European Fire Pump Listing

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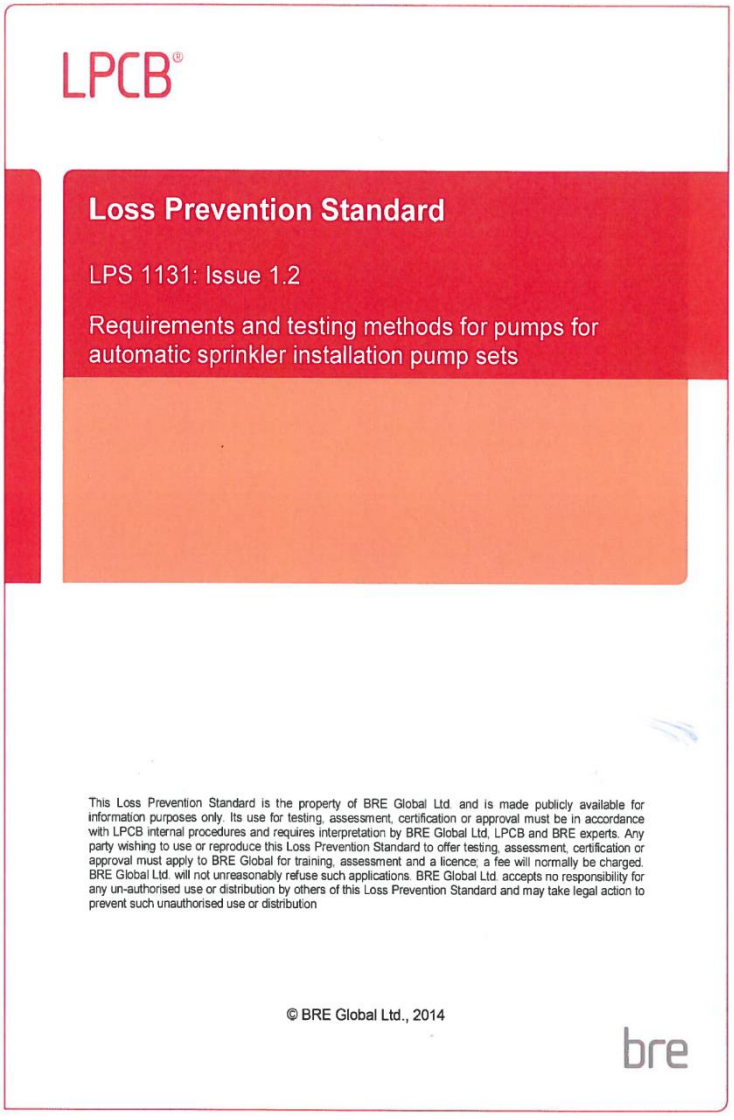
Current Status of European Listings

- Germany - National Listings
- France - National Listings
- UK - National Listings
- Poland - National Listings
- Hungary - National Listings
- Czech Republic - National Listings

- Other areas may operate a policy of National Annex but do not list or approve pump build or performance

What is a fire pump listing standard and why is it important ?



LPCB®

Loss Prevention Standard

LPS 1131: Issue 1.2

Requirements and testing methods for pumps for automatic sprinkler installation pump sets

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Criteria to approve a Sprinkler Pump

- The LPC requirements for listing a Fire Pump are written to reflect pump running life and design criteria that are far in excess of requirements that would be needed for an equivalent industrial application. The requirements take into account the arduous operating parameters and critical nature of a sprinkler pump.

Procedure to approve a sprinkler pump with LPCB

- The manufacturer submits documents such as curves, general arrangement drawing, sectional drawing, critical components drawings (shaft, sleeve, Impeller), material specs, parts list, installation instructions, manual to the LPCB
- The next step is to submit design calculations (hydraulic thrust loads, bearing loads, bearing life calculations, shaft stresses) to prove the pump meets the requirements.
- Product test data (flow/head tests. Flow/ power tests, NPSH tests) follow.

