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غرف مضخات الحريق

FIREFIGHTING PUMP ROOM

(ALL CODE DETAILS)

اعداد / مهندس احمد رضوان

النسخة الاولي ٢٠٢٣

بسم الله الرحمن الرحيم

❖ **الحمد لله والصلاة والسلام علي رسوله الكريم وبعد:**

- ♥ هذا الملخص الذي خالصا لوجهة الله تعالي.
- ♥ جميع المعلومات مدعومة من الاكواد العالمية NFPA 20 HAND BOOK 2021.
- ♥ الدافع الذي جعلني ابدا في التجميع والترتيب هو الصـــعوبة التي تواجه الاغلب في البحث عن المعلومات ف الكود وربما كانت كسلا او عدم توفر الطريق الصحيح للارشاد والتعليم.
- ♥ وهذا الامر سيحول مهندسين الميكانيكا لمجرد مشرف علي التفيذ بسبب غياب الاساس العلمي للمعلومة لديه وسيؤدي لغياب المعلومات الهندسية لديه.

وَمَا أُوتِيتُم مِّنَ الْعِلْمِ إِلَّا قَلِيلًا (٨٥)

ما وصـــلك الان هو توفيق وهداية من الله وبعض من الاجتهاد الشـــخصي_ بنفسي_ والتجميع والتنظيم للمعلومات ولا أستطيع ان انسب الفضل كامل لنفسي. فهناك ملفات قمت بالاستعانة بها وبعض من اجتهادات المهندسين السابقين بالخبرة المباشرة لي او بفيديوهات اليوتيوب.

كتبه مهندس ميكانيكا / احمد رضوان
٢٠٢٣/١

الفهرس

نظرا لاختلاف كل غرفة مضـخات حريق عن الاخري بسـبب اختلاف الوضـع العام للغرفة وحجمها ومكان الخزان، نقسم الشرح لاقسام عامة ليسهل الوصول للمعلومة.

توضيح عام

- في حالة ذكر مسـافة في شرح جزء معناها يجب عليك الالتزام بتوفير هذه المسـافة باي شكل كان حسب طبيعة المكان.

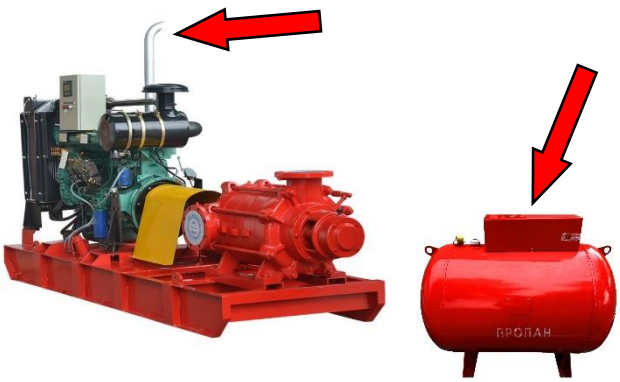
- في حالة عدم ذكر أي مسـافة في شرح أي جزء معناها يتم التركيب حسـب طبيعة المكان ... بمعني ممكن يتم توصـيل الأجزاء ببعضـها متصـلة او تترك مسـافة بينهم هذه حرية لك.

مقدمة

كيف تفرق بين المضخات بسهولة في الموقع:

- مضخة jockey حجمها صغير مقارنة بالمضخات الاخري ورفيعة وطويلة وتسمي booster pump

- مضخة diesel موصل عليها خزان وقود و ليها شكمان

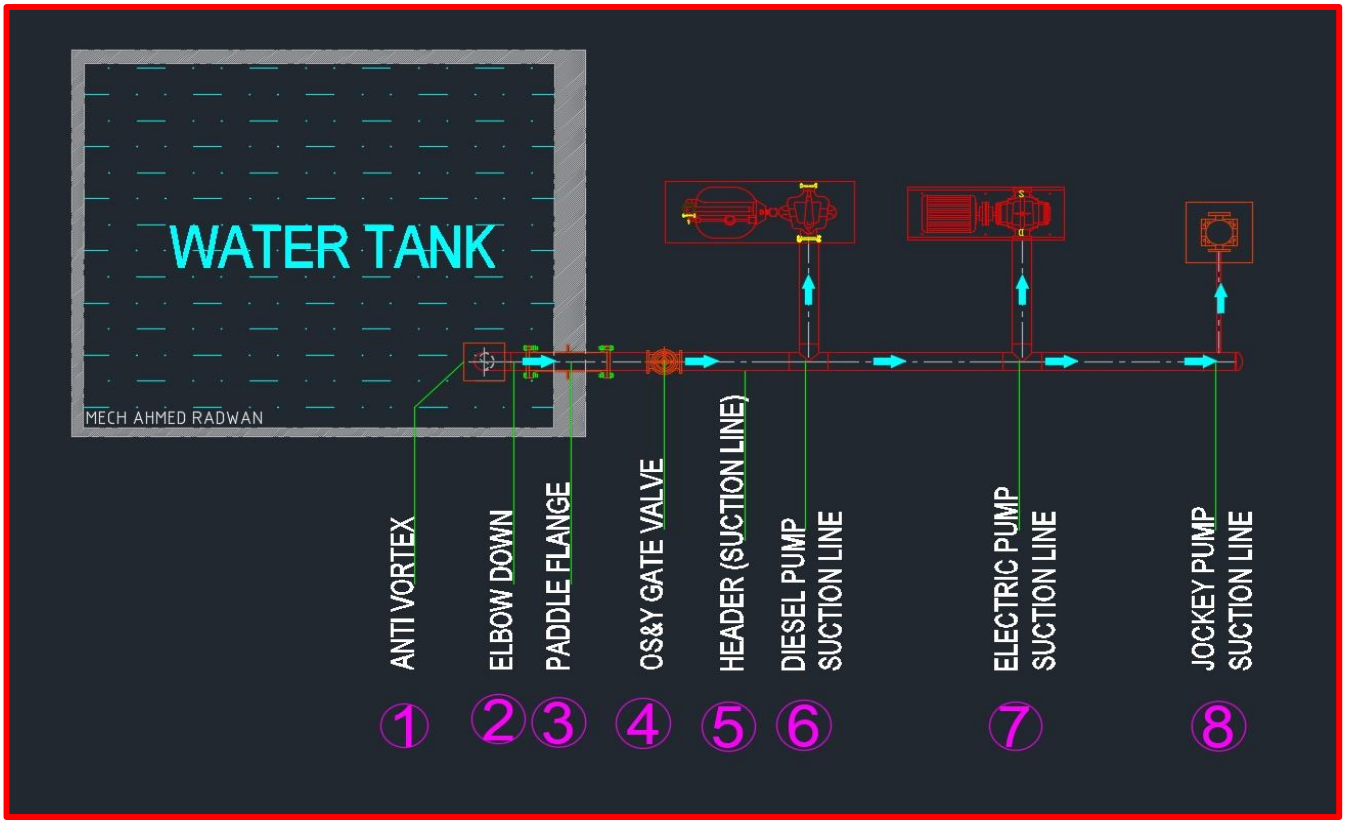


- مضخة electrical شكلها بسيط ومركب عليها ماتور كهرباء

١. خط سحب المضخات

يبدأ خط سحب مضخات الحريق بداية من خزان الحريق ومكوناته كالاتي بالترتيب:

