) Gasket requirements
- (+) Flange requirements
- (+) Closed head relief valve
- (+) Wear rings
- (+) Bearings
- (+) Shaft sealing
- (+) Orifice plates

LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## General Design

Stable Pump Head -v- Flow Rate Curve

Rated speed not to exceed 12 bar in the closed valve condition.

*Note: Applications for approval of pumps with higher pressures will be accepted, e.g. for high rise sprinkler systems and special applications.*

## Operating Range

Flow rates at the NPSH shall be below 5.38m.

*Under EN12259-12 NPSH @5m is required.*

## Closed Valve Conditions

A minimum bypass flow rate shall be specified, to minimise the possibility of pump failure in the closed valve condition.

LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

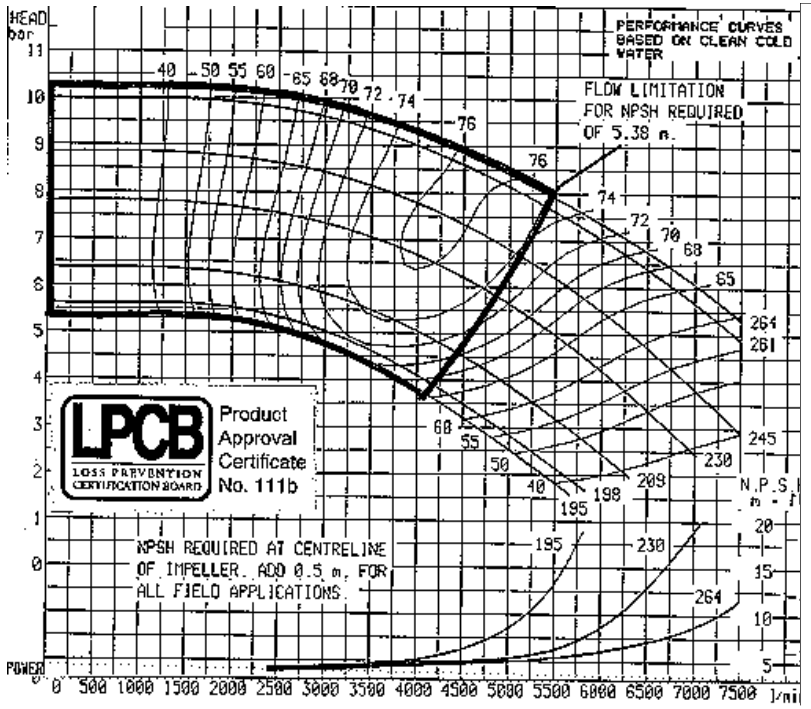
## Performance Tests

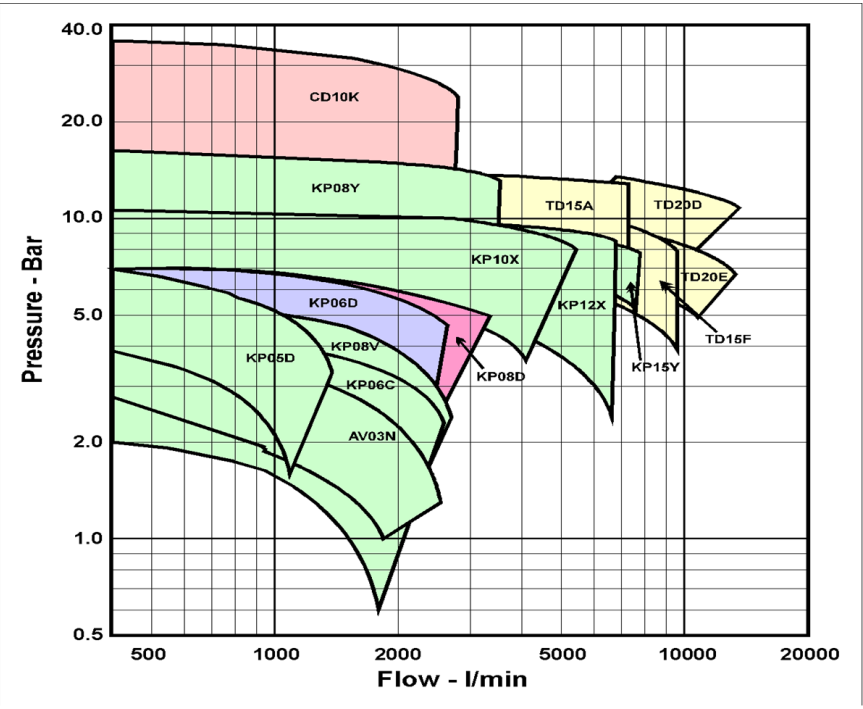
- A pump model with a range of duties shall be tested, as a minimum with maximum and minimum impeller diameters
- If the range of duties is achieved using orifice plates at the pump outlet, the pump will be tested using maximum, minimum and an intermediate orifice plate diameter.
- The performance characteristics of the pump shall be verified at the rated speed, over a range of flow rates.

LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## Performance Tests

- The performance characteristics of the pump shall be verified at the rated speed, over a range of flow rates.



LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## Performance Tests

### Pump Total Head

The Pump Total Head shall be verified after the closed valve test.

### Required Net Positive Suction Head Curve

The NPSH required curve shall be determined using clean cold water.

The flow rate at which the NPSH required is 5.38m shall be clearly marked on the performance curves for the range of impeller diameters and speeds tested.

NOTE : EN12259-12 requires NPSH to be taken at 5m. Both figures are available under the LPS 1131 listing if required.

LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## Performance Tests

### Pump Power Input Curve

The maximum pump power is verified to a maximum flow rate corresponding with the following requirements:

a) For pumps with an ever-increasing power input, to an NPSH required at the pump suction flange, of 16 metres.

b) For pumps with a detectable peak power value (at an NPSH required of less than 16 metres), until a peak is determined: It shall be demonstrated that the peak is occurring by design and not cavitation.

The electric driver will require at least 5% more power than the power required at these points. The diesel driver will require at least 10% more power than the power required.

LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## MARKING - Nameplate

The pump shall have securely fitted to it a nameplate which is durable, non-combustible, legible and indelible and contain the following information:

a) Supplier's name or trademark.

b) Supplier's address.

c) Model designation.

d) Serial number.

e) Year of manufacture.

f) LPCB Approval Mark and Reference No.

g) Rated flow (L/min).

LPS 1131
Xxx/xx

SPP PUMPS

# LPS 1131 *LPS Standard for Sprinkler System Bare-shaft Pumps*

## Fire Pump

| Product | Type | Suction Inlet Diameter/ Discharge Outlet Diameter (mm) | Impeller Diameter (mm) | Rated Speed (rev/min) | Rated Flow (L/min) (at NPSH req. = 5.38m) | Rated Head (bar) (at NPSH req. = 5.38m) | Closed Valve Head (bar) | LPCB Ref. No. |
|---|---|---|---|---|---|---|---|---|
| TD20D Thru-stream (2),(5) | Horizontal split case | 250/200 | 340 | 2950 | 13600 | 10.8 | 15.7(1) | 111b/01 |
| TD20D Thru-stream (2),(5) | | | 275* | 2950 | 12000 | 7.6 | 10.3(1) | 111b/01 |
| TD20D Thru-stream (2),(5) | | | 273* | 2950 | 11600 | 7.4 | 10 | 111b/01 |
| TD20D Thru-stream (2),(5) | | | 245* | 2950 | 8500 | 6 | 8 | 111b/01 |
| TD20D Thru-stream (2),(5) | | | 340 | 2950* | 13600 | 10.8 | 15.7(1) | 111b/01 |
| TD20D Thru-stream (2),(5) | | | 340 | 2400* | 13500 | 6 | 10.3(1) | 111b/01 |

Changes within the new EN12845 standard to take into account for water supplies .