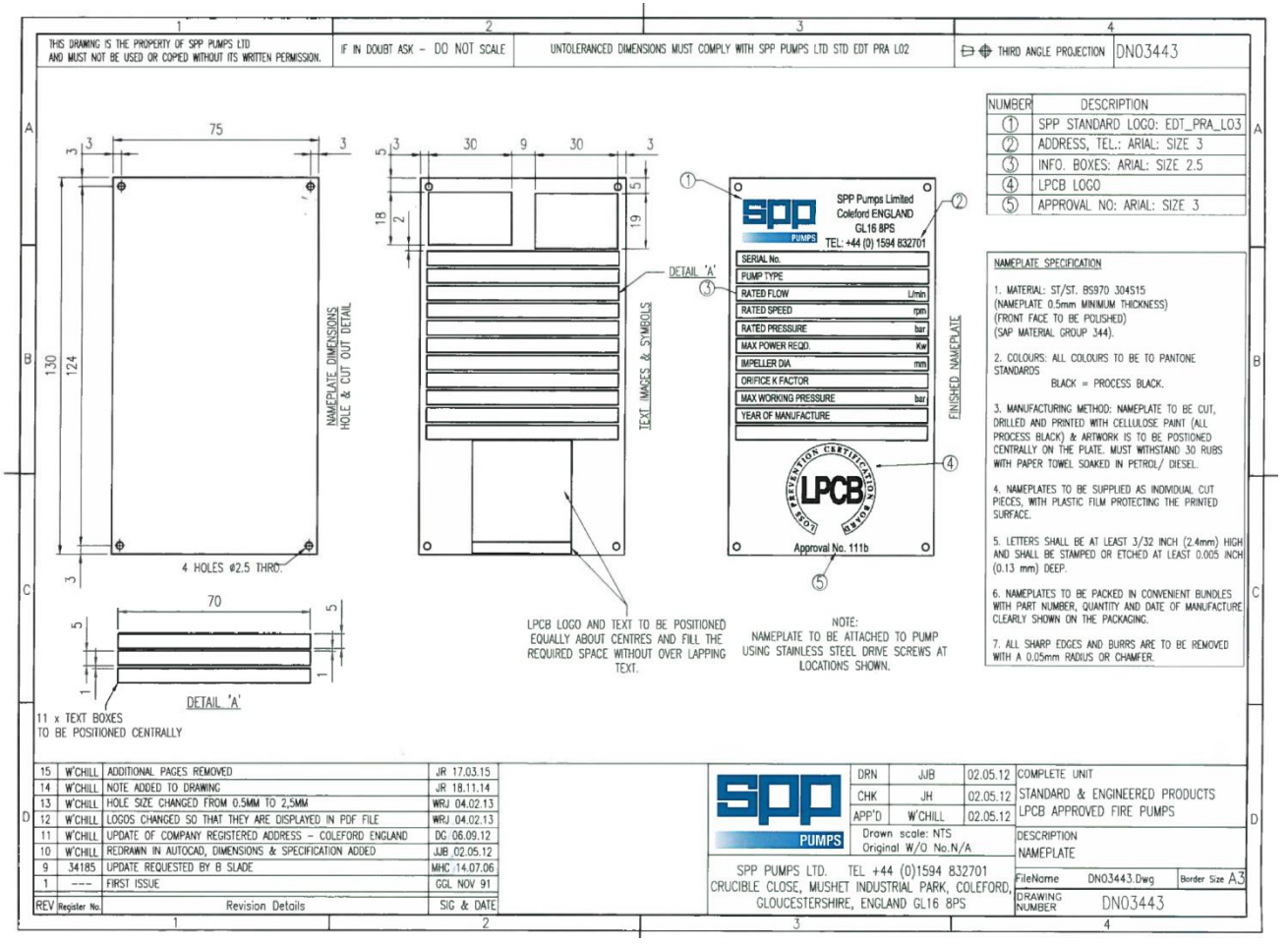
Procedure to approve a sprinkler pump

- LPC visit our facility to carry out Flow / Pressure / Power / NPSH / Vibration / Temperature
- 2 hours monitored run at closed valve
- Hydrostatic pressure test (flange and gasket tightness, strength test)

Procedure to approve a Sprinkler Pump

- Calibration certificates (pressure transducers, flowmeter, wattmeter, voltmeter, ammeter, optical tachometer, digital thermometer, test motor/torque meter, vernier callipers, micromete)r are inspected
- Calibration laboratories must be accredited to ISO/IEC 17025:2005 for all instrumentation i.e. UKAS for the UK

Pump Name Plate



What differentiates a Fire Pump from an Industrial pump.

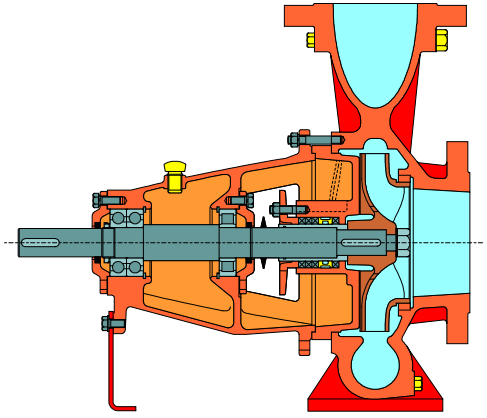
- Fire pump runs 20 to 30 minutes per week
- Pump runs each week against closed valve / no flow
- 90 minutes water supply when called into action.
- 6, 8, 10, 12 hours (1 gallon per hp for NFPA) fuel supply when running at duty
- Must perform to duty point as soon as possible

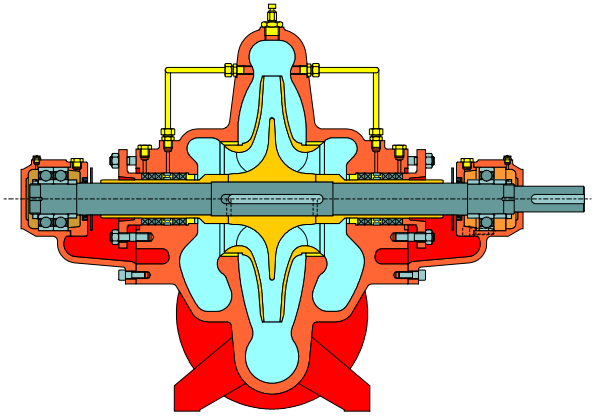
- On the face of it these issues seem small but there is a world of difference between the applications

What differentiates the Fire Pump Shaft from industrial pumps ?