١. مانع الدوامات ANTI VORTEX
٢. كوع توصيل ELBOW
٣. فلانشة توصيل للخزان PUDDLE FLANGE
٤. محبس OS & Y Valve
٥. قطر خط السحب HEADER
٦. خط سحب المضخة الاساسية
٧. خط سحب المضخة الاحتياطية
٨. خط سحب مضخة الجوكي
٩. مصفاة خط السحب SUCTION STRAINER



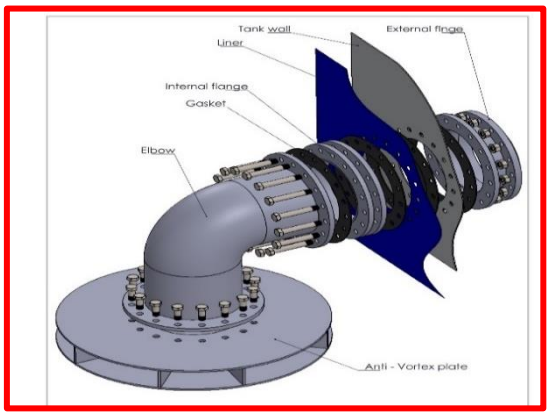
الصورة للتوضيح وليست للتنفيذ

بعض الملاحظات:

من رقم ١ حتي رقم ٥ يعتبر ثابتة بشكل عام في اغلب غرف المضخات، رقم ٦ و ٧ و ٨ يتغير ترتيبهم حسب نوع المضخات واتجاة السحب واتجاة الطرد وحسب مكان الخزان وحسب ابعاد الغرفة بمعني ممكن المضخات تتلف او يتغير ترتيبهم.

١)مانع الدوامات anti-vortex

١. يبدا من الخزان وفي بداية خط السحب anti-vortex
٢. دورها تمنع حدوث اي دوامات اثناء سحب المضخة



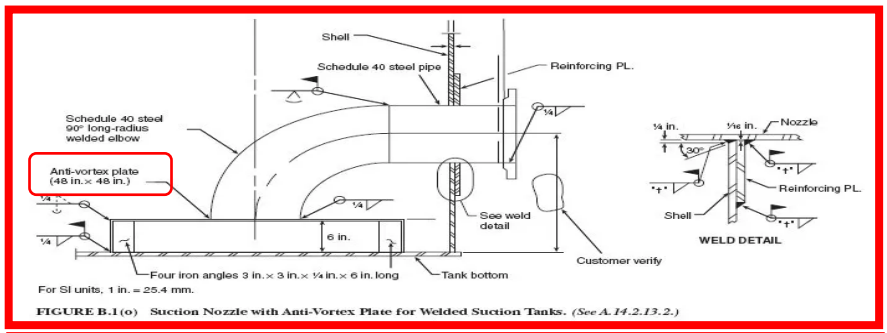


FIGURE B.1(o) Suction Nozzle with Anti-Vortex Plate for Welded Suction Tanks. *(See A.14.2.13.2.)*

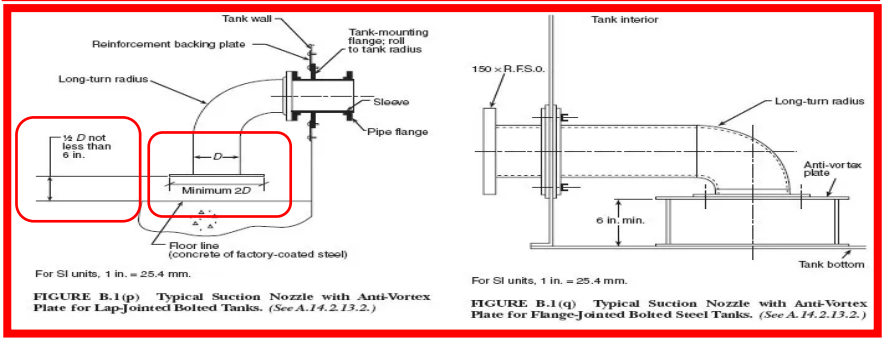


FIGURE B.1(p) Typical Suction Nozzle with Anti-Vortex Plate for Lap-Jointed Bolted Tanks. *(See A.14.2.13.2.)*

FIGURE B.1(q) Typical Suction Nozzle with Anti-Vortex Plate for Flange-Jointed Bolted Steel Tanks. *(See A.14.2.13.2.)*

ليها بعض الشروط كالاتي:

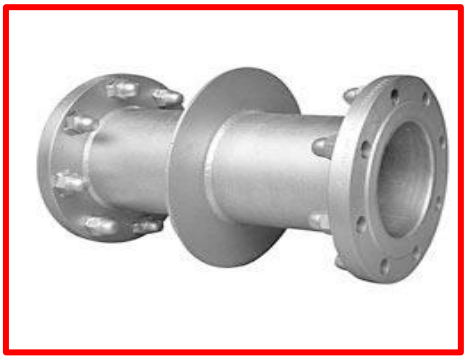
- عرضها لا يقل عن ٢ ضعف قطر السحب (دائري)
- عرضها لا يقل عن ٢*٢ ضعف قطر السحب (مربع)
- ارتفاعها عن الارض ½ القطر ولا يقل عن ٦ بوصة ولا تزيد عن ١٥ سم
- المقاس المقترح من الكود هو ٤٨ بوصة*٤٨ بوصة
- ينفع تعمل plate أكبر لكن لا تقل عن هذه المقاسات

The plate is mounted parallel to the floor of the tank at a height at least half the diameter of the suction pipe but not less than 6 in. (152 mm) above the tank floor and is connected to a long turn elbow that connects to the discharge flange installed in the wall of the tank. Water that flows out of the tank drops under the plate, up through the hole, up into the elbow, and out the discharge flange into the suction pipe. By forcing the water to follow this path, the creation of a vortex is prevented. See Exhibit I.4.22 for anti-vortex plate detail.

When water discharges at or near the bottom of an above grade storage tank or holding basin, a vortex forms as the water level lowers, and without an anti-vortex plate, air will be introduced into the suction pipe. A similar phenomenon occurs when a sink full of water empties through its drain. If this vortex were allowed to develop in a suction tank, it would result in turbulence (air bubbles) in the suction pipe and cause damage to the pump. To prevent this from happening, an anti-vortex *plate* is placed in the bottom of the tank and connected to the discharge flange of the tank.

