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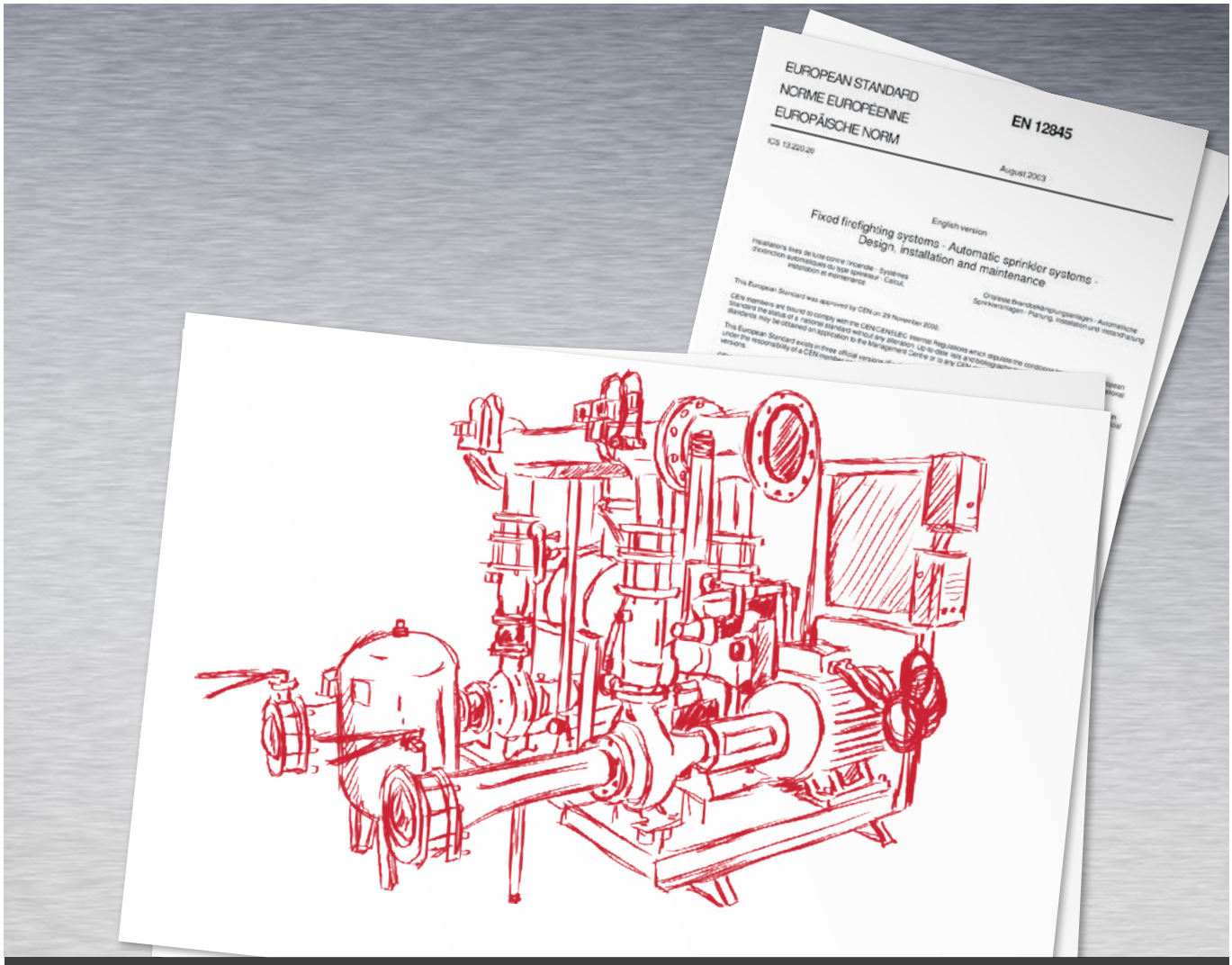


FIRE PUMP SYSTEMS IN ACCORDANCE WITH EN 12845 STANDARD

✓ Information about EN 12845 fire protection standard via fixed fire extinguishing systems

Contents

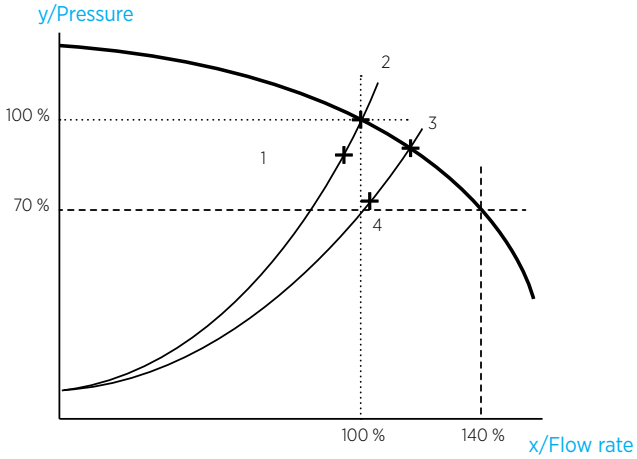
What should be the Performance Properties of a Fire Pump in line with EN 12845?

As per EN 12845, a fire pump should have a stable H(Q) curve.

Closed Valve Value: The closed valve value of the pump (maximum pump pressure at zero flow rate) should not exceed 125% of the nominal value.

Nominal Value: Junction point of a requested flow rate-pressure value on the pump hydraulic curve.

Maximum Load: The pump should be able to operate with a capacity of 140% of the nominal flow rate, if required. When the fire pump operates with a capacity of 140% of the nominal value, the pressure should drop down to maximum 70% of the nominal value.



Graphic 1

Comments

1. Most undesired area

2. Designed pump flow

3. Desired highest flow

4. Most desired area

Spacer Coupling

Pumps should be of back pull out type, which ensures easy and quick maintenance of impeller and mechanical seals without the need of removing pump body from the suction and delivery port. Therefore the spacer coupling is used.

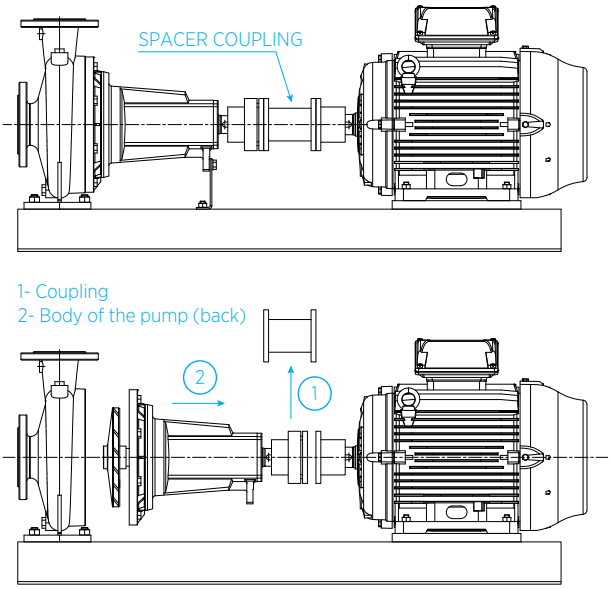


Figure 1

Multi-pump Applications of the Fire Pump

Pumps should have an applicable typical pressure-flow rate curves and be able to operate with all possible flow rates.

Where two pumps are installed, each pump should ensure predefined flow rate and pressure itself. Where three assembled pumps co-exist, each pump should ensure at least 50% of a given flow rate at a given pressure.

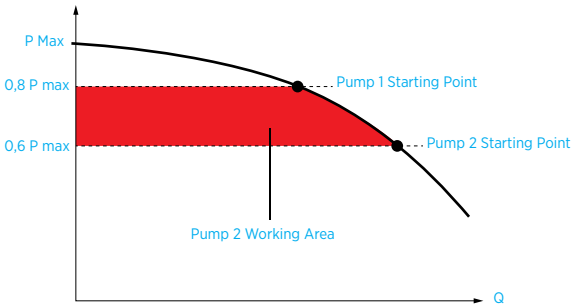
Fire Pump Valve and Accessories

A foot valve should be assembled to the end of the suction pipe of the pump, if the minimum water level is lower than the pump. Check valve should be assembled to the delivery pipe of each pump.

If the pump operates against a closed valve, arrangements should be applied to allow constant sufficient water flow in order to prevent over-heating. This flow should be considered in system's hydraulic calculation and pump selection. The outlet should be clearly visible, and outlets should be separated where there are multiple pumps

Diesel motor cooling circuits commonly use the same water. However this issue should be taken into account if additional water has been used. Where a pressure gauge is assembled on the pump for inlet and outlet pressure gauges should be readily reached.

Starting Fire Pump Up



Graphic 2

When the pressure in the mains drops to a value that is not lower than 80% (the pressure in closed valve condition), the first pump set automatically starts-up. In two-pump modules, the second pump starts-up before the pressure drops to a value not lower than 60%. When the pumps start-up once, they will keep operating until they are stopped (manually). EN 12845 fire-fighting booster set can be separately adjusted from the mains pressure. An extra automated start-up setup should be assembled for each pump. This setup should include a tank positioned at a higher level than the pump, and the pipe joint should be sloping to the water-dispensing side of the pump. A non-return valve should be assembled to this joint. Figure 2 demonstrates an example. Tank, pump, and suction pipe system should be kept completely full with water even if there is a leakage from the foot valve. The pump should start-up when water level of the tank drops to two third of the normal level.

Eccentric Suction Kit

In EN 12845 standard, the eccentric suction kit is obliged to be attached to the suction flange separately for each pump. Suction performance is improved in this manner as well as air pocket formation in the pipe during suction is prevented. Figure 26 demonstrates the points to consider when connecting the eccentric suction kit. In order to improve suction performance, the other end of suction kit should be two or three times bigger than the pump's suction flange. If the pump's suction flange is 50 mm, then other end of the eccentric suction kit should be at least 65 mm. Also the suction valve should always face the larger side.

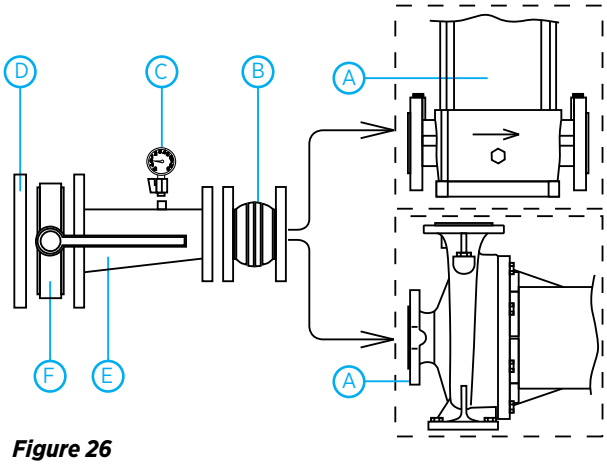


Figure 26

Comments

A Pump
B Vibration absorber (in diesel motor module)
C Vacuum meter
D Flange
E Eccentric suction kit
F Butterfly valve

1. Positive Suction Assembly

As indicated in EN 12845, for pumps, a positive suction condition should be established as much as possible.