- 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
- Correct materials are key as pump remains inactive for prolonged periods and needs to avoid corrosion failures.

What differentiates a Fire Pump from an Industrial pump.



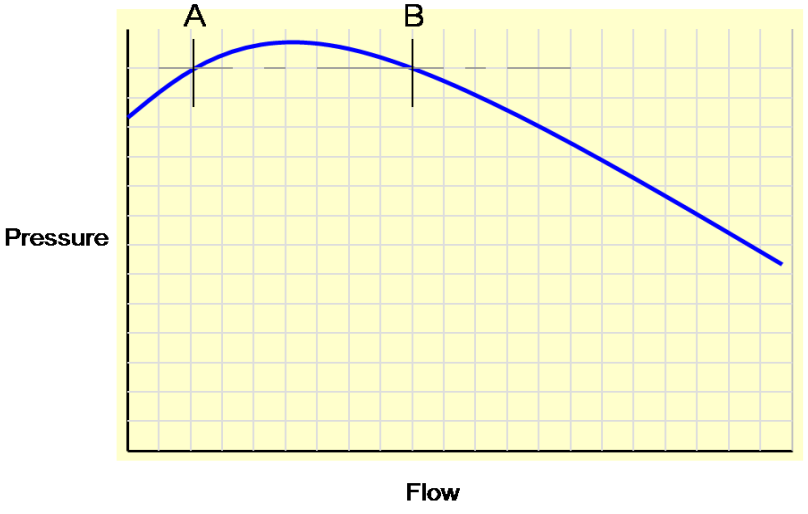


Fire pump design must take into account :

- 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 H/Q Curve

- Unstable Curve means that there is no predictable operating point
- Pump can run at point A or point B as they satisfy the same presssure. 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



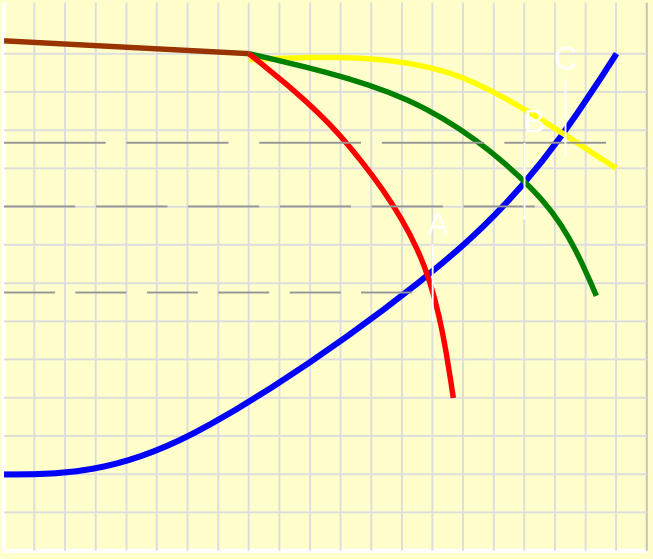
UK BSI National Annex

Guidance and material related to UK practice

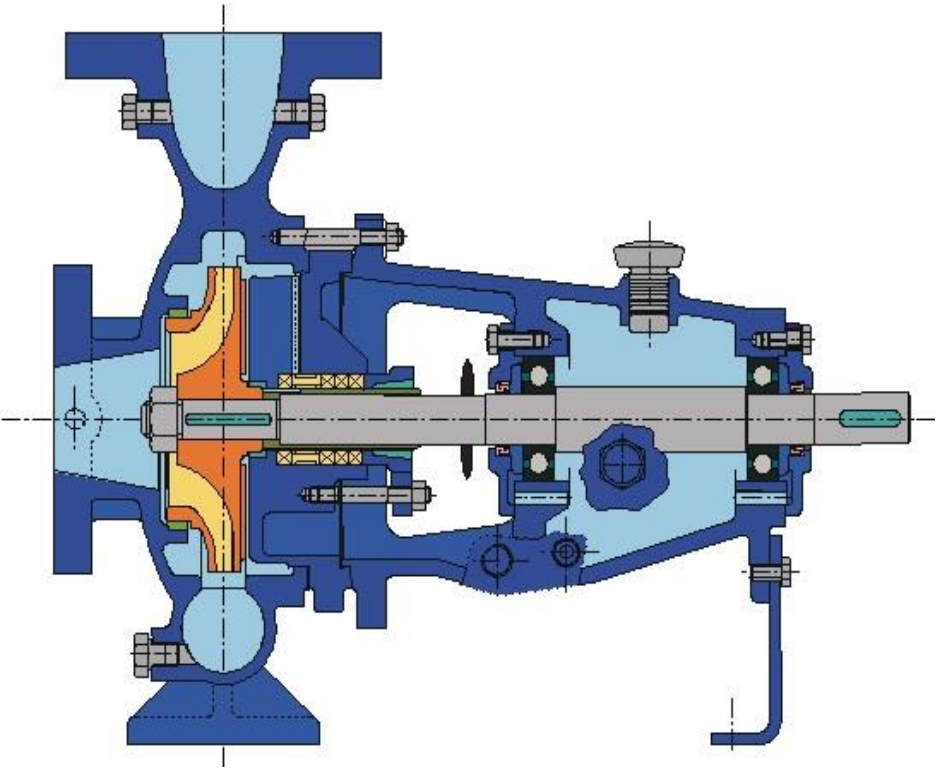
- NA.2.2 Pump stability
- In the UK, only pumps with a stable H(Q) curve are permitted for use for sprinkler systems (i.e. ones for which the maximum head and shut-off are coincidental and the total head declines continuously with increasing rate of flow).