An anti-vortex plate is a flat, square, or round sheet of steel. The length of the sides or the diameter of the plate must be at least twice the diameter of the suction pipe. It is recommended that the plate be at least 48 in. (1219 mm) along each side. A hole that is the same size as the suction pipe is located in the center of the plate.

٢)فلانشة توصيل للخزان Puddle flange



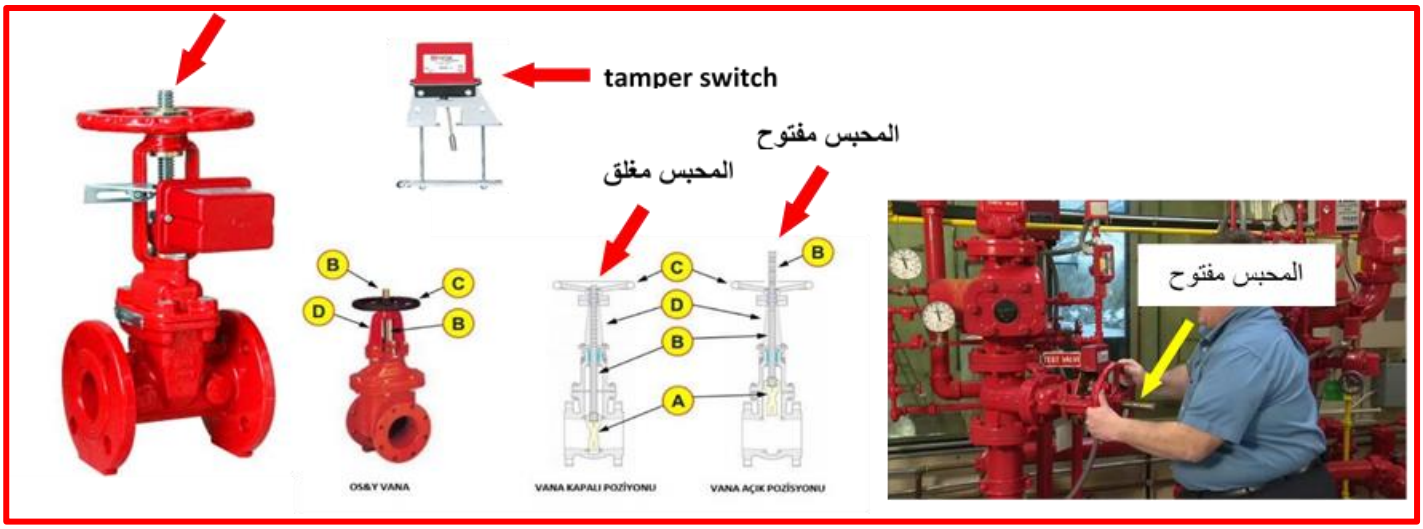
١. للخزان الخرساني يتم عمل جرابات بالحوائط قبل الصب وتوضع فلانشة عمياء تسمى فلانشة عدم تسريب في منتصف الحائط بحيث تعمل كحائل أكثر قوة في وسط الخرسانة Puddle Flange عبارة عن ماسورة قطرها نفس قطر الماسورة التي سيتم توصيلها بالخزان وبها فلانشة بالمنتصف يكون قطرها أكبر من قطر الماسورة.
٢. تصنع ال Puddle flange من الحديد المجلفن أو الصلب الذي لا يصدا أو من البلاستيك.
٣. قطرها نفس قطر HEADER زي ما يتحسب بعد كدا.
٤. **لها وظيفتان:**

١-منع تسريب الماء من الخزان للخارج.
٢ -تعمل على التثبيت الجيد للماسورة بالخزان لها مقاسات Standard بالسوق ويمكن تصنيعها بالموقع توضع قبل الصب وتكون الفلانشة في المنتصف ويتم لحامها بأسياخ الحديد التي يتم تسليح الخرسانة بها.

٣)محبس OS & Y Valve

محبس عادي جدا زي اي محبس ولكن فيه مميزات:

- في حالة الفتح بقدر الاحظ بسهولة لاني هشوف العمود المسنن بارز للخارج.
- بيركب عليه جهاز تاني اسـمه tamper switch بيعطي اشـارة لو المحبس اتفتح او اتقفل لان دا نظام حريق قفل اي محبس ممكن يوقف النظام بالكامل.
- قطره نفس قطر الماسورة للسحب من الخزان



- المحابس المستخدمة مع مضخات الحريق هي كالاتي:

A.3.3.17.2 Indicating Valve. Examples are outside screw and yoke (OS&Y) gate valves, butterfly valves, and underground gate valves with indicator posts.

- في حالة استخدام اي محبس مثل butterfly بدلا من محبس OS & Y
- يلزم توفير مسافة ١٥ متر بين المحبس ودخول المضخة.

4.28.3.1 Where a backflow preventer with butterfly control valves is installed in the suction pipe, the backflow preventer is required to be at least 50 ft (15.2 m) from the pump suction flange (as measured along the route of pipe) in accordance with 4.15.5.2.

- بيني وبينك كدا إنك توفر مسافة ١٥ متر الكلام دا صعب في ارض الواقع.
- الا لو لقيت غرفة المضخات قد ملعب كرة السلة.

٤)تحديد قطر خط السحب والطرد

بعد حساب كمية Q من التصميم ... نختار الاقطار من الجدول

مثال اقطار السحب والطرد عند ٧٥٠ جالون/دقيقة

Table 4.27(a) Summary of Centrifugal Fire Pump Data (U.S. Customary)

	Minimum Pipe Sizes (Nominal) (in.)						
Pump Rating (gpm)	Suction[a,b,c]	Discharge[a]	Relief Valve	Relief Valve Discharge	Meter Device	Number and Size of Hose Valves	Hose Header Supply
25	1	1	¾	1	1¼	1 — 1½	1
50	1½	1¼	1¼	1½	2	1 — 1½	1½
100	2	2	1½	2	2½	1 — 2½	2½
150	2½	2½	2	2½	3	1 — 2½	2½
200	3	3	2	2½	3	1 — 2½	2½
250	3½	3	2	2½	3½	1 — 2½	3
300	4	4	2½	3½	3½	1 — 2½	3
400	4	4	3	5	4	2 — 2½	4
450	5	5	3	5	4	2 — 2½	4
500	5	5	3	5	5	2 — 2½	4
750	6	6	4	6	5	3 — 2½	6
1000	8	6	4	8	6	4 — 2½	6
1250	8	8	6	8	6	6 — 2½	8
1500	8	8	6	8	8	6 — 2½	8
2000	10	10	6	10	8	6 — 2½	8
2500	10	10	6	10	8	8 — 2½	10
3000	12	12	8	12	8	12 — 2½	10
3500	12	12	8	12	10	12 — 2½	12
4000	14	12	8	14	10	16 — 2½	12
4500	16	14	8	14	10	16 — 2½	12
5000	16	14	8	14	10	20 — 2½	12

Notes:
(1) The pressure relief valve is permitted to be sized in accordance with 4.19.2.1.
(2) The pressure relief valve discharge is permitted to be sized in accordance with 4.19.6.2.
(3) The flowmeter device is permitted to be sized in accordance with 4.21.2.3.
(4) The hose header supply is permitted to be sized in accordance with 4.21.3.4.
[a]Actual diameter of pump flange is permitted to be different from pipe diameter.
[b]Applies only to that portion of suction pipe specified in 4.15.3.3.
[c]Suction pipe sizes in Table 4.27(a) are based on a maximum velocity at 150 percent rated capacity to 15 ft/sec (4.6 m/sec) in most cases.