1.1 Defining Positive Suction Height

1. Water, of at least two third capacity, is required to occur over the suction axis of the reserve tank.
2. Minimum water level of the pump's suction axis (x) should not be higher than 2 m. The assembly, to which the pump would be connected, should be bound with a cuff. Furthermore the pump pipe should connected to the tank with an upwards sloping in order to prevent air pocket formation in the pipeline. An eccentric suction kit is necessary to put to the pump suction in EN 12845 norm. This kit would prevent air pocket formation in the suction pipe. This part should be provided together with the fire pump. A flange with a larger diameter than the pump suction diameter should be welded to the end of special pipe of a length two times the pump suction diameter with flat top and tapered bottom. A suction valve should be put over this flange also. In this manner, it is ensured that the diameter of the suction valve to be one size bigger than the suction flange, and an easier suction is provided. A pipe with a diameter of the suction valve should be piped from this valve to the reserve tank. In this manner, the suction pipe would be piped with a bigger diameter than the pump suction diameter. Thus the pump will easily suck without cavitation, and the pump would be prevented to discontinue sucking by air occurrence in the pump due to air pockets. This situation is imperative for EN 12845 and necessarily required.
3. EN 12845 provides following details for the positive suction pipe, assembly suction pipe, and valves; NPSHd ≥ NPSHr + 1 (m)

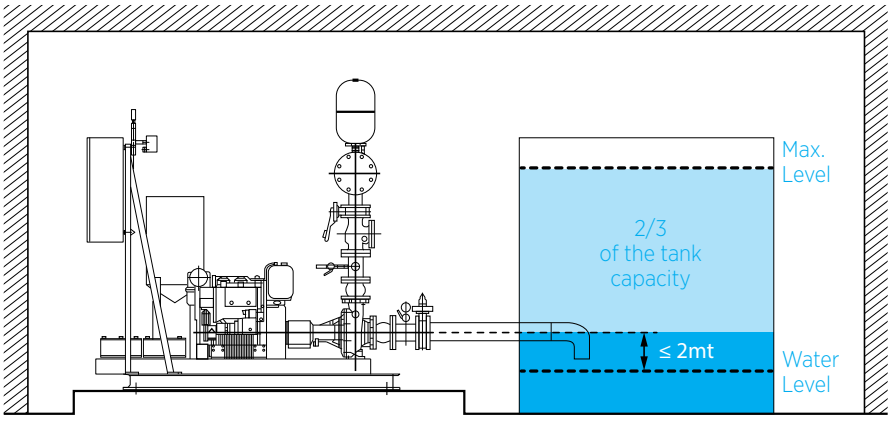


Figure 3

In other words, the pump's NPHS value should be 1 meter more than the NPSH value at the pump's maximum capacity. As you know, NPSH shows the net positive suction pressure.

So it indicates the net hydraulic load on the pump's suction. While NPSHd showing the value calculated at the pump's suction orifice, NPSHr indicates the minimum NPSH value allowing to pump to operate without cavitation. EN 12845 demonstrates this condition using the following formula;

$NPSHd = Pa + H - \sum Y$

Pa = atmospheric pressure

H = geodesic difference

$\sum Y$ = defines suction pressure losses at pipes, valves, fittings and elbows.

The value to get via this formula is pressure losses at the suction line. This value should be as low as possible so that the NPSH value would be higher. Suction pipe diameter and water flow rate are to be adjusted to lower this loss. What is important here is to ensure the most suitable conditions as mentioned above. In this manner, the NPSHd value should be lower than the NPSHr value. EN 12845 requests the positive suction pipe to be not lower than 65 mm. In this manner, water speed in the suction pipe would not be higher than 1.8 m/s at the maximum flow rate of pump. To this end, when the pump's suction flange is smaller than 65 mm, this value should be increased to at least 65 mm via the tapered suction kit or eccentric suction kit. This situation would also ensure the pump's suction speed to be lowered to the desired levels.

2. Negative Suction Assembly

A pump operating with a negative suction is an undesired condition in pump water connections. There occur problems including air pockets and higher NPSV values. However, if necessary, an assembly should be realized as indicated in Figure 4. The maximum depth from which the pump would suck should not exceed 3.2 m. In practice, the pump is desired to be at the nearest position to the suction location. When sucking from deeper points, separate suction lines should be arranged for each pump instead of a single collector in multi-pump systems. Considering these occasions, it would be suitable each pump to be assembled to suck from deeper points separately as demonstrated in Figure 5. In practice, the suction pipe should be immersed in water with an elbow, and a filter flap should be installed to the suction pipe end. Do not install a shut-off valve onto the suction line. The filter at the suction flap end should be occasionally cleaned up and prevented to be clogged with dirt and foreign substances. During cleaning, this process should be conducted by removing the suction pipe without emptying the reserve tank.

2.1 Calculating Piping for the Negative Suction Line

Those made to calculate the suction pipe and valves in the positive delivery line should be exactly repeated for the negative suction pipe. EN 1285 provides following details for this selection;

NPSHd ≥ NPSHr +1 (m)

In other words, the pump's NPHS value should be 1 meter longer than the NPSH value at the pump's maximum capacity.

Contrary to the positive delivery line, when calculating the negative suction line the suction distance as well must be added. This situation would cause a decreased NPSHd value, thus H distance should be the lowest. As sucking from deeper points lowers the pump capacity, losses caused by suction pipe, flap, filter, and elbow should be added to the suction losses. Then keeping the suction losses at the lowest levels is of significant importance. In this case, the suction pipe diameter should be picked properly, and a lower water speed in the suction pipe should be ensured. EN 12845 standard states that the suction pipe diameter is not to be smaller than 80 mm and the water speed is not to be higher than 1.5 m/s at the maximum pump flow rate. NPSHr value is provided by pump manufacturers. Here the NPSHd value should be checked for whether it is in line with the formula above, and if it is not, the suction pipe should be widened or the section depth should be lowered.

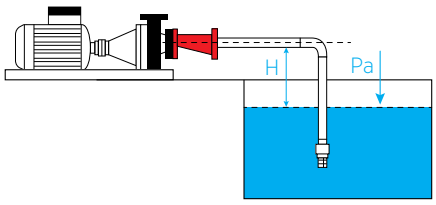


Figure 5

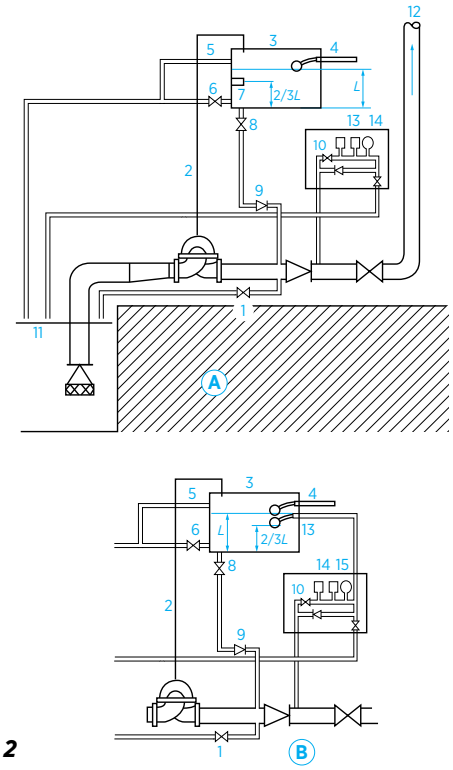


Figure 2

Pump start-up assembly for uplifting water by sucking

Comments

1. Discharge valve for testing
2. Air discharge of the pump, and the lowest flow line
3. Reserve Tank
4. Inflow
5. Overflow channel
6. Discharge valve
7. Low level key to start-up the pump
8. Priming supply stop valve
9. Priming supply non-return valve
10. Pump start-up assembly
11. Suction tank
12. Mains power assembly
13. Low level valve to start-up the pump
14. Pressure keys to start-up the pump
15. Pressure gauge

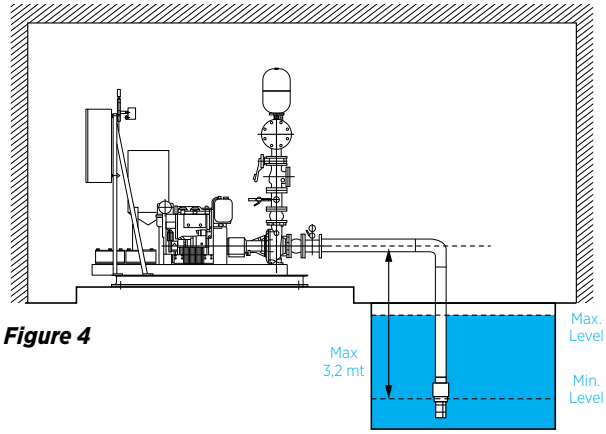


Figure 4

3. Reserve Tank (for Positive Water Line)

A single reserve tank is needed for each main pump. (For negative suction pumps only) This is not applicable for a pilot pump.

This reserve tank to be used for pumps to suck water from the negative suction will prevent any possible water losses in the suction pipe, and the pump will be prevented to operate dry.

Reserve tank capacities as per the risk classes are indicated below;

Danger class	Minimum tank capacities in liter	Distance between tank and pump pipe diameters
DT	100	25
ST, YTI, YTD	500	50

Schedule 5

Comments

DT **Low danger class**
(low fire load)

ST **Standard danger class**
(average fire load and averageflammability)

YTI **High danger class**

YTD **High danger class**
(storage)

Tank joint and accessories diagram;

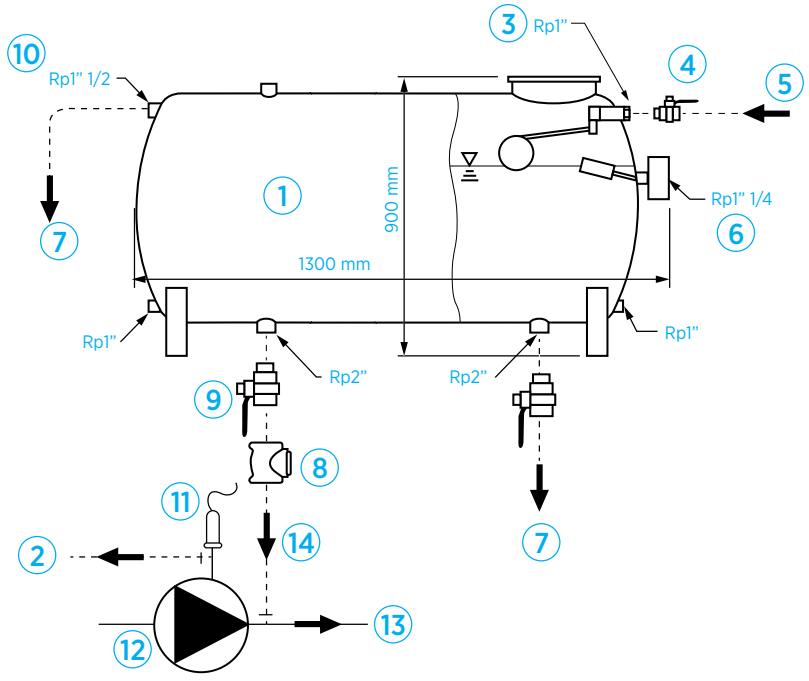


Figure 7

Comments

1. Reserve tank
2. Water recirculation pipe
3. Float valve
4. Filling valve
5. Main water supply network
6. Level indicator
7. Drainage outlet
8. Non return valve
9. Reserve tank valve
10. Overflow pipe
11. Pressure switch
12. Main pump
13. Sprinkler installation flow
14. Main pump intake port

Figure 8 demonstrates the reserve tank application diagram in a negative suction fire pump assembly according to EN 12845 standard.