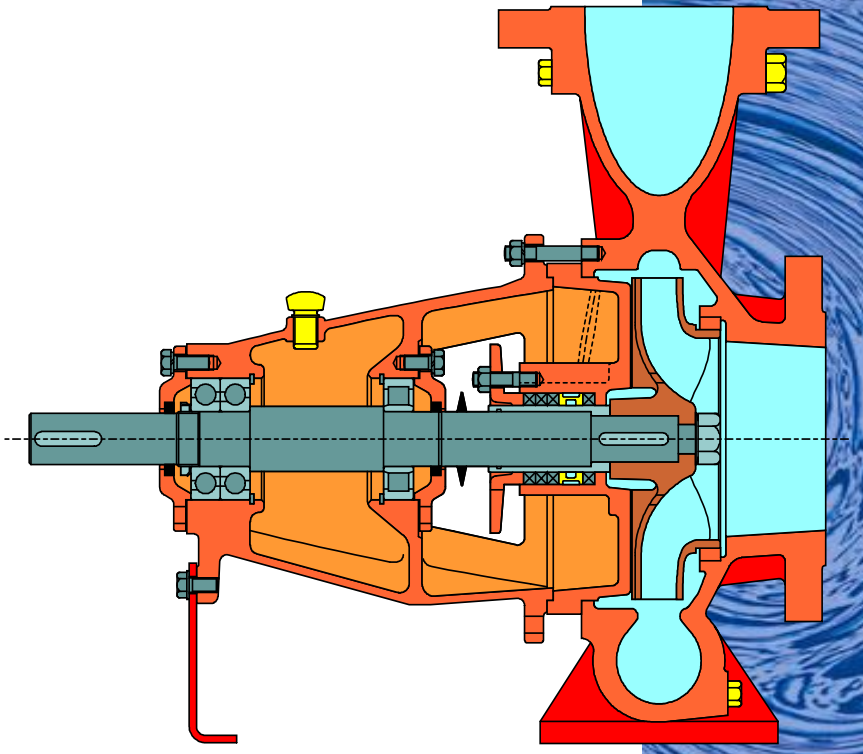
Curve Shapes have to be correct

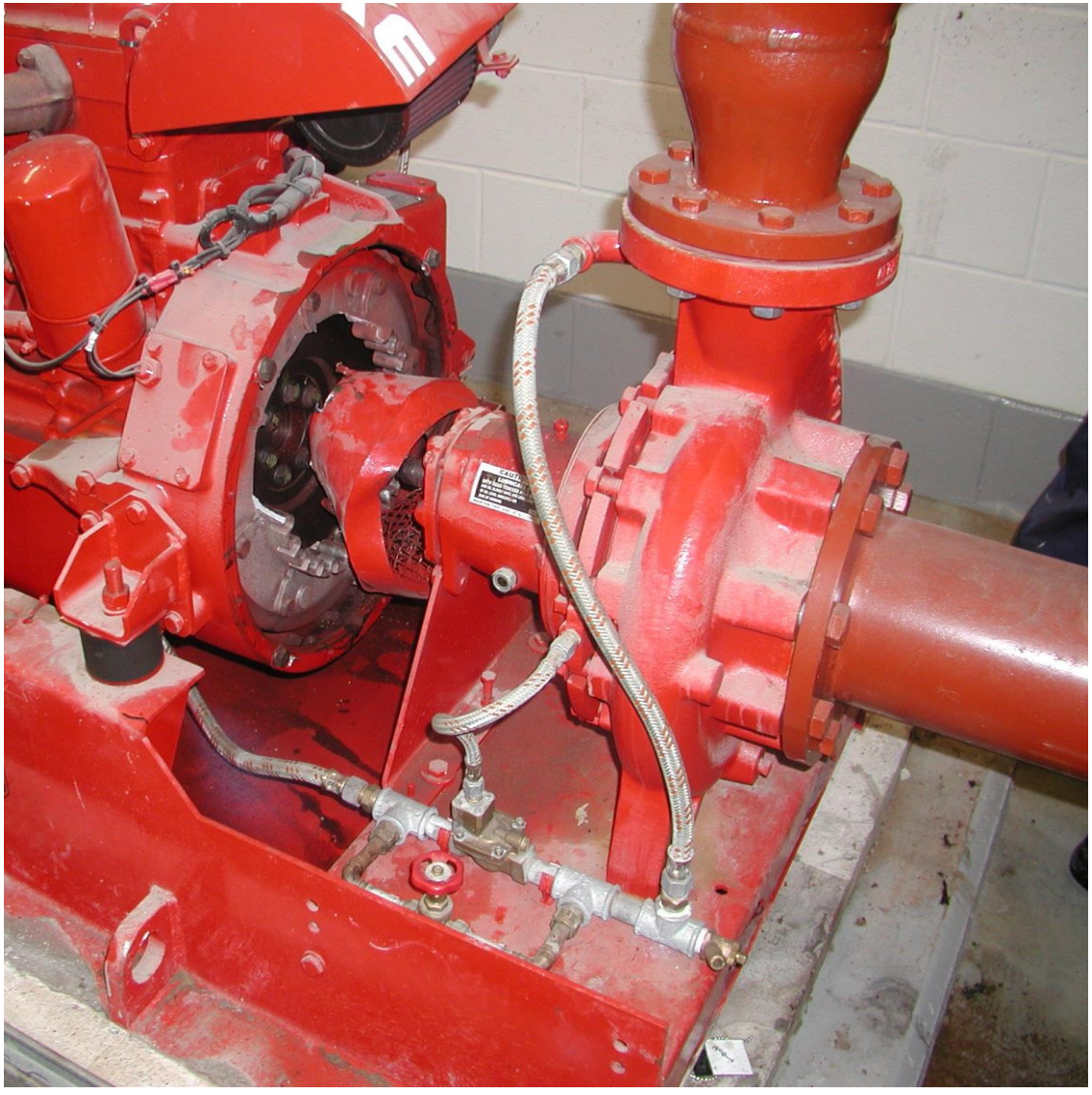
- Shape of the curve is critical to the operation of the system
- Curve C. Too flat results in high power demand and reduced water supply time
- Curve A. Too steep a curve and the pump pressure is reduced at the intersect. There may be insufficient pressure for the spray pattern of the sprinkler head for some favourable areas of operation.
- A steep curve means a high C.V.
- Flattening performance curves means curve C, higher power absorbed and water usage.



Industrial Pump V Fire Pump







For an EN12845 high hazard sprinkler system, the pump selection must comply with:-