- من الجدول قطر السحب للمضخة الديزل والكهرباء يكون ٦ بوصة
- بعد اختيار قطر السحب نختار قطر HEADER وبيكون كالاتي:
- قطر HEADER = قطر السحب للمضخة الكهرباء + درجة اكبر (معلومة لا اعرف مصدرها)
- بمعني قطر المضخة كان ٦ بوصة نختار HEADER قطر ٨ بوصة
- بمعني قطر المضخة كان ١٠ بوصة نختار HEADER قطر ١٢ بوصة

(الاقطار المتوفرة ١ و١,٢٥ و١,٥ و٢ و٢,٥ و٣ و٤ و٦ و٨ و١٠ و١٢ وهكذا)

اختيار مضخة الجوكي:

- اما عن طريق انها تعوض التسريب في النظام في ١٠ دقايق.

One guideline that has been successfully used to size pressure maintenance pumps is to select a pump that will make up the allowable leakage rate in 10 minutes or 1 gpm (3.8 L/min), whichever is larger.

- اما عن طريق انها تعطي كمية من التدفق يكافي ١% م كمية تدفق المطلوبة للنظام

A rule of thumb for sizing jockey pumps supplying underground piping is to use 1 percent of the fire pump rated capacity and add 10 psi (0.7 bar) to the pressure rating of the fire pump.

For example, a fire pump with a rated capacity of 1000 gpm at 100 psi (3785 L/min at 6.9 bar):

Jockey pump flow

1000 gpm × 1% = 10 gpm

- ضغط مضخة الجوكي تكافئ ضغط النظام + ٠,٧ بار

Jockey pump pressure

Fire pump rating (100 psi) + 10 psi = 110 psi

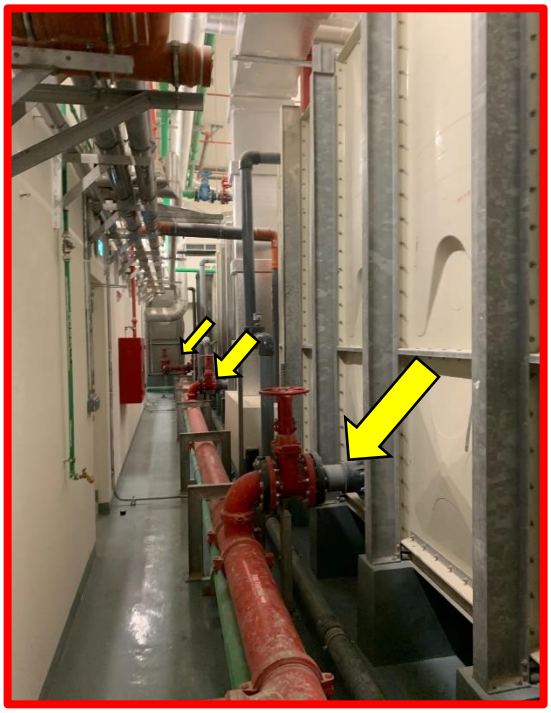
Therefore, the jockey pump rating would be 10 gpm at 110 psi (37.8 L/min at 7.6 bar).

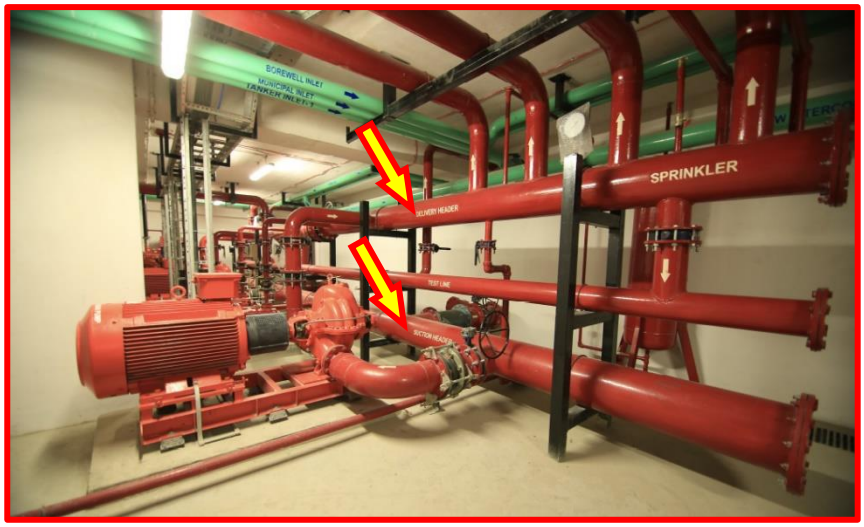
An exception to this general rule is when older underground systems leak excessively. In such a case, the jockey pump capacity should be increased further, based on the leakage rate of the underground system.

- الخلاصة مش هتلاقي في السوق مضخات بالسعة القليلة دي فاختار كمية تدفق مضخة الجوكي علي ٥% او ١٠% للنظام .... من الجدول يكون قطر سحب الجوكي ٢ بوصة
- لان ١٠% من ٧٥٠ تساوي ٧٥ ونختار ١٠٠ لعدم توفر ٧٥ فالجدول

يتم تجميع المضخات على خط سحب واحد وخط طرد واحد.

- خط سحب واحد يوصل بين المضخات وخزان المياة
- خط طرد واحد يوصل بين المضخات ونظام الرشاشات
- ممكن تلاقي خطين سحب وخط طرد ... المهم تفهم الفكرة عموما والتركيب سهل.





خطوط Suction لمضخات الحريق

- مقاس مواسير suction يتم تصميمها علي اساس الاتي :
- تتحمل 150 % من كميه التدفق المطلوبه
- ان سرعه المياه في المواسير لا تزيد عن 15 ft/sec
- حيث ان اقصي سرعه مسموح عند Pump Flange هي ١٥ ft/sec

اقرا الصورة المرفقة التالية

4.15.7 Multiple Pumps. Where a single suction pipe supplies more than one pump, the suction pipe layout at the pumps shall be arranged so that each pump will receive its proportional supply.

The use of multiple pumps may be required for several reasons, such as to increase flow, to increase pressure, or to provide redundancy. The following are examples of multiple pumps arranged to meet these objectives.