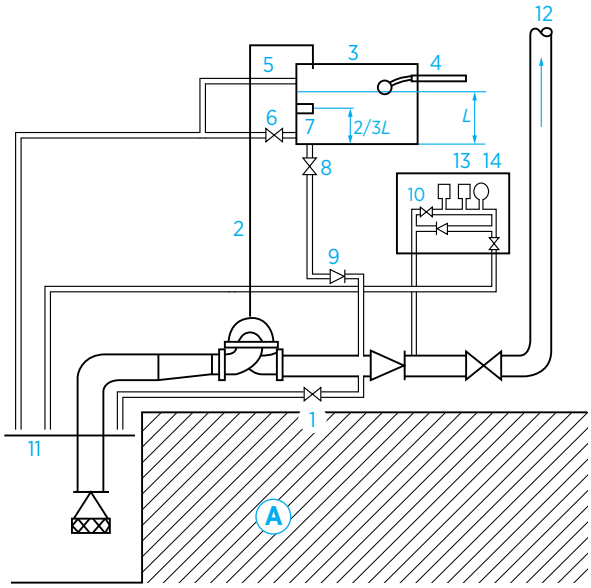


Figure 8

Comments

1. Test and discharge valve
2. Air discharge from the pump, and water recirculation
3. Reserve tank
4. Tank filling
5. Tank overflow pipe
6. Drainage valve pressure switch
7. Low level switch to start-up the pump
8. Stop valve
9. Ball valve
10. Pump start-up pressure switch
11. Main suction water tank
12. Outlet to sprinkler installation
13. Signal from main pump body
14. Pressure Guage

4. Pilot (Jockey) Pump

Pilot pump is generally called as Jockey Pump. This pump is of significant importance in fire-fighting booster sets. In general, Pilot Pump flow rate would be 10% higher and pressure would be 10% higher than main pumps. In this manner, pilot pumps would be smaller and therefore motor powers thereof would be lower. These pumps keeps the system pressure at a desired level by occasionally enabling when the system pressure drops down. In this manner, frequent enabling of the giant motor main pumps would be prevented when the system pressure drops down. EN 12845 requires the electrical control panel of pilot pumps to be manufactured separately from the electrical control panel of main pumps. Pilot pumps connected to the system should suck independently. Suction line of the pilot pumps should not be connected to the main pumps' suction line. Consequently following results would be prevented;

Assuming the Pilot Pump suction pipe (4) is connected to the main pump suction pipe (3) (Figure 9), when the pilot pump sucks water, it would not suck water from the main pump suction pipe only but from positive level tank as well (1). Main pump suction line is connected to the positive level tank. If the positive level tank is emptied, as the system suction line turns to be dry, main pumps and pilot pump would be broken. If there is no electronic level switch on this tank, the pilot pump would not stop and operate dry. So the tank would empty and an undesired condition would occur. If we think there is a level switch also, when the level gets low, the main pumps will enable to fill the tank, and the fire alarm will enable as well. As it is known, in EN 12845, as the main fire pumps enable when the pressure drops down, the fire alarm enables, furthermore these pumps are stopped manually.

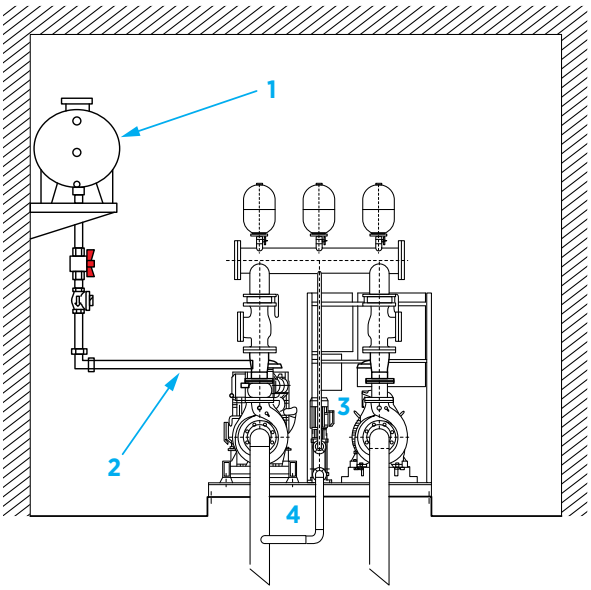


Figure 9

5. Connecting the Pump to Water Supply Network

The water supply network can be used for the pumps to get water. However, in this case, seamless water existence in the water supply network and constantly available sufficient water should be guaranteed. The line coming from the water supply network is connected to the main pump delivery collector; when the pressure from the water supply network becomes insufficient, the main pump will enable.

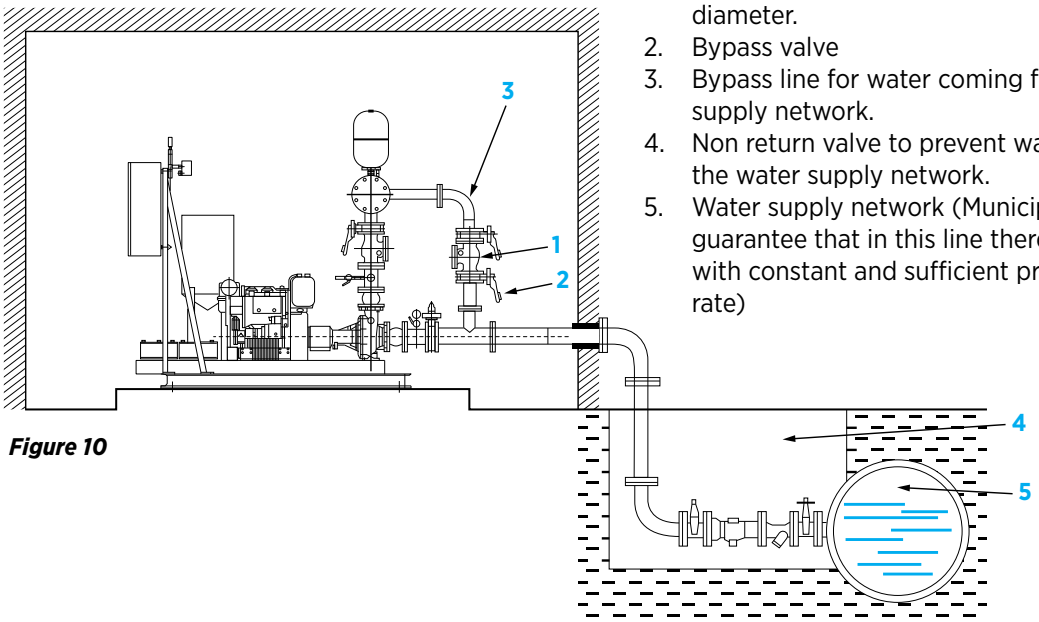


Figure 10

5.1 Additional Pressurizing Pump

Here what is called as pressurizing pump is a pump enabling when there occur no sufficient pressure. Such connections should be realized as demonstrated in Figure 10.

Comments

1. Non return valve size connected to delivery collector should not be lower than the pipe diameter.
2. Bypass valve
3. Bypass line for water coming from the water supply network.
4. Non return valve to prevent water returning to the water supply network.
5. Water supply network (Municipality should guarantee that in this line there would be water with constant and sufficient pressure and flow rate)

In practice, water supply networks are not relied on. In this case, reserve tanks are considered. (Figure 11) Then reserve tanks, which are filled by the water supply network whenever water is lasted, are widely used.

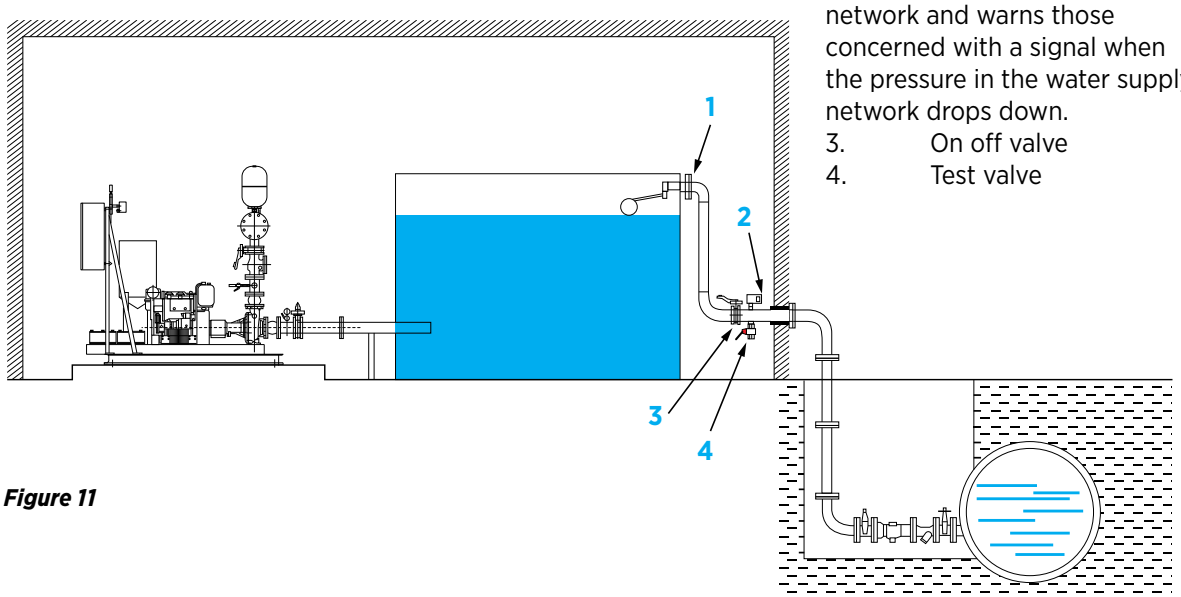


Figure 11

Comments

1. Float valve is mainly used to fill these tanks when they get empty.
2. Pressure switch is connected on the line coming from the water supply network and warns those concerned with a signal when the pressure in the water supply network drops down.
3. On off valve
4. Test valve

6. Diesel Pump

Considering for the cases of the water supply network being cut by authorities during a fire or the network getting disabled, EN 12845 proposes a diesel pump to be put next and in parallel to the electrical pump. In this case, the diesel pump is required to be of same capacity as the electrical pump; and the diesel pump is designed to immediately enable with the pressure dropping when the electrical pump gets disabled. Thus seamless water supply to the sprinkler system would be possible.

There are number of points to consider regarding diesel pump assembly and surrounding environment. These are, in the order;

1. Pump room should be ensured to be well-ventilated. Proper combustion air supply as well as fresh air cooling in air or water cooling types are of significant importance. Furthermore, against the possibility of exhaust gas escaping into the room, the room should be most appropriately ventilated with outer air. If possible, this ventilation should be ensured through a direct channel from the radiator inlet of the diesel pump to the outer air. (Figure 11)

2. Exhaust pipe should be definitely channeled outside in a proper way and with an appropriate diameter apart from any obstruction. This pipe should be necessarily headed outside and never considered to be directed to inside the building, another room within the building, or ventilation hall of the building.

3. There should be venting windows in the room, allowing the outer air to readily enter inside, and fresh air entrance should be ensured.

6.1 Underground Diesel Pump

Diesel pumps may be placed underground fire rooms when necessary. In this case, a ventilator should be positioned to throw the heated air inside out for the air cooling Diesel motor and fresh air should be supplied to inside through another vent as demonstrated in Figure 12.

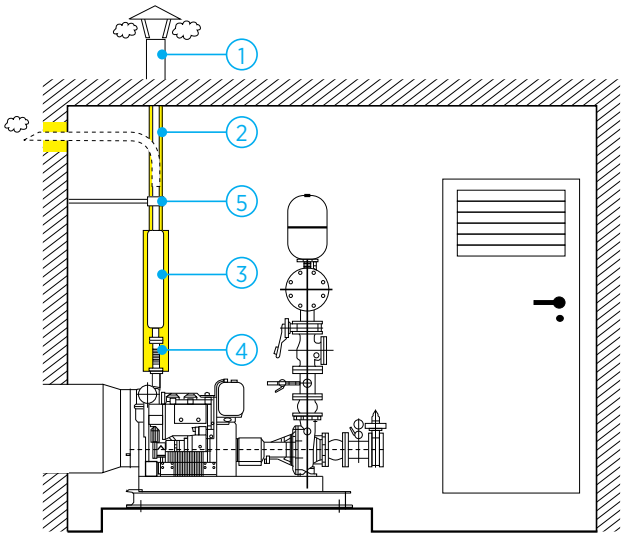


Figure 11

Comments

1. Rain capped chimney
2. Exhaust pipe insulation (rock wool)
3. Silencer
4. Vibration absorber
5. Exhaust pipe should be secured to the wall.

In this case, a strong ventilation fan should be preferred and controlled by the room thermostat. Besides, also the smoke detector should control the fan motor, operating in parallel to this thermostat. In this manner, when the air inside is heated or there occur any smoke, the air fan should enable.