- Pump rated duty is a function of the most unfavourable area (MRA)
- Pump curve pressure must be at least 0.5 Bar higher than the MRA requirement
- Pump must be able to supply 140% of the MRA flow at a pressure of not less than 70% of the MRA pressure
- Pump NPSHR at 140% must be 1 m less that the NPSHA at the pump inlet
- Pump driver must cater for the maximum pump power absorbed or the power absorbed at the flowrate where the pump NPSHR is equal to 16m or maximum suction static head plus 11m
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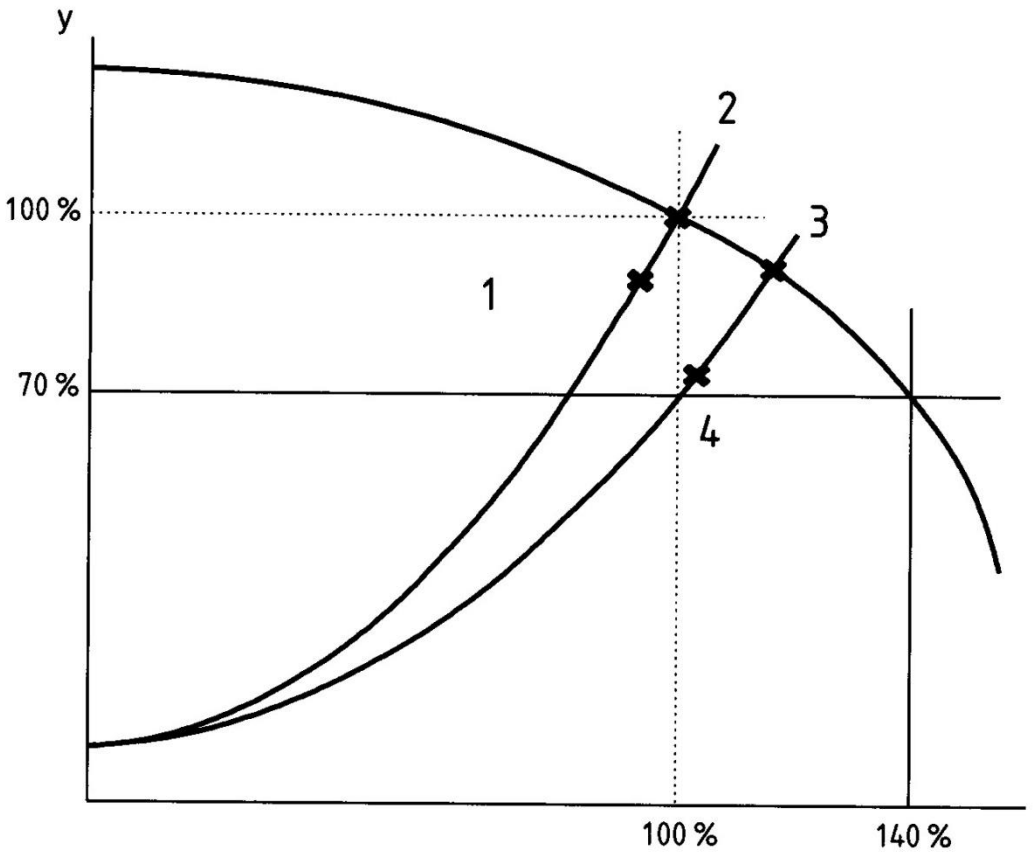
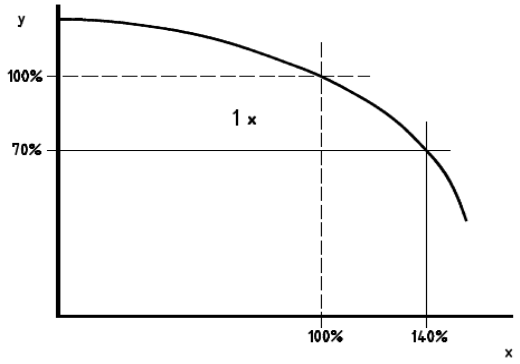
EN 12845