Scenario 1. Multiple fire pumps arranged in parallel operating simultaneously without redundant (backup) pumps.

The following list identifies some applications where simultaneous operation of multiple pump may be required to meet the fire protection system demand(s):

1. Simultaneous operation of multiple deluge systems that may be required in aircraft hangers and refineries
2. Fire fighting, including extinguishing and exposure protection in refineries and chemical plants
3. High water–demand mitigation systems

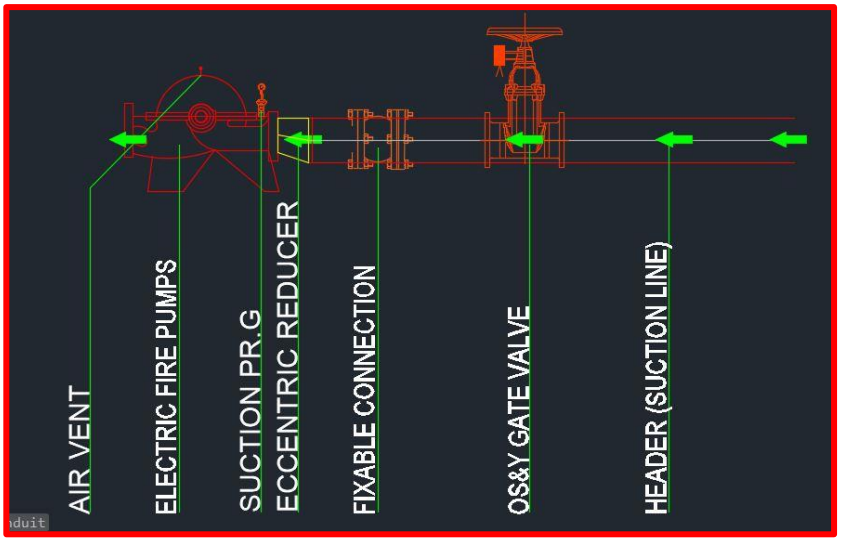
In the above applications, two or more pumps installed in parallel may be required to meet the water demand of the fire protection system. In this scenario, common suction piping must be sized to supply multiple pumps operating at 150 percent of rated volume. The suction pipe should be sized so that the velocity does not exceed 15 ft/sec (4.57 m/sec) in any portion of the suction piping when all of the simultaneously operating pumps are operating at 150 percent of rated capacity. As an example, if three 5000 gpm (18,925 L/min) fire pumps operating simultaneously are required to meet a 14,500 gpm (54,888 L/min) system demand, suction piping common to all three pumps must be sized for a flow of 3 × 1.5 × 5000 = 22,500 gpm (85,172 L/min). Flow rates in Schedule 30 pipe at a velocity of 15 ft/sec (4.57 m/sec) for pipe sizes up to 24 in. (600 mm) nominal diameter are shown in Commentary Table I.4.3. A flow rate of 22,500 gpm (85,172 L/min) would require a pipe with a minimum internal diameter of 24.76 in. (629 mm) to limit the velocity of 15 ft/sec (4.57 m/sec). A 30 in. pipe in normally available pipe sizes would be required for this example. Suction piping that is common to two pumps must be sized for 2 × 1.5 × 5000 = 15,000 gpm (56,781 L/min). Commentary Table I.4.3 indicates that a minimum 24 in. nominal pipe diameter is required. Suction piping that is common to only one pump must be sized for 1 × 1.5 × 5000 = 7500 gpm (28,391 L/min). Commentary Table I.4.3 indicates that a minimum 16 in. nominal pipe diameter is required.

COMMENTARY TABLE I.4.3 *Flow Rates in Schedule 30 Pipe at a Velocity of 15 ft/sec (4.57 m/sec)*

Nominal Pipe Diameter		Flow at Velocity of 15 ft/sec (4.57 m/sec)	
in.	mm	gpm	L /min
8	200	2392	9055
10	250	3773	14,281
12	300	5367	20,317
14	350	6447	24,403
16	400	8680	32,858
18	450	10,770	40,769
20	500	13,256	50,179
24	600	19,216	72,740

٢. مجموعة محابس سحب المضخة

١. صمام عزل OS & Y Valve (تم شرحه سابقا)
٢. وصلة مرنة Flexible Connection
٣. نقاصة لا مركزية للأنابيب Eccentric Reducer.
٤. مقياس ضغط السحب Compound Suction Gauge
٥. محبس تنفيس المضخة AIR VENT



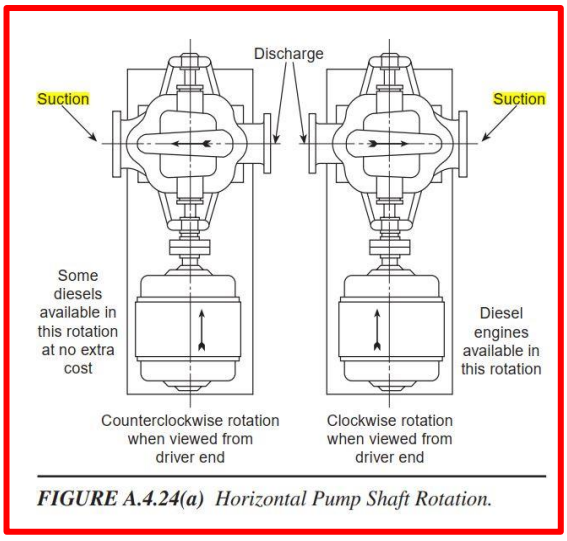
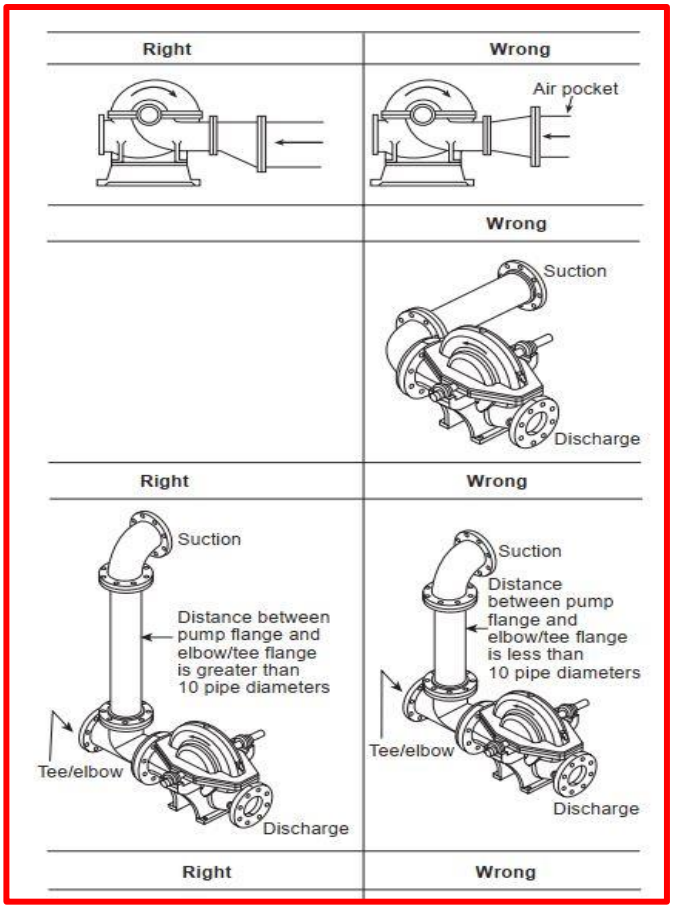


FIGURE A.4.24(a) Horizontal Pump Shaft Rotation.