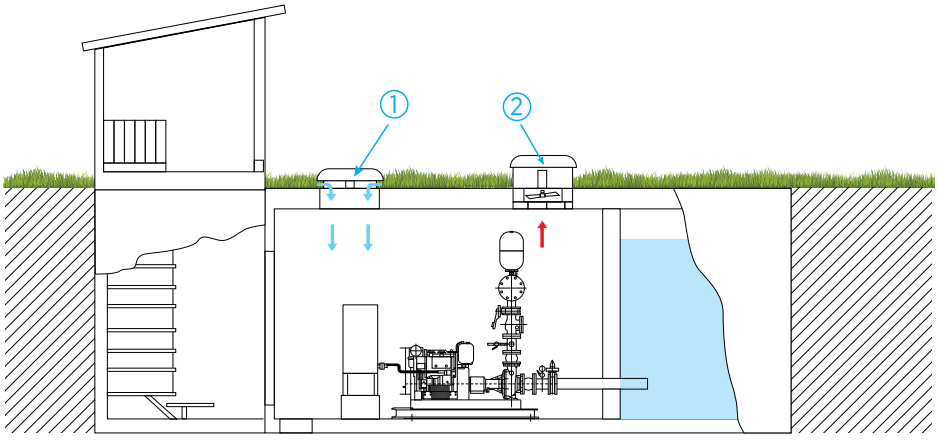


Figure 12

As shown, when a radiator and a water cooling diesel motor are used together, a ventilation venting should be put for the combustion air from outside and the exhaust pipe should be directed to the outer air. A proper ventilation should be definitely ensured. Exhaust pipe should be headed outside and insulated. Pipe height should be at least 2.4 m and of distance from living quarters away from human beings.

7. Pump Room

According to EN 12845 standard, the fire pump room should be an environment in line with this standard provisions. This room should resist fire for 60 minutes and protected and not be used for any other purpose. Considering this condition, the fire pump room should be built in accordance with the following;

7.1 Pump Room

a) It should be considered as an independent building.

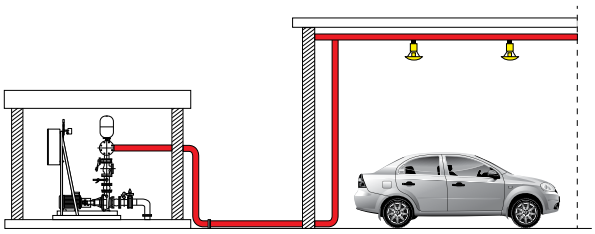


Figure 13

b) Adjacent buildings can be used provided that there is a sprinkler system and an outlet to outside is provided.

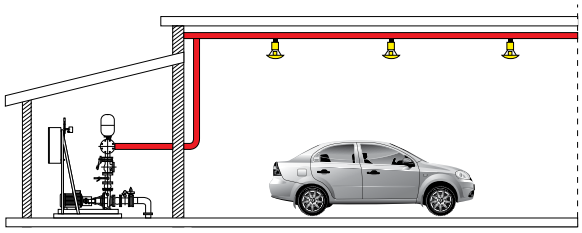


Figure 14

c) There can be a fire room inside the building provided that there is a sprinkler system and an outlet to outside is provided.

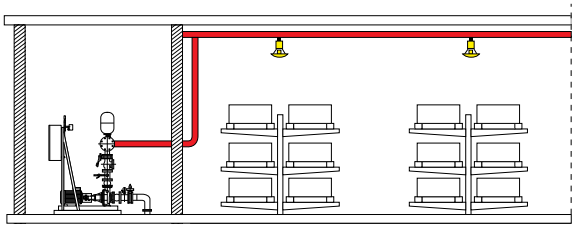


Figure 15

7.2 Pump Room Sprinkler Protection

There should be a sprinkler protection at the fire pump room (EN 12845). It would be appropriate that any sprinkler system in this room is supplied directly from the pump delivery collector.

As shown in Figure 16, the sprinkler supply line should be taken immediately after the pump supply line and check valve. Over this line, a ball valve (1) and flow switch (2) should indicate the sprinkler (4) operation with an audio and flashing alarm in accordance with EN 12259-5 standard. This alarm system should be located in the control room. Using test and drainage valve (3), this system should be verified to operate (by opening the valve). Other end of the drainage valve should be connected to the reserve tank, and the water should be returned to the reserve tank during the test, which is performed by opening the valve. All the electrical devices to be used in this system should be of IP55 protection class. Why is the sprinkler system is located in the fire pump room is a frequent question. Diesel motors are used in various fire pump systems and these motors are provided with fuel. In a possible fire which may arise in the meantime, this standard is also referred for life safety of the worker in the room. Remember that the pumps in this location have electrical supply lines as well, any spark which may occur in this case is possible to cause a fire. Beyond that, a sprinkler system is a must in each location having flammable liquid or fuel.

"Authorized personnel only" sign should be put on the pump room door, and this door should be locked, only the principal technician having the key. EN 12845 requires the weekly tests to be periodically and manually performed by the principal technician. Because the service technician will record and sign that they perform these tests and show this log and test performance to the authorities during fire department or municipality audits. As the building owner or building management is primarily responsible for these tests to be properly performed, they should constantly check this test log. Remember that irregular test performance and not keeping the system ready may cause life and property losses.

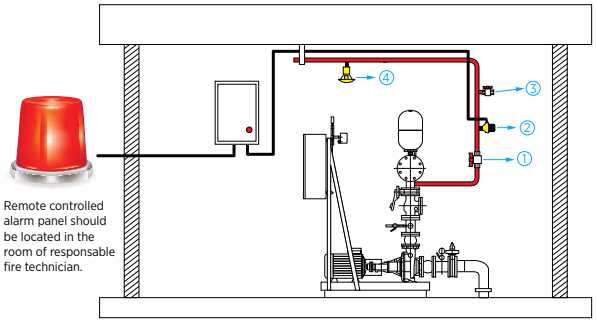


Figure 16

7.3 Fuel tank

If there is a pump connected to a diesel motor in the fire pump room, special precautions for the fuel tank should be taken. The leading risk regarding fuel tank use is fuel leakage. A flammable liquid around the diesel motor introduces a fire risk at any moment.
Fuel tank should be assembled away from the diesel motor and onto the foot, aligned to the fuel pump of the diesel motor, without allowing any fuel leakage. Diesel motor should not suck the fuel from a deeper level, in contract, the fuel should arrive the pump with a positive pressure. In this way air pocket formation in the fuel pump would be prevented. As air pocket formation in the fuel pump would cause the diesel motor to stop, caution should be exercised to this condition.

7.4 Fire Room Temperature

Pump room temperature should not be lower than +4°C when electrical pumps stand only, and than +10°C when a diesel motor exist. A thermostat heater should be put in the room to this end. Also humidity should be checked, and no humidity over 80% should not be allowed. Otherwise it may cause electrical or electronic materials in the control panels to oxidize and deteriorate.

7.5 Fire Room Ventilation

If there are diesel motor pumps exist in the pump rooms, caution should be exercised to the ventilation. Well ventilation of the pump room is of significant importance to drop the humidity rate down as explained in Article 1.4. Additionally the pump room ventilation is substantial for increased humidity inside and particularly cooling the diesel motor during operation. Although EN 12845 does not suggest numerous ventilation alternatives and let appliers to decide, we submit the information we gathered from other standards for your review in order to let you benefit.

Diesel motors put in the pump room may occur as cooling the water with air via the radiator or cooling the water with water via heat exchanger. Pump room ventilation should occur over natural ways and through windows constantly open to outer air. These openings should stand on two walls facing to each other, and thus the air flow covers all over the room.

Particularly these openings being above and near the ceiling would be appropriate in terms of ventilation and room cooling as the heated air rises up. Opening surface should not be lower than 0.1 m^2. A more accurate calculation should be made for each location separately. (Figure 17)

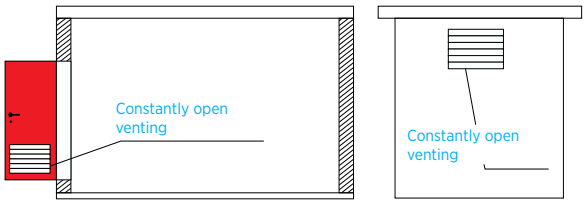


Figure 17

These openings cannot guarantee the temperature inside. Therefor thermostat controlled automated air damper or ventilators may be enabled when the temperature gets increased. Preventing the temperature to get negative values is substantial. Otherwise you cannot prevent the water inside pumps and pipes to freeze; this condition causes the pumps and pipes to crack and broke, and moreover the pump cannot supply compressed water to the system when a fire outbreaks. To prevent such condition, the pump room should be kept at +4°C by putting thermostat heaters. (Figure 18 and 19)

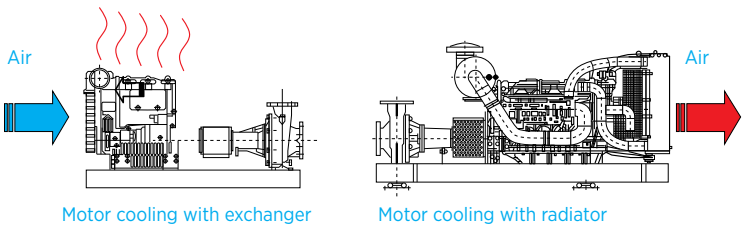


Figure 18

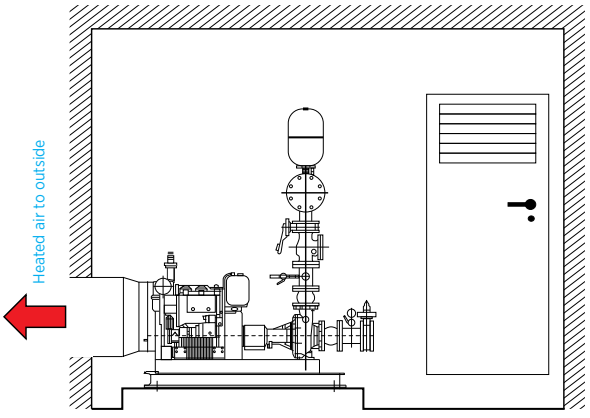


Figure 19

7.6 Cooling Diesel Motor Down

Diesel motors can be cooled down in two ways: cooling the water with air via radiator or cooling the water with water via heat exchanger. Diesel motor is cooled down with air in air cooling diesel motors. Such cooling motors are much cheaper and simpler. But these have lower capacities than water radiator or water exchanger motors. Water cooling motors are especially preferred at 20 kW sizes. For both systems, proper heated air removal is substantial. Air temperature inside should be prevented to increase. (Figure 20)

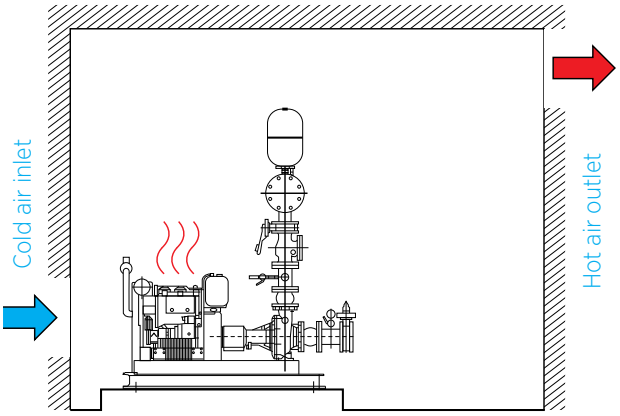


Figure 20

7.6.1 Water-to-water Cooling System

Water-to-water cooling system particularly used in ships. Use of such cooling systems are widened because of their smaller sizes and constant cooling water. Pump room should be ventilated even with the application. If natural ventilation cannot occur, electrical motor air fans starting-up with pumps enabling should ensure this air circulation. (Figure 21)