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



How to make an EN12845 high hazard pump selection:-

The most unfavourable area (MRA) demand is - 4500 l/min at 8.5 Bar

So the pump selection criteria to consider is:-

- Impeller must be sized to achieve a minimum duty of 4500 l/min at 9.0 Bar
- Pump must be able to achieve a flowrate of 6300 l/min at least 5.95 Bar
- Pump flowrate must be increased to compensate for pump circulation relief valve or engine cooling water demand
- Pump NPSHR at 6300 l/min must be 1 m less that the NPSHA at the pump inlet

NPSH Calculation

The suction piping, including all valves and fittings, shall be designed in such a way as to ensure that the available NPSH at the pump inlet exceeds the required NPSH by at least 1 m with the maximum demand flow (See Table 14) and maximum water temperature (see 10.4).

Table 14 — Pump pressure and flow rating

Pipework	Hazard Class	Rated pump flow	Pump inlet condition
Pre-calculated	LH/OH	Maximum demand flow from Table 6	For tanks, with water supply at low water level (see *X* in Figure 4). For booster pumps, with minimum town main pressure.
	HH	1,4 x Flow Required from Table 7	
Fully calculated	All	Maximum demand flow	

Driver Required Power Calculation

- Pumps shall be driven either by electric motors or diesel engines, capable of providing at least the power required to conform to the following:

- a) for pumps with non-overloading power characteristic curves, the maximum power required at the peak of the power curve;
- b) for pumps with rising power characteristic curves, the maximum power for any conditions of pump load, from zero flow to a flow corresponding to a pump NPSH required equals to 16 m or maximum suction static head plus 11 m, whichever is greater.

Why have European Listings ?

- Confidence in the products installed when investing in projects in all parts of the EU.
- Create a minimum quality, design and build standard for pump supply throughout the European Union.
- Ensure a product is compatible for the application.
- Harmonise requirements throughout the EU.
- Develop a listing procedure that is compatible and complimentary to EN12845.
- Develop standards that are based around the listings that already exist in the countries that have adopted listing procedures.

EN12259

Fixed firefighting systems — Components for sprinkler and water spray systems — Part 12: Pumps

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- Listings will remain in place for products which have already secured European listings with current listing bodies.

- Document must meet the criteria of the CEN Consultant

EN12259-12

1 Scope

This European Standard is applicable for:

End suction pumps

Axial horizontal split case pumps

Ring section pumps

This European Standard is applicable for:

Inline pumps
(Vertical shaft pump with inlet and outlet in line)

Vertical turbine pumps

Submersible motor pumps

4. Product Characteristics

- **4.1 Operational Reliability and Performance parameters under fire conditions (working pressure, range of operation, pump characteristic in accordance with annex B)**
- **4.2 Durability of Operational Reliability and Performance parameters under fire conditions (resistance to deterioration, material and build)**
- **4.3 Connections**