المسافة التي ذكرت في الكود بين اول ELBOW/TEE للاخذ من HEADER تكون ١٠ اضعاف قطر خط سحب المضخة بمعني لو خط السحب ٨ بوصة يبقي ٨٠ بوصة يعني ٢ متر وطبعا المسافة دي تقريبا مش هتلاقيها متوفرة في اغلب المضخات للاسف عموما حاول تنسقها على قد ما تقدر.

(2) For horizontal split-case fire pumps, there should be a distance of not less than 10 diameters of suction pipe for side connection (not recommended) to the fire pump suction flange.*(See 4.15.6.3.1.)*



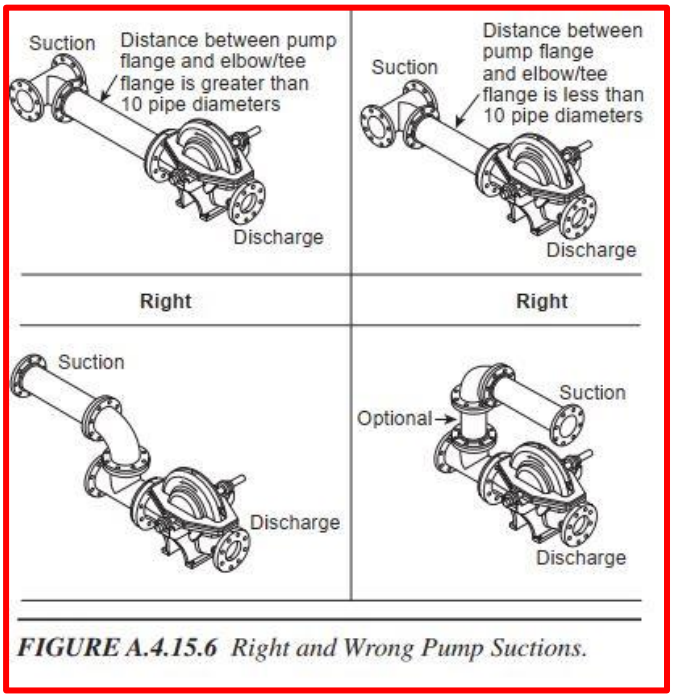
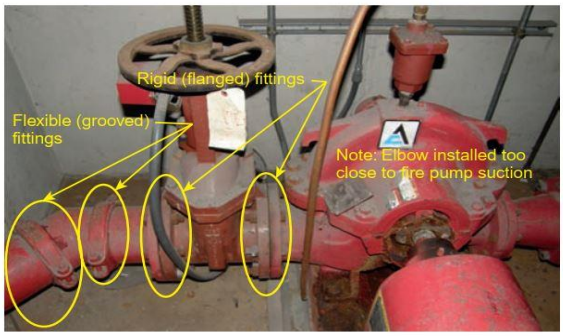
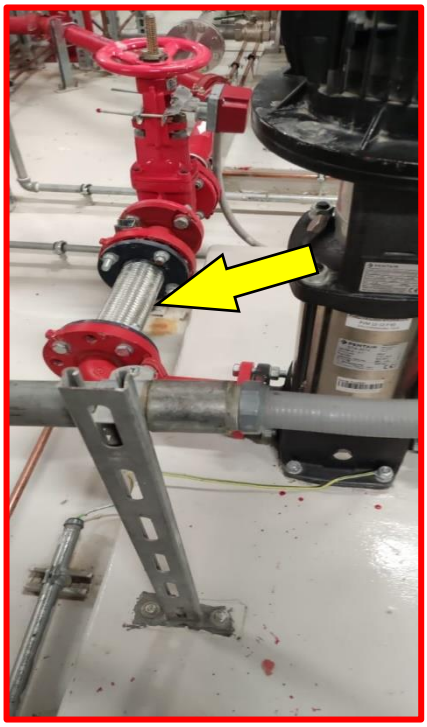


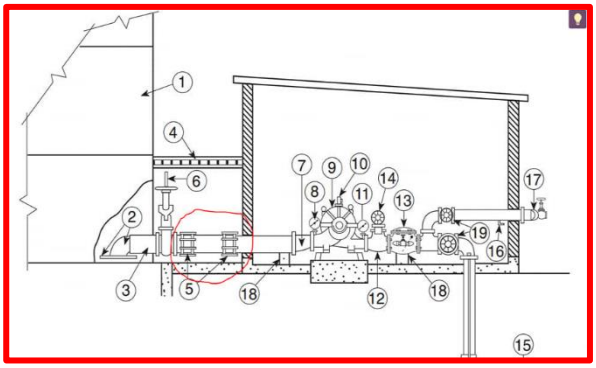
FIGURE A.4.15.6 Right and Wrong Pump Suctions.

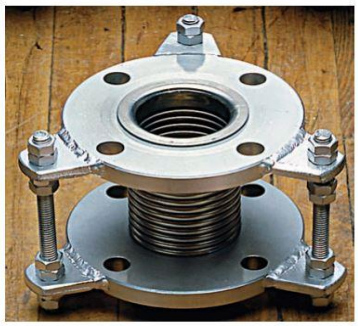
١) الوصلة المرنة FLEXIBLE CONNECTION

- اسمها في الكود Flexible Joint
- يوجد منها نوعين نوع مطاطي ونوع استالس
- النوع الاستالس هو الافضل
- تستخدم لمنع نقل الاهتزازات من المضخة للنظام









Strain relief can be accomplished by means of a flexible joint such as that depicted in Exhibit I.4.18 or by a series of grooved couplings as shown in Exhibit I.4.19. Flanged fittings are not flexible. When using grooved couplings for strain relief, rigid grooved couplings should not be used. Deflection for most nonrigid grooved couplings is on the order of 3½ in. to 4½ in./20 ft (89 mm to 114 mm/6 m) length of pipe in sizes 6 in. to 8 in. (150 mm to 200 mm). A series of these grooved couplings in the suction pipe provides flexibility if the pump or tank foundations begin to settle and should also provide for limited movement due to expansion and contraction. The purpose of providing such strain relief is to prevent damage to the pump suction flange, since misalignment or stress placed on the pump suction flange can cause the flange to crack. The fire pump design should avoid the use of separate foundations for the pump and the driver, particularly in earthquake-prone areas.