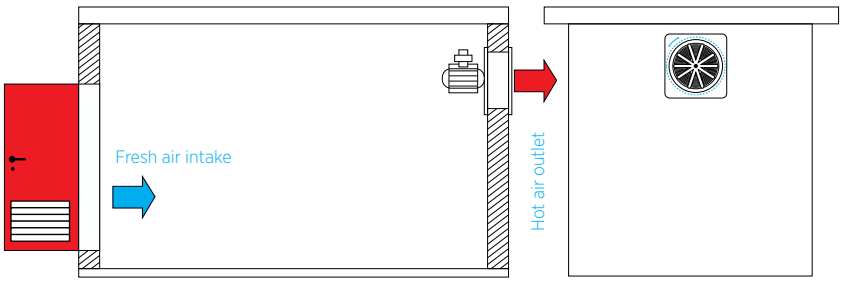


Figure 21

7.6.1.1 Water-to-water Cooling System Connection

A heat exchanger with a capacity suitable for water-to-water cooling system should be picked. Picked exchanger should be able to prepare cooling water which would seamlessly cool the diesel pump when operating at full capacity. A pressure dropper (3) should be put in the circuit and the pressure should be prevented to increase over 10 bar in order to block any exchanger damage. A bypass line should definitely put within the assembly established between the diesel motor and exchanger. In case of any problem with the main line, the bypass line should be opened manually. Electrical solenoid valve (4) put in the circuit should be opened upon main pump enabling. Solenoid valve opening should be monitored with the signal lamp and on the panel in the main panel room. (Figure 22)

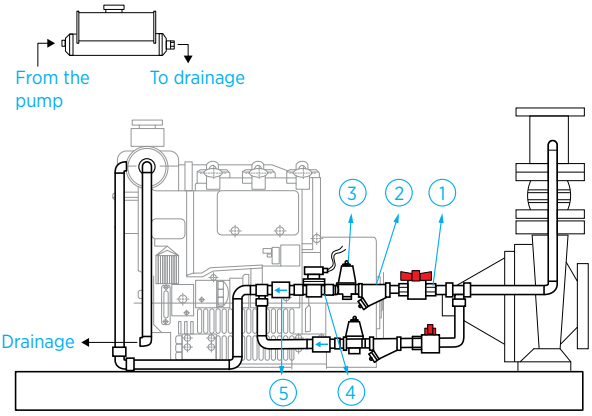


Figure 22

Comments

1. Ball valve on/off
2. Dirt Filter
3. Pressure reducer
4. Solenoid valve
5. Non return valve

Some complementary products should be used for fire pumps. These complementary products are defined in EN 12845 standard.

Flow meter

Flow meter is a device used to measure pump flow rate. EN 12845 wishes this device to be used but not dictates. Particularly when enabling the pumps, this device help to make required measurements and check whether the employed pumps provide the calculated flow rate. This flow meter is observed to be connected differently in NFPA 20 norm and CEA 2001 norm. (Figure 23) Both are suitable, and the difference is that the pump flow rate is measured in NFPA 20 and the collector flow rate is acquired in the latter. EN 12845 indicates that it would be sufficient to measure over the collector only.