4.1 Operational Reliability and Performance parameters under fire conditions

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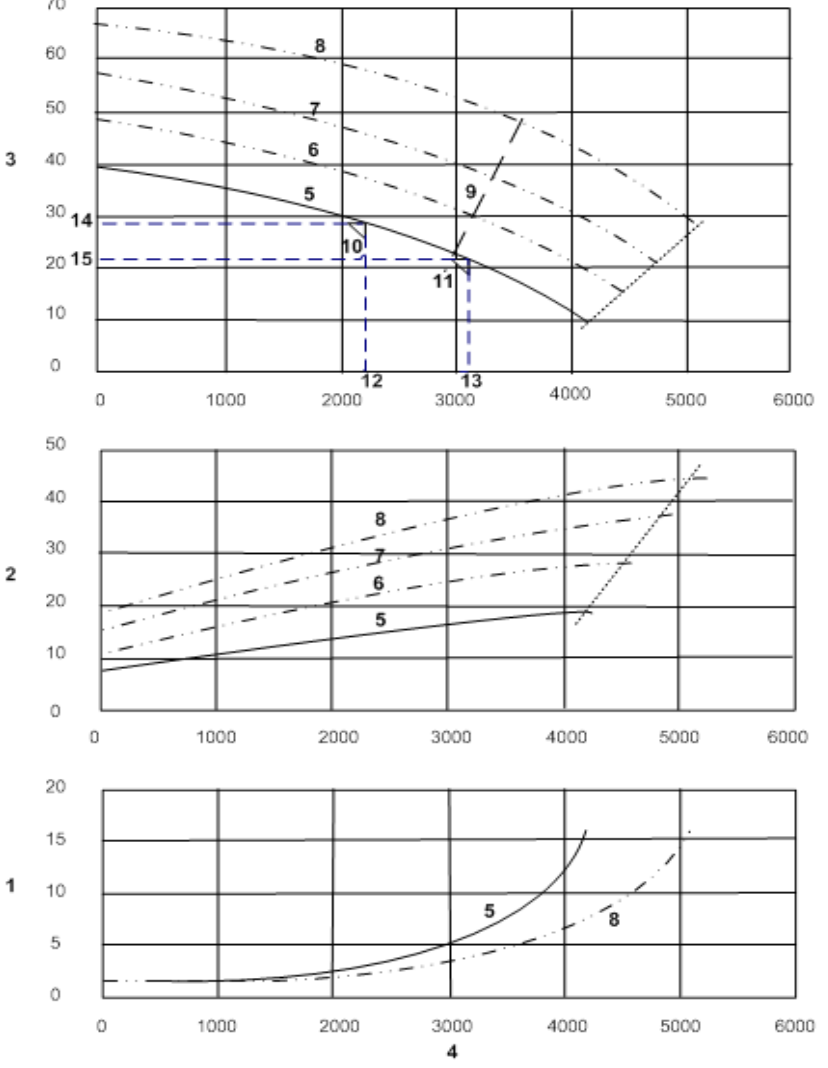
- **4.1.2.4** When tested in accordance with 5.1.2.1 taking into account 5.1.2.3, pumps shall have a stable characteristic curve H(Q) within the measurement uncertainty range as specified in EN ISO 9906:2000 Grade 2.

EN12259 -12 Pump Performance

Line 9 is the maximum point of the rated flow limit. The rated flow should be within 5m NPSH Required

The pump shall be capable of 140% of the rated flow at a pressure of no less than 70% of the rated pressure.

This NPSH available at the maximum demand flow point should be at least 1m more than required at that point by the pump.



1	NPSHR in m	9	Rated flow limit Q_r (corresponding to NPSHR of 5m)
2	P in kW	10	Maximum demand flow (EN12845 7.3.2.2 and Table 7) and nominal pump flow (EN12845 10.7.2 and Figure 7)
3	H in m	11	Specified higher pump flow (EN 12845 10.7.2)
4	Q in l/min	12	Maximum demand flow Q_m
5	Impeller $Ø_1$ in mm	13	Specified high flow Q_s
6	Impeller $Ø_2$ in mm	14	Head at maximum demand flow H_m
7	Impeller Ø3 in mm	15	Head at specified high flow H_s
8	Impeller $Ø_4$ in mm		