٢) مسلوب لا مركزي Eccentric Reducer

- الغرض من ان يكون تصـــغير القطر من اتجـاه واحـد هو تقليـل احتماليه تكوين فقاعات هواء عند سـحب المضـخة وعدم امكانيه حدوث التكهف Cavitation
- لا يتم اسـتخدامه في حالة كان قطر السـحب للمضـخة نفس قطر مدخل المضـــخة ... بمعني كان HEADER ٨ بوصـــة وســـحب المضخة ٨ بوصة أيضا.

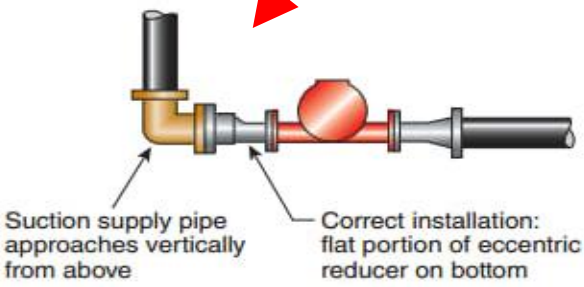
- معلومة منتشرة خاطئة يقال ان اتجاة المسلوب دائما لاسفل وهذا خطا
  - الصح يعتمد اتجاة تركيب المسلوب اللامركزي علي حسب سحب المضخة كما بالصور بالأسفل

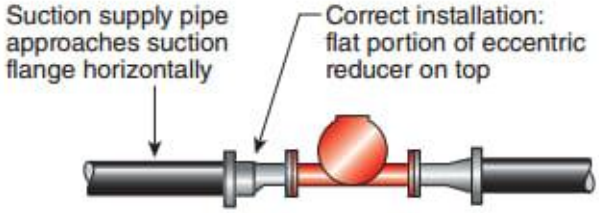
6.3.2 Where necessary, the following fittings shall be provided:

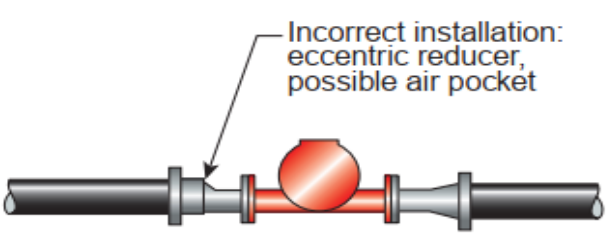
(1) Eccentric tapered reducer at suction inlet

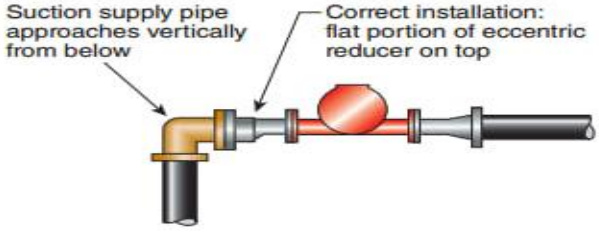
When the pump suction pipe is larger than the pump suction flange, an eccentric tapered reducer is required to minimize the possibility of air pockets forming at the pump suction. See 4.15.6.4. The flat portion of the reducer must be on top, with the actual reduction in pipe diameter taking place on the bottom of the fitting (see Exhibit I.6.7).

The discharge arrangement consists of a check valve, test header, discharge control valve, and a bypass. A bypass is provided here, unlike in the other examples in this section, because the supply pressure is of material value to the fire suppression system even without the pump (see 4.15.4.1). In this example the suction pipe size is the same as the pump suction opening, so an eccentric reducer is not needed. Requirements specific to centrifugal fire pumps can be found in Chapter 6.