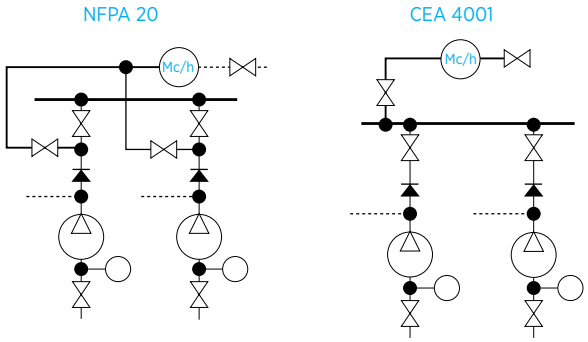


Figure 23

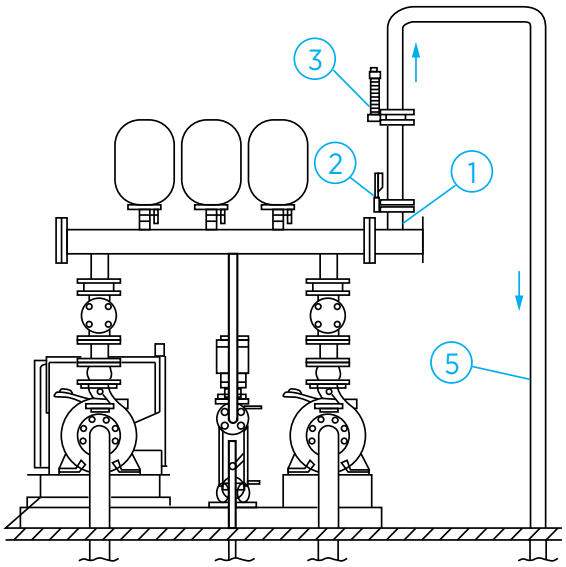


Figure 24

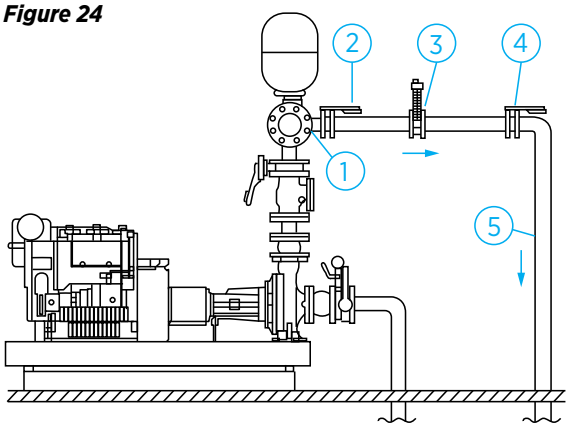


Figure 25

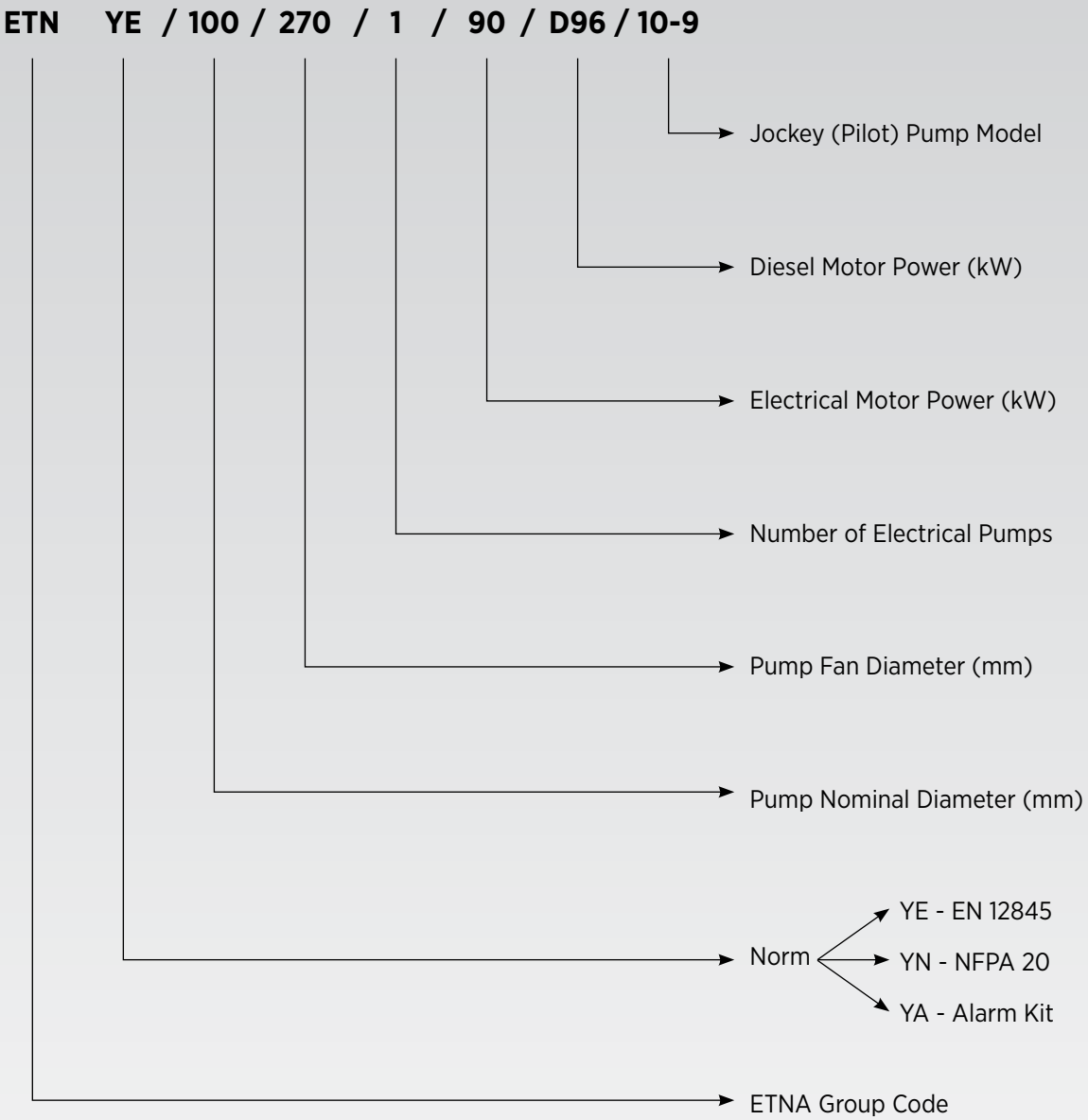
Comments

1. T joint (to connect the flow meter)
2. Shut-off valve
3. Flow meter
4. Test valve
5. Return to the tank

GENERAL PROPERTIES OF ETNA FIRE PUMP SYSTEMS IN LINE WITH EN 12845

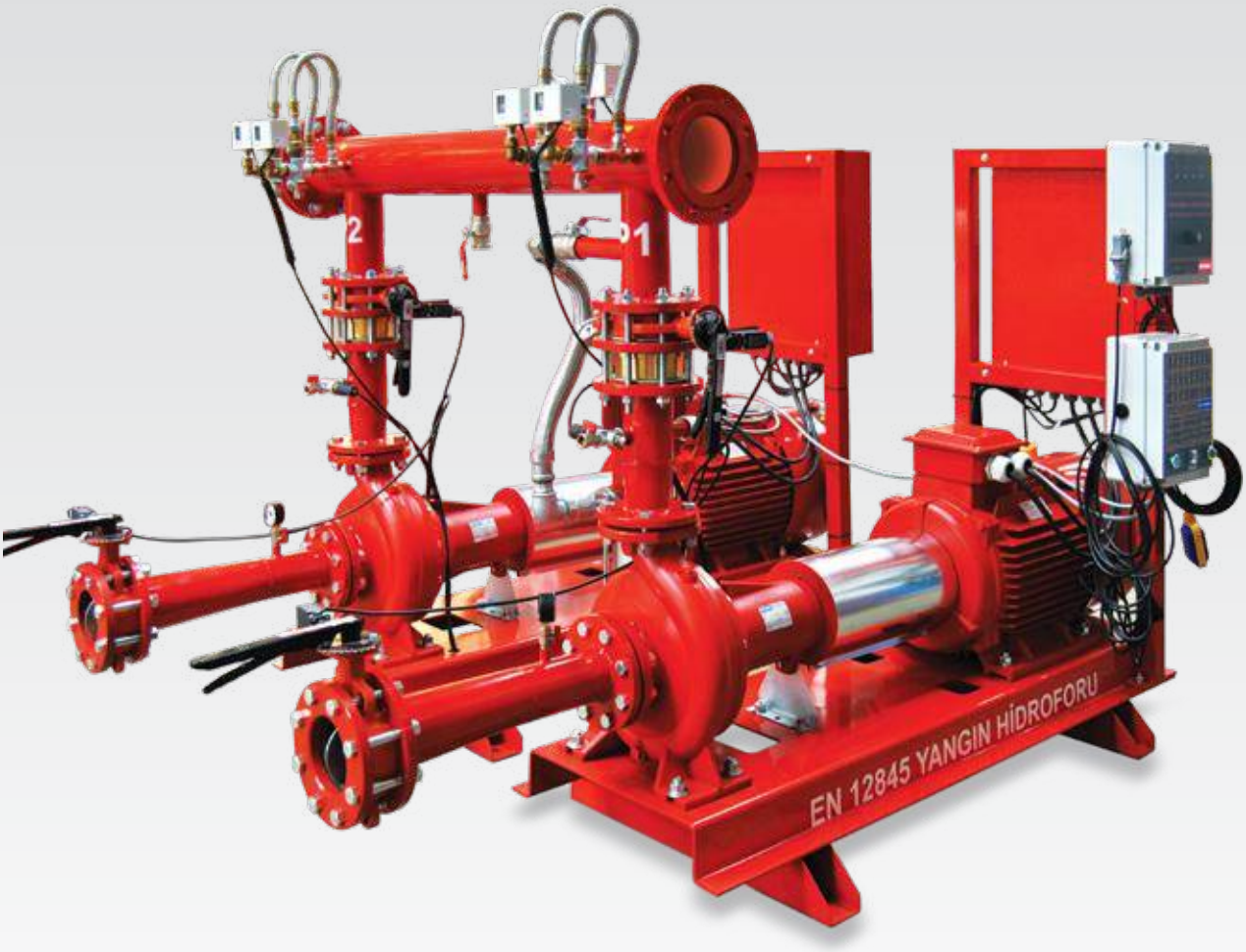
- Our products are modular, and each module is manufactured in accordance with EN 12845 standard.
- Water speed in fire pumps, especially within the suction line, is substantial, and EN 12845 standard approach to the subject is more precise than other standards. Water speed should not exceed 1.8 m/s in a positive suction system and 1.5 m/s in a negative suction system.
- Eccentric reduction suction kit is standard, including negative suction condition.
- Motor powers are designated to operate with a capacity of 140% of the nominal flow rate. When pumps operate at 140% capacity, the pressure should not drop down than 70%.
- Negative code suction may be forced using end suction type pumps. However it is always necessary to employ an “operation tank” for each pump.
- Pumps start-up with the command taken from the pressure switch and then stopped by hand (manually).
- Diesel pump module is activated in line with EN 12845 standard.
- Diesel pump emergency manual operation is also in line with the standard.
- Main pump modules have inlets that are suitable to be connected to 1″ forward-feed tanks (operation tank) in case they will be operated by drawing water from underground tank (negative suction).
- To prevent mechanical seals to be damaged due to overheating during closed valve test operations, pump modules would be able to circulate back to the water tank or the operation tank.
- The sections allocated for pump modules should be sprinkler protected.
- EN 12845 Fire-fighting booster sets are factory-calibrated and tested. Thus they enable fast and easy assembly.
- Remotely monitored alarm panel provides audio and visual warnings.
- All measurements and calculations are for clean water at +20°C.
- Motors are picked for constant operation conditions.
- Even the power is out in the building, electrical motors should supply from a separate panel.
- Required diesel motor shaft power is calculated to be 10% higher.
- Motor-pump connection is made with flexible coupling.
- Pumps are back-pull out type and easy to maintain.
- Suction and delivery line valves are butterfly valves, and these valves can be established together with monitoring keys, if necessary.
- Pilot pump involved in the system should be picked to provide a flow rate with a capacity of 10% of the nominal value and a pressure with a capacity of 110% of the nominal value.

CODING OF ETNA FIRE PUMP SYSTEMS IN LINE WITH EN 12845



Specifications

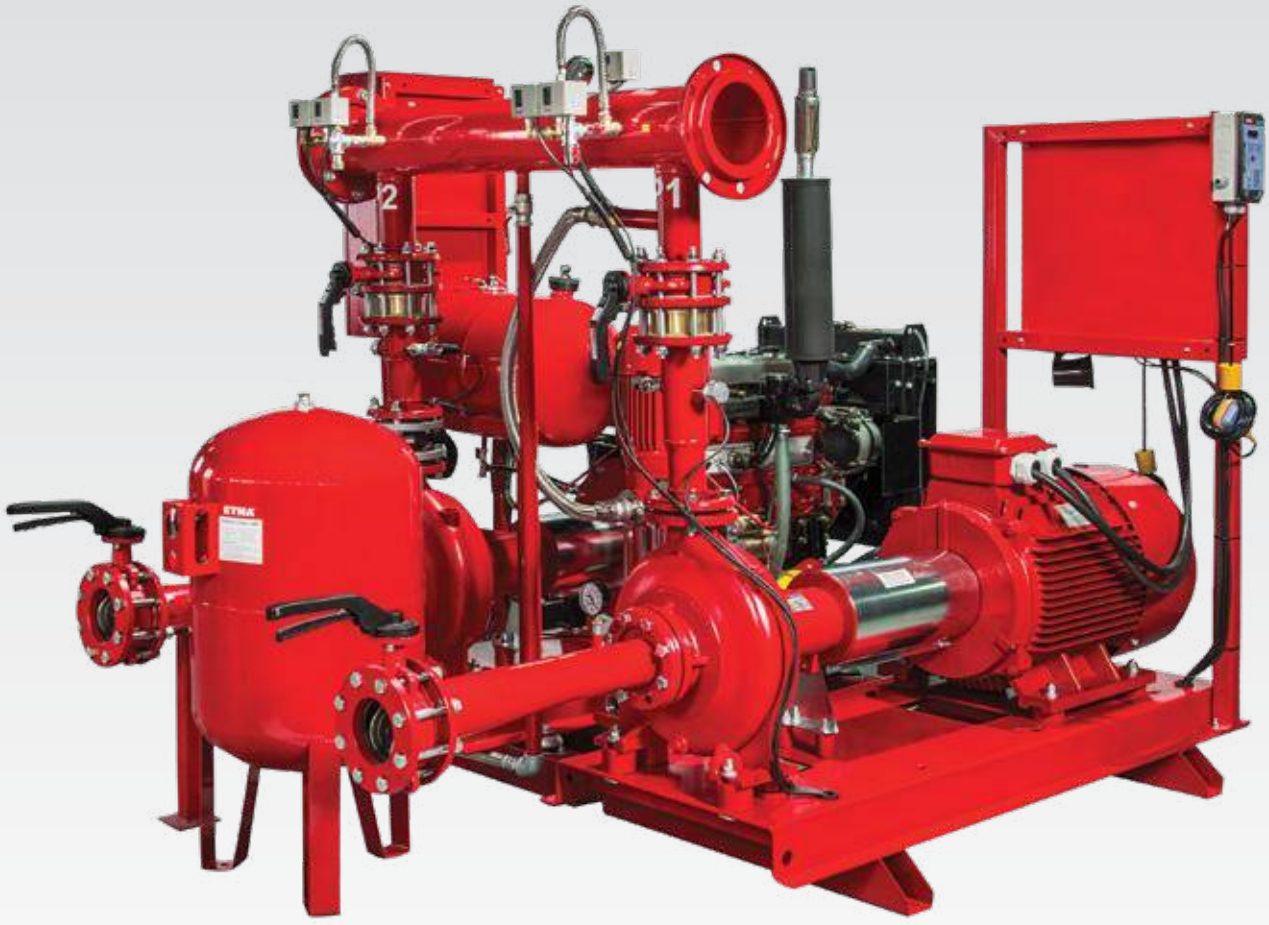
Number of Main Pumps	: 1 - 3
Number of Pilot Pumps	: 1
Maximum Capacity - Flow Rate	: 3 x 450 m^3/h
Maximum Pressure	: 230 mSS
External Control Voltage	: 24 V
Panel Control Class	: IP 54



ELECTRIC / DIESEL DRIVEN FIRE PUMP

Specifications

Number of Main Electrical Pumps	: 1
Number of Main Diesel Motor Pumps	: 1
Number of Pilot Pumps	: 1
Maximum Capacity - Flow Rate	: 2 x 450 m^3/h
Maximum Pressure	: 230 mSS
External Control Voltage	: 12 - 24 V
Panel Control Class	: IP 54



Fire Pump Supply Main Switch Panel

Main switch panel of the building and its extension should be located to the fire section to be not used for any purpose another than supplying power.

When the connections on the main switch panel providing power to the building and its extension are cut, power supply to the control circuit should not be closed. Each key at power supplies of spray pumps should be labeled as follows:

DO NOT TURN OFF THE POWER SUPPLY TO THE FIRE PUMP MOTOR DURING FIRE!

Letter height within the expression above should be at least 10 mm and in white on a red backplane. The switch should be protected against breakage.

Main Switch Panel and Pump Control Mechanism

When calculating the cable thickness to be used, the current should be estimated by taking 150% of the maximum possible full load current.

a) It should be able to automatically operate the motor when received a signal from pressure keys,
b) Motor should be able to operate when activated manually,
c) It should be able to stop the motor only by manual activating.

An ammeter should be installed to the control mechanism.

Monitoring Pump Operation

Following conditions should be monitored.
- Three phase alternating current (AC) power supply for the motor,
- The pump desired to operate,
- Pump operation,
- Startup failure.

Each monitoring situations should be separately and visibly defined in the pump room. On the same place, also pump operation and failure alarms should be acoustically and visually shown to the watching principal staff.

Visible failure notification should be yellow. Audio signals should be of at least 75 dB signal strength and able to be muted. A lamp experiment should be performed to check signal lamps.

Diesel Motor Pump Modules

Diesel motor should be able to operate at full capacity at a high place with a constant power output in line with ISO 3046. The pump reaches full capacity 15 seconds after it starts to operate. Horizontal pumps can be driven directly. Fuel tank is made of welded steel sheet, and if multiple machinery are being used, their fuel tank and supplies are positioned separately. The fuel tank is positioned to a location higher than the fuel pump of the motor in a way that will provide positive pressure. However, this location is not just above the motor. There should be enough fuel for the fuel tank to meet the following conditions and to operate at full capacity.

- **3 hours for DT**
  (Low danger class, water tank volume 15 m^3)
- **4 hours for ST**
  (Standard danger class, water tank volume 23 m^3)
- **6 hours for YTI and YTD**
  (High danger class, water tank volume over 23 m^3)

Emergency Manual Operation System

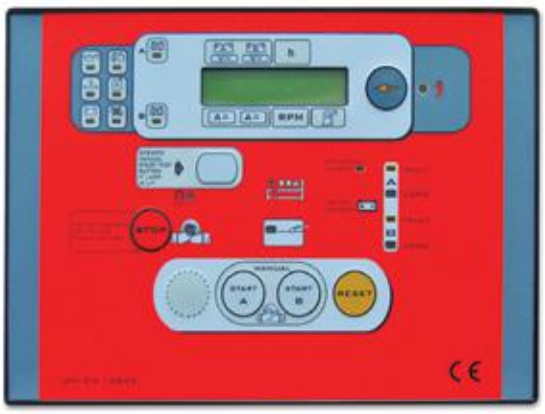
The emergency manual operation systems that are operated with the power supplied from both accumulators should have breakable covers. For periodic inspections, system operation should be in line with the rules defined in EN 12845.

ELECTRIC DRIVEN PUMP PROTECTION - CONTROL PANEL IN ACCORDANCE WITH EN 12845

- Except for the electrical motor, all outlet connections are low voltage (12/24 Vdc)
- 3 Voltmeters
- 3 Ammeters (max.1000 A)
- Grid phase meter 50/60 Hz
- Phase sequence
- Wattmeter (Active power)
- Varmeter (Reactive power)
- V/A meter (Current power)
- Cosine meter (Power factor)
- Total operating time
- Partial operating time
- Automatic - Manual switch, manual start and stop in manual mode

DIESEL DRIVEN PUMP PROTECTION - CONTROL PANEL IN ACCORDANCE WITH EN 12845

- Except for the motor, all outlet connections are low voltage (12/24 Vdc)
- 2 Batteries
- 2 Voltmeters
- 2 Battery ammeters
- Tachometer
- Temperature gauge
- Oil temperature gauge
- Oil pressure gauge
- Fuel level gauge
- 2 Battery charging rectifiers
- Battery efficiency control
- Operation error report
- Manual operation buttons
- Warning lamp test button
- Test commissioning
- Monitoring individual charging of batteries
- 3+3 = 6-cycle automatic start-up attempt from batteries
- Automatic - Manual switch, manual start and stop in manual mode



Alarm Panel and Valve Monitoring Panel

Fire-fighting booster sets must always have an alarm panel. Fire-fighting booster sets, which are not used for most of the time, should be kept ready for a fire. Therefore an alarm panel is put and added to the system to warn the authorized staff for maintenance in case the booster set does not operate or fall from being ready. Following signals are required to be received within EN 12845 norm.