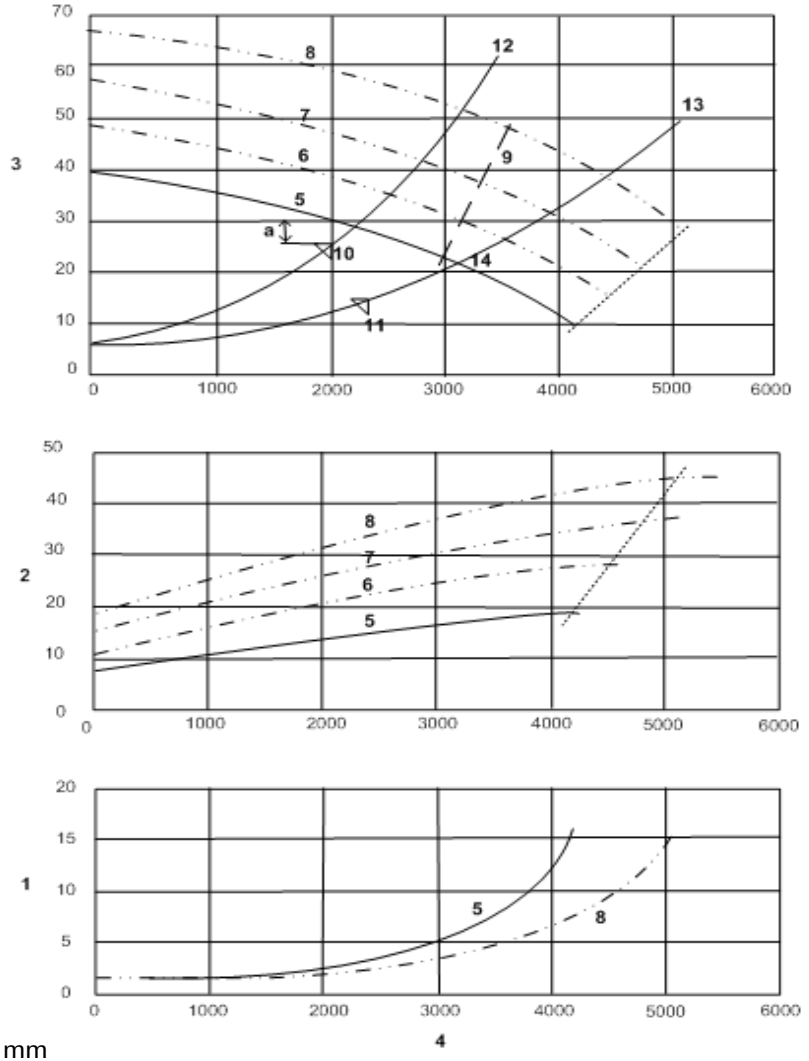
EN12259 -12 Pump Performance

Pumps should be 0.5 bar higher than that required for the MRA

Line 9 is MRA limitation line at 5m NPSH Required

The pump set shall also be capable of supplying the flow and pressure at the MFA for all water supply levels.

This NPSH available at the MFA point should be at least 1m more than required at that point by the pump



1	NPSHR in m	8	Impeller $Ø_4$ in mm
2	P in kW	9	Rated flow limit Q_r (corresponding to NPSHR of 5m)
3	H in m	10	Installation demand point, most unfavourable area of operation,
4	Q in l/min	11	Installation demand point most favourable area of operation,
5	Impeller $Ø_1$ in mm	12	Most unfavourable area demand flow
6	Impeller $Ø_2$ in mm	13	Most favourable area demand flow
7	Impeller $Ø_3$ in mm	14	Maximum demand flow

[a] The pump shall provide at least 0.5 bar higher than that required for the most unfavourable area, reference EN12845 10.7.3

4.2 Durability of Operational Reliability and Performance parameters under fire conditions

Resistance to deterioration

- **4.2.1.1** The pump shall meet the requirements of 4.2.1.2 and 4.2.1.3
- The performance shall be expressed as the description “Requirements are met”.
- **4.2.1.2** The pump casing shall be made from cast iron, cast steel, stainless steel, bronze or aluminium bronze.
- Pump shafts shall be made from stainless steel.
- Protective sleeves for shafts, metal parts of mechanical seals, impellers, impeller fastenings (impeller nuts, locking plates or washers and adjusting springs) and wear rings, including their counterparts shall be made from bronze or stainless steel.
- **4.2.1.3** Casing wear rings shall be fitted and shall be prevented from rotating.

4.3 Connections

The dimensions of all connections shall be specified by the pump manufacturer.

5.0 Testing, assessment and sampling methods

- **5.1 Operational Reliability and Performance parameters under fire conditions**
- **5.1.1 Working Pressure**
  - **5.1.1.1 Hydrostatic test pressure will be a minimum of 1.5 the maximum working pressure and maintained for a period of at least 10 minutes.**

5.1.2 Range of operation

- **5.1.2.1**
- Where there are a range of impeller diameters, tests shall include the maximum and minimum impeller diameters.
- Performance between tested impeller diameters may be interpolated
- **5.1.2.2** The pump shall be run for a minimum of 2 hours with the maximum impeller diameter at maximum allowable continuous speed and the minimum by-pass flow specified by the manufacturer.
- The pump inlet and outlet temperatures shall be measured throughout the test.
- The maximum water temperature rise across the pump shall not exceed 10 °C for the duration of the test.
- Measure the head, flow rate and power input throughout the test at intervals not exceeding 15min.

- The test data required for the purpose of evaluation is established at a minimum of 7 points uniformly distributed between the lowest rate of flow and the highest rate of flow to be measured. The lowest rate of flow to be measured shall be between zero and the minimum by-pass flow. NPSHR shall be determined for minimum and maximum impeller diameters and speeds at 5 points between rated flow and the highest flow. The highest flow to be measured shall be sufficient to demonstrate a non-overloading power characteristic or a flow corresponding to at least NPSHR of 16m.
- Pumps intended for use in High Hazard Process (HHP) or High Hazard Storage (HHP) pre-calculated systems shall be tested to at least 140-_% of the maximum demand flow where it shall be demonstrated that the total differential head of the pump is at least 70-_% of the total differential head at the design flow.