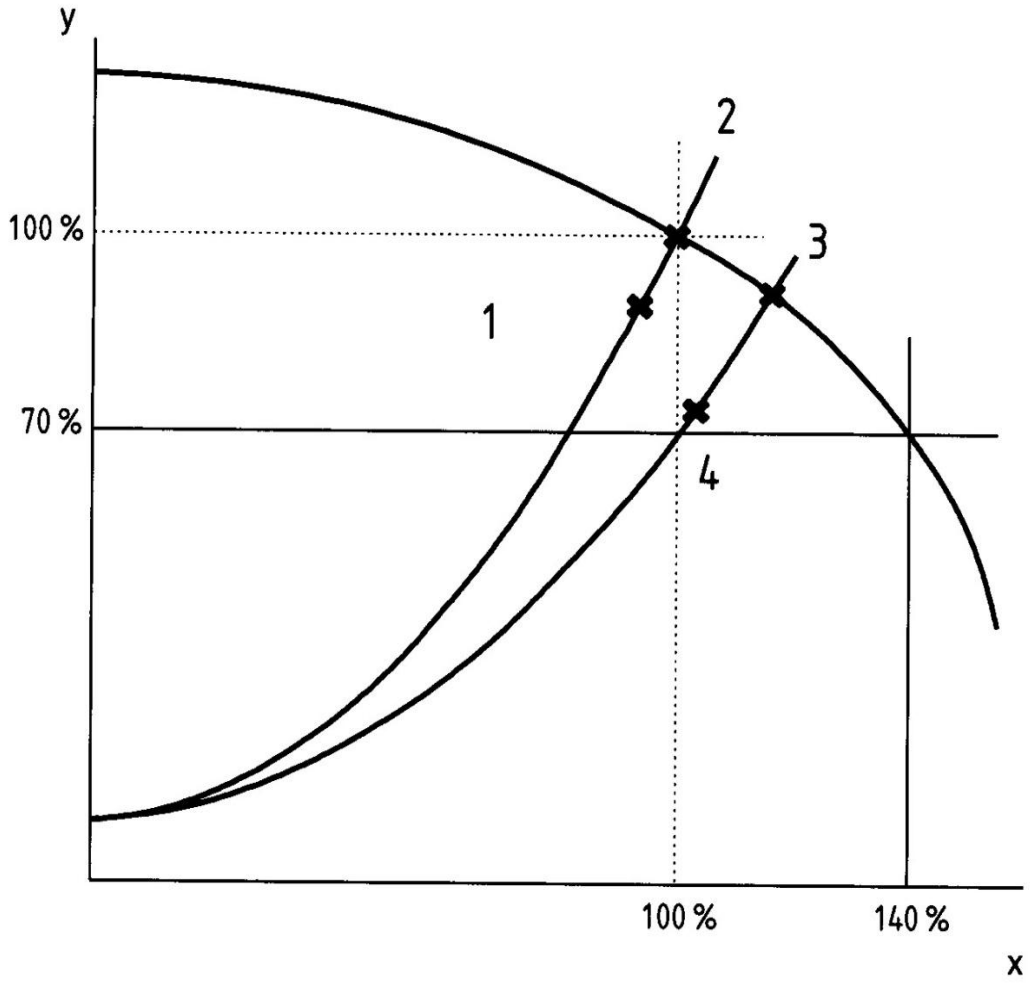
Pre-calculated OH I, II, III and IV  flow and pressure will change to the new  FH1 and FH2 duties.

Reference to HHP and HHS will be FH3 to FH5 or HHS1 to HHS5

## Proposed Design changes to EN12845 in 2026 edition

Water tank volume based on point 2 instead of point 3

*This will result in smaller sprinkler supply tanks*




**Key**
1 Most unfavourable area
2 Design pump flow
3 Maximum demand flow
4 Most favourable area
x Flow

## EN12845 2026 Proposed design changes

- OH will become FH2 and FH3

- Smaller diameter for suction pipes.

1.8m/s maximum velocity will now increase to 4m/s for positive suction

1.5m/s maximum velocity will now increase to 2.5m/s for suction lift

- Type of water supply will depend on category of risk and number of sprinklers on the water supply

- Extra demand for hydrant duties

1500 l/m for FH1

2000l/m for FH2

| | Acceptable water supply | | |
|---|---|---|---|
| Category of risk & Number of sprinkler supplied by the same water supply (2) | Single water Supply | Single superior water supply | Duplicate water Supply |
| FH1 | X | X | X |
| FH2 less than 1000 spk | X | X | X |
| FH2 more than 1000 spk | | X | X |
| FH3-FH5 less than 500 spk | X | X | X |
| FH3-FH5 more than 500 spk | | X | X |
| HHS less than 500 spk | X | X | X |
| HHS from 500 to 5000 spk | | X | X |
| HHS more than 5000spk | | | X |