- Energy on
- Pump enabling request
- Pump is running
- Operation error

This alarm panel receives all these warnings from the booster set but in order to allow relevant technicians to see or hear these warnings, alarm panels should be built separately and put to the locations, at which technicians stand, through an extension cord. In this way any problem which may arise in the booster set would be realized by relevant technicians and the required maintenance would be provided.

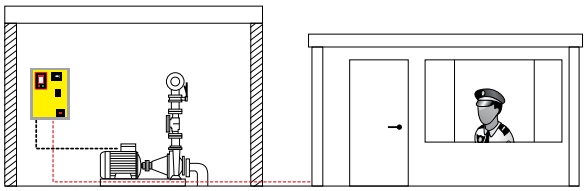


Figure 48

Valves

Relevant technicians should follow whether those valves on the booster set are open. Therefore, thanks to the micro switch to be installed to the on/off arms of the butterfly valves used, the valves are readily monitored at the technicians' location via remote monitoring panel. This feature is conducted with a rising stem valve in NFPA 20 but whether the valve is fully open or closed cannot be understood. Thanks to this system, a signal will come to the remote monitoring panel when the valve is tampered, and technicians will be warned with a visual and audio warning.

1 Remote Monitoring Alarm Panel (standard)

- All panel outlets are 12 Vdc. Inlet 230 Vac.
- Rectifier inlet 230 Vac – outlet 12 Vdc 7Ah. Led light visual warning.
- 95 dB. audio warning.
- Led test button.
- Alarm silencing button:
- Battery charge ON – OFF switch.
- Electrical and diesel with 2 pieces of 5 m multi-plug cable. Connected to the pump panels.
- When desired, 5 m extension cables are optional together with male/female end plugs..

Operation Alarm Indicator

Each of the below given status is displayed in the pump set location and maintenance room.

a) Using a key preventing the automatic operation of the motor.
b) Not being able to operate the motor after six attempts.
c) Pump operation.
d) Diesel motor control mechanism failure. Warning lights should operate as required.

Alarm Transmission

Alarms, of which functions to be monitored and alarm levels are stated in EN 12845 standard, are assembled to an alarm panel in the sprinkler control room or pump room and offer visually or acoustically (75 dB) warning as per the alarm significance. Alarm systems are mounted to a fixed control spot in or out of the facility to transmit the alarm to the responsible individual for intervention.

Alarm and Valve Control Panel

Alarms can be monitored remotely as defined in the standard based on their significance.
• Signals that can be indications of fire like water flow signal are displayed as fire alarm (red alarm).
• In case of fire, the technical failures like power failure that prevents the system to work correctly are displayed as failure alarms (yellow alarm):

Alarms for Electrical Pump Set

1. When requested (pressure drop) YELLOW (visual and audio alarm)
2. Operation failure YELLOW (visual and audio alarm)
3. Operating (water flow) (fire alarm) RED (visual and audio alarm)
4. No power (technical failures) YELLOW (visual and audio alarm)
5. Pump suction valve is open GREEN (visual alarm)
6. Pump suction valve is closed RED (visual alarm)
7. Pump outlet valve is open GREEN (visual alarm)
8. Pump outlet valve is closed RED (visual alarm)
9. No water in the water tank RED (visual and audio alarm - stopping the pump is not allowed EN 12845)

Alarms for Diesel Pump Set

1. Automatic mode is closed YELLOW (visual and audio alarm)
2. Operation failure YELLOW (visual and audio alarm)
3. Operating (water flow) (fire alarm) RED (visual and audio alarm)
4. Failure in the control system YELLOW (visual and audio alarm)
5. Pump suction valve is open GREEN (visual alarm)
6. Pump suction valve is closed RED (visual alarm)
7. Pump outlet valve is open GREEN (visual alarm)
8. Pump outlet valve is closed RED (visual alarm)
9. No water in the water tank RED (visual and audio alarm stopping the pump is not allowed EN 12845)
10. No fuel in the fuel tank RED (visual and audio alarm) (when nominal filling level drops to 25%,"MIN YAKIT (MIN FUEL)" warning is displayed).

Pilot (Jockey) Panel

All its outlets are low voltage except for motor connection.

- Energy warning lamp
- Pump running lamp
- Failure lamp
- Automatic-Manual removable key switch
- Phase sequence
- Other electrical value are monitored from Main Electrical motor panel

EN 12845 & NFPA 20 NORMS COMPARISON TABLE

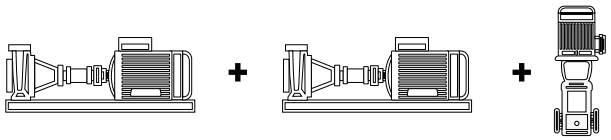
	SPECIFICATIONS	EN 12845
MATERIAL PROPERTIES	PUMP BODY	Rear Suction Back Pull Out Type
	PUMP BODY MATERIAL	GG25, GGG40 or AISI 304
	IMPELLER	GG25, AISI304 or Bronze
	PUMP SHAFT	AISI 316
	TIGHTNESS	Mechanical Seal or Soft Seal (5 Lines)
	BEDDING	Rolling Bearing
	COUPLING CONNECTION	Spacer Coupling allows intervening the pump without removing its parts including impeller, diffuser, and seals.
PERFORMANCE PROPERTIES	CLOSED VALVE PRESSURE	It should be 125% of the nominal value.
	MAXIMUM LOAD	The pressure should be lower than 70% when the flow rate value increases to 140%.
	BACKING-UP	In two-pump systems, each pump should ensure predefined flow rate and pressures alone. Where three pumps co-exist, each pump should ensure at least 50% of a given flow rate at a given pressure.
	LEAKAGE ELIMINATION PUMP (PILOT PUMP)	There is no certain limitation. Its use is optional.
	WATER FLOW RATE	Flow rate should not exceed 1.8 m/s in positive suction and 1.5 m/s in negative suction.
	STARTING THE PUMP UP	When the pressure in the mains drops to a value that is not lower than 0.8 P (P; Pressure in Closed Valve Condition), the first pump set should not automatically start-up. In a two-pump set, the second pump should start-up before the pressure drops to a value not lower than 0.6 P. The pump should operate until stopped manually once starts-up.
AUXILIARY EQUIPMENT	AUTOMATIC AIR VENT	YES
	FLOW RATE METER	YES
	MANOMETER	YES
	MAIN DRAIN VALVE	NO
	OPERATION TANK	YES (They are used for each pump in systems intended for negative suction. It should be 100 L in DT and 100 and 500 L in ST and YT, respectively. Pumps would automatically enable when the water level in tanks drops to 2/3.)
	ELECTRICAL CONTROL PANEL	YES (For each single pump)
	RISING STEM VALVE	NO (Butterfly valve available, optional 12V DC remote monitoring panel available)
	RELIEF VALVE	NO (Body cooling is made via circulation pipe in circle with main tank)
	ELECTRICAL SUCTION KIT	YES (Pump suction diameter cannot be smaller than DN80 in negative suction and than DN 65 in positive suction. To this end, the suction part of pump should be connected to a linear or tapered pipe of two diameters long. Tapered pipe should have a horizontal cap part and maximum immersing angle not exceeded 20°. Valves should be installed to this suction kit, not directly to the pump inlet.)
	SUCTION COLLECTOR	NO (No recommended for positive suction, and definitely not used in negative suction. Pumps suck separately.)
	DELIVERY COLLECTOR	YES (calculated as per 1.3 m/s Positive, 1.5 m/s negative load. No need for rising stem valve use as frictional losses are mitigated.)
	PANEL FOR EACH PUMP	YES
	LOCKED PANEL	YES
	PRESSURE SWITCH	Locked Except for the Panel
	PHASE ERROR NOTIFICATION	YES
	PAHSE ORDER ERROR NOTIFICATION	YES
	CONTROLLER PHASE ERROR NOTIFICATION	YES
	MANUAL, SEMI-AUTOMATIC AND FULL AUTOMATIC OPERATION	YES
	AUTOMATIC STOP	YES
	MANUAL STOP BUTTON	Locked on the Panel
	SEPARATE ALARM PANEL	YES
	AUDIO ALARM	YES
	LIGHT ALARM	YES
	SELF-TEST PROGRAM	YES (Not applicable for EN 12845 Sprinkler Systems. Performed manually by user.)

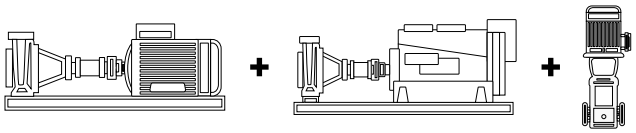
NFPA 20	NOTES
Detachable Body or Rear Suction Type	
GG25 or GGG40	
Bronze or AISI 304	
AISI 316	
Soft Seal (5 Lines)	
Grease Lubrication Rolling Bearing	
Connecting Coupling	

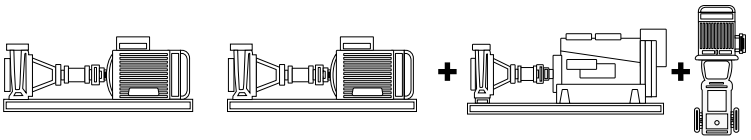
It should not be higher than 140% of the nominal pressure.	
Minimum pressure at 150% flow rate should not be lower than 65% of the nominal pressure.	A similar hydraulic curve is defined in both norms.
There is no certain limitation.	100% back-up for pumps is inevitable in terms of fire safety.
It should have a capacity of at least 1 gpm or to meet any allowable leakage in 10 minutes and not lower than the pressure required by the system.	
Water flow rate in the nominal flow rate should not exceed 3 m/s.	Lower design speeds in collectors decrease frictional losses. Collector diameters would be bigger in the fire pump in line with EN 12845. A bigger diameter pipe and accessory use eases the pump suction advantageously.
There is no certain limitation.	