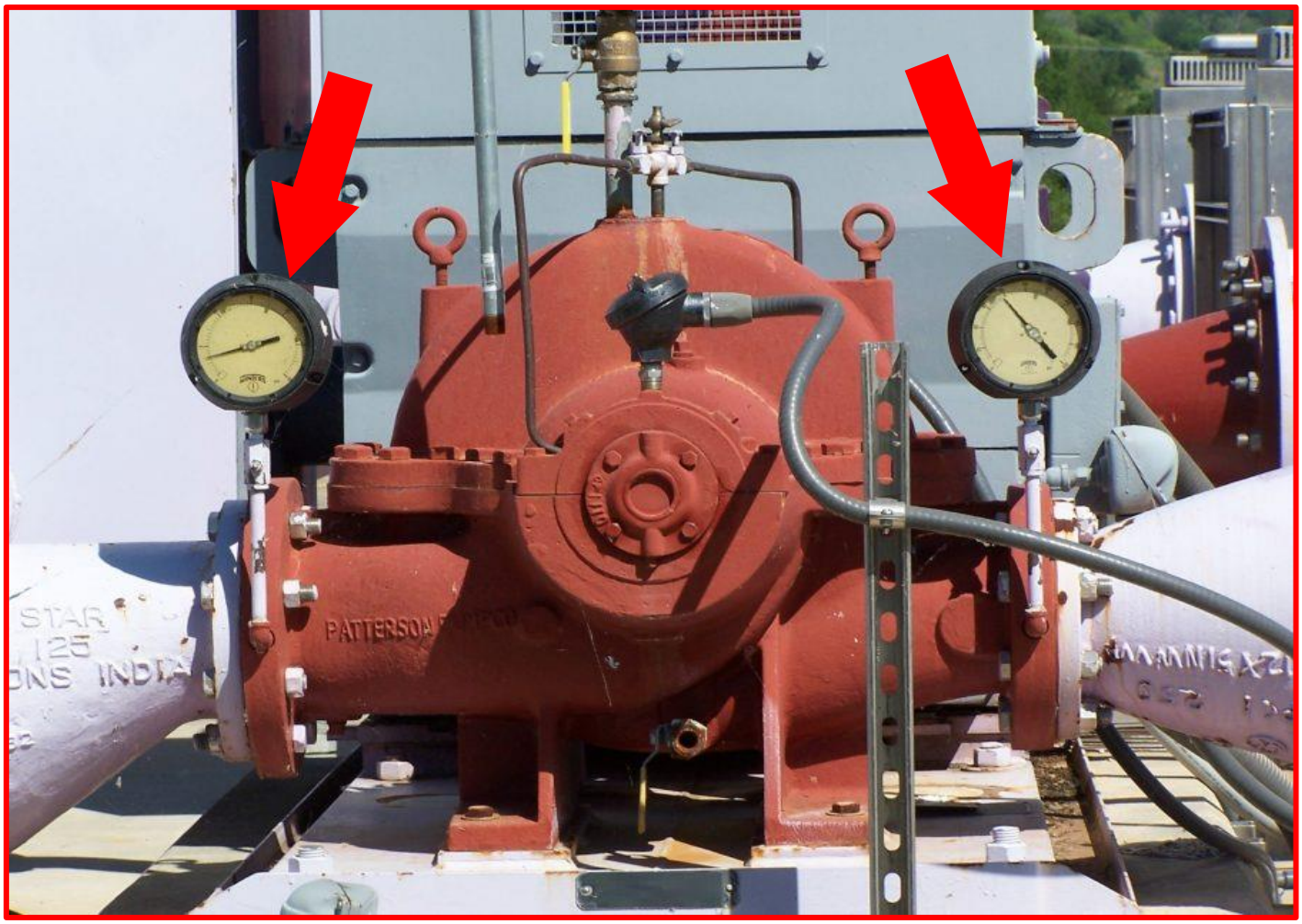


٣) مقياس ضغط السحب Compound Suction Gauge

- يستخدم في قياس ضغط المياة قبل وبعد المضخة

8.5.1 Gauges. A compound suction gauge and a discharge pressure gauge shall be furnished.

A compound suction gauge is a gauge that is capable of reading negative and positive pressures. The discharge pressure gauge is not required to be a compound gauge because it is assumed that the discharge pressures will never be negative. Both gauges are needed to indicate the pressure boost across the pump.



٤) محبس تنفيس المضخة AIR VENT

6.3.3 Automatic Air Release.

6.3.3.1 Unless the requirements of 6.3.3.2 are met, pumps that are automatically controlled shall be provided with a listed float-operated air release valve having a nominal 0.50 in. (12.7 mm) minimum diameter discharged to atmosphere.

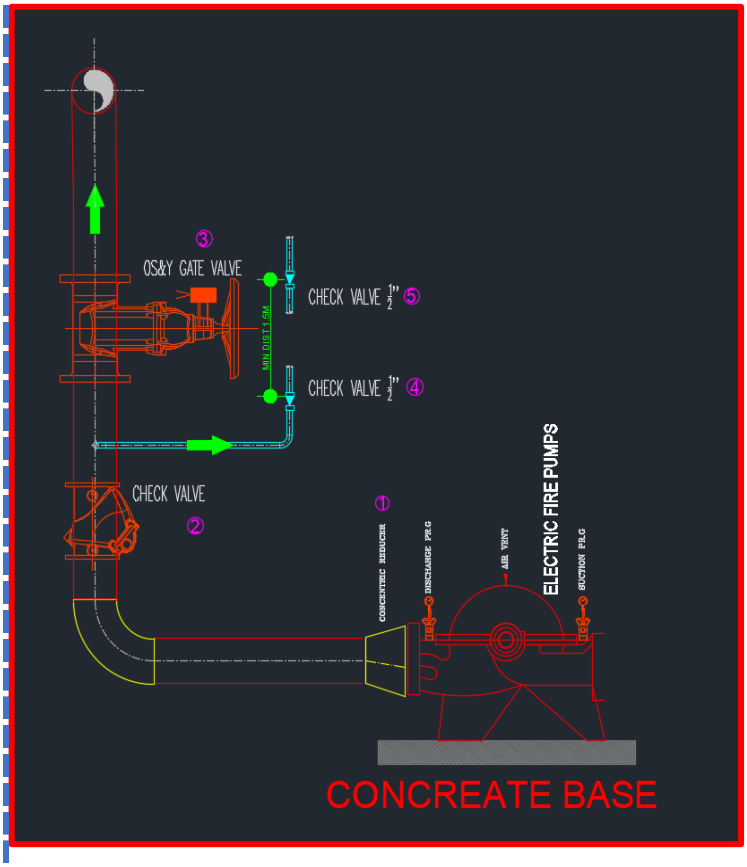
Air in the impeller can cause cavitation, damage the impeller, and negatively impact the pump performance. Exhibit I.6.11 illustrates an automatic air release valve.

EXHIBIT I.6.11 Automatic Air Release Valve. (Courtesy of Global Vision Inc.)

6.3.3.2 The requirements of 6.3.3.1 shall not apply to overhung impeller–type pumps with top centerline discharge or that are vertically mounted to naturally vent the air.

مجموعة محابس طرد المضخة

١. نقاصة مركزية للأنابيب Eccentric Reducer- Increaser تم شرحها مسبقا
٢. وصلة مرنةFlexible تم شرحها سابقا
٣. صمام عدم الرجوع Check (Non-Return) Valve
٤. خط استشعار الضغط
٥. خط فحص Test Line Connections
٦. محبس OS & Y Valve
٧. الخط المزود لنظام إطفاء الحريق.



١.صمام عدم رجوع NON RETURN VALVE

- يتم تركيب صمام عدم الرجوع بعد المضخة فقط
- لا حاجة لتركيبة قبل المضخة
- يتم تركيبه بعد المسلوب المركزي والوصلة المرنة لو تم تركيبهم
- لعدم رجوع المائع من النظام ودوران المضخة عكس الاتجاة
- يركب في اتجاه السريان مع اتجاه السهم المرسوم على المحبس
- قطر المحبس نفس قطر الماسورة للطرد (راجع جزئية حساب قطر خط السحب والطرد للطلمبات)

خط التحكم SENSING LINE

- يتم التوصيل بعد طرد المضخة وبعد محبس عدم الرجوع NON RETURN VALVE وقبل محبس الغلط OS & Y قبل الدخول للشبكة ونهايته هي وحدة التحكم CONTROL PANEL

A.10.5.2.1 Installation of the pressure sensing line between the discharge check valve and the control valve is necessary to facilitate isolation of the jockey pump controller (and sensing line) for maintenance without having to drain the entire system. *[See Figure A.4.31(a) and Figure A.4.31(b).]*

- يلزم تركيب لكل مضخة خط استشعار و وحدة تحكم الا في حالة مضخات WATER MIST

4.31.1 For all pump installations, including jockey pumps, each controller shall have its own individual pressure sensing line.

FAQ Can the sensing line for a fire pump and pressure maintenance pump be combined and installed as a single pipe?

Each pump controller, including the pressure maintenance pump controller, must have its own dedicated sensing line. Except for water mist positive displacement pumping units, each pump, including the pressure maintenance pump in multiple pump installations, must also be provided with a separate dedicated sensing line. Providing separate dedicated pressure sensing lines adds reliability to the starting and control of the pumps. For example, if one line becomes obstructed, the other line is not affected. See Exhibit I.4.39 for an illustration of pressure sensing lines for a diesel-driven fire pump that are combined and, therefore, not compliant with 4.31.1.

- نوع المادة المستخدمة هي نحاس واستالس لضمان عدم حدوث اي صدأ

4.31.3* The pressure sensing line shall be brass, rigid copper pipe Types K, L, or M, or Series 300 stainless steel pipe or tube, and the fittings shall be of ½ in. (15 mm) nominal size.

A.4.31.3 The use of soft copper tubing is not permitted for a pressure sensing line because it is easily damaged.