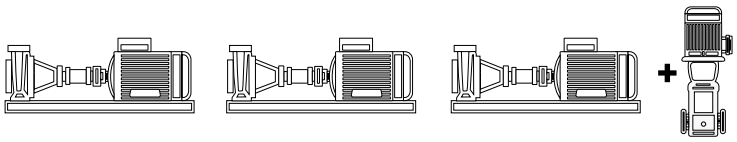
YES	
YES	
YES	
YES	
NO	Provided that an operation tank is used, the negative code suction pump should be prevented to operate dry. EN 12845 allows such application. In NFPA 20, there is no application for negative code suction with norm pumps.
YES (For each single pump)	
YES (It should be separate in suction and delivery line.)	
YES (Is is used for body cooling.)	
NO	Eccentric suction kit use ensures the water directed to the pump to flow in laminar flow, air like flow-breaking factors to be prevented to reach the pump, flow rate to be dropped down due to a passage to a level bigger diameter than anticipated, and frictional losses to be declined. With EN 12845 eccentric suction kit use, a substantial advantage is acquired for the pump suction line.
YES	
YES	
YES	
YES	
Locked in the Panel	
YES	
YES	
YES	
YES	
NO	
Accessible on the Panel	
YES	
YES	
YES	
YES	

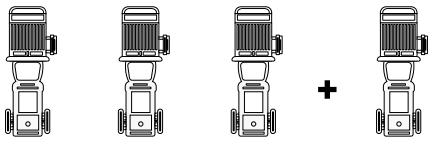
EN 12845 BOOSTER SET VERSIONS

Description	
Booster set with two main electrical motor pumps and jockey pump	

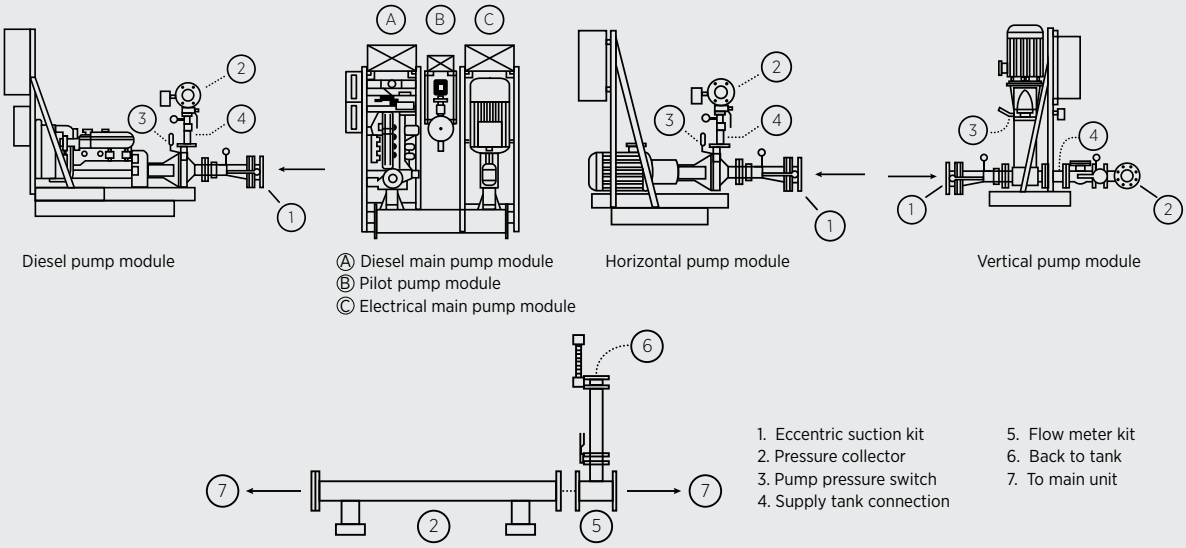
Description	
Booster set with electrical motor, diesel engine and jockey pump	

Description	
Booster set with two electrical motor, diesel engine and jockey pump	

Description	
Booster set with three electrical motor and jockey pump	

Description	
Booster set with three vertical shaft pump and jockey pump	

MODULAR SYSTEM



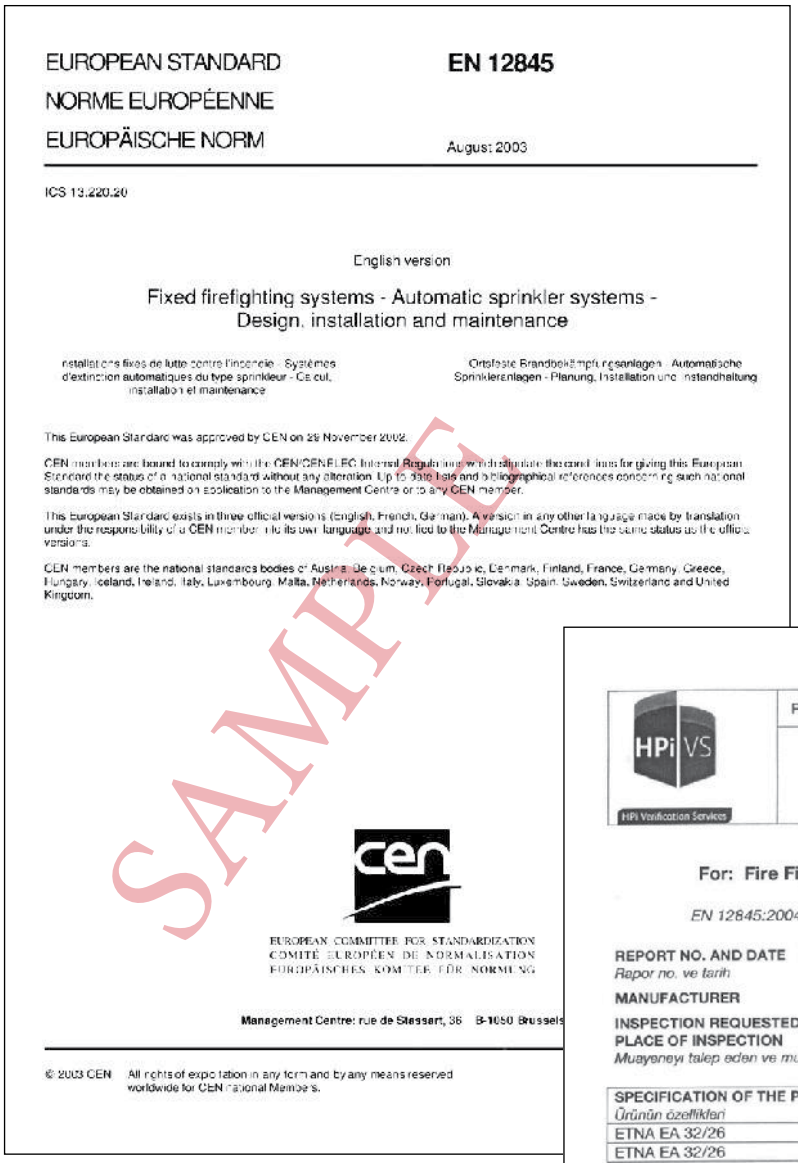
Diesel pump module

Ⓐ Diesel main pump module
Ⓑ Pilot pump module
Ⓒ Electrical main pump module

Horizontal pump module

Vertical pump module

1. Eccentric suction kit
2. Pressure collector
3. Pump pressure switch
4. Supply tank connection
5. Flow meter kit
6. Back to tank
7. To main unit



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12845

August 2003

ICS 13.220.20

English version

Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance

Installations fixes de lutte contre l'incendie - Systèmes d'extinction automatiques du type sprinkleur - Calcul, installation et maintenance

Ortsfeste Brandbekämpfungsanlagen - Automatische Sprinkleranlagen - Planung, Installation und Instandhaltung

This European Standard was approved by CEN on 29 November 2002.

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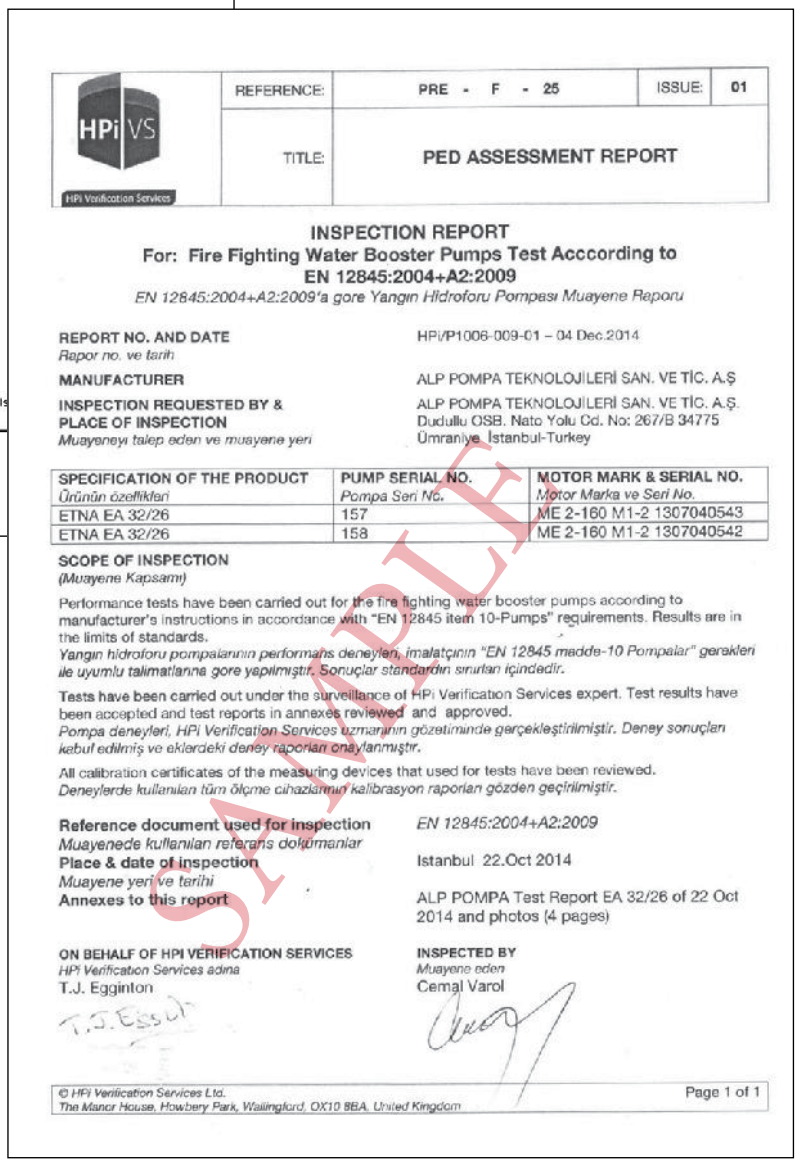

HPi VS	REFERENCE:	PRE - F - 25	ISSUE: 01
	TITLE:	PED ASSESSMENT REPORT	

INSPECTION REPORT
For: Fire Fighting Water Booster Pumps Test Acccording to EN 12845:2004+A2:2009
EN 12845:2004+A2:2009'a gore Yangın Hidroforu Pompası Muayene Raporu

REPORT NO. AND DATE — HPI/P1006-009-01 – 04 Dec.2014
Rapor no. ve tarih

MANUFACTURER — ALP POMPA TEKNOLOJİLERİ SAN. VE TİC. A.Ş

INSPECTION REQUESTED BY & PLACE OF INSPECTION — ALP POMPA TEKNOLOJİLERİ SAN. VE TİC. A.Ş. Dudullu OSB. Nato Yolu Cd. No: 267/B 34775 Ümraniye İstanbul-Turkey
Muayeneyi talep eden ve muayene yeri

SPECIFICATION OF THE PRODUCT *Ürünün özellikleri*	PUMP SERIAL NO. *Pompa Seri No.*	MOTOR MARK & SERIAL NO. *Motor Marka ve Seri No.*
ETNA EA 32/26	157	ME 2-160 M1-2 1307040543
ETNA EA 32/26	158	ME 2-160 M1-2 1307040542

SCOPE OF INSPECTION
(Muayene Kapsamı)

Performance tests have been carried out for the fire fighting water booster pumps according to manufacturer's instructions in accordance with "EN 12845 item 10-Pumps" requirements. Results are in the limits of standards.
Yangın hidroforu pompalarının performans deneyleri, imalatçının "EN 12845 madde-10 Pompalar" gerekleri ile uyumlu talimatlarına gore yapılmıştır. Sonuçlar standardın sınırları içindedir.

Tests have been carried out under the surveillance of HPi Verification Services expert. Test results have been accepted and test reports in annexes reviewed and approved.
Pompa deneyleri, HPi Verification Services uzmanının gözetiminde gerçekleştirilmiştir. Deney sonuçları kabul edilmiş ve eklerdeki deney raporları onaylanmıştır.

All calibration certificates of the measuring devices that used for tests have been reviewed.
Deneylerde kullanılan tüm ölçme cihazlarının kalibrasyon raporları gözden geçirilmiştir.

Reference document used for inspection — *EN 12845:2004+A2:2009*
Muayenede kullanılan referans dokümanlar
Place & date of inspection — Istanbul 22.Oct 2014
Muayene yeri ve tarihi
Annexes to this report — ALP POMPA Test Report EA 32/26 of 22 Oct 2014 and photos (4 pages)

ON BEHALF OF HPI VERIFICATION SERVICES
HPi Verification Services adına
T.J. Egginton

INSPECTED BY
Muayene eden
Cemal Varol

Page 1 of 1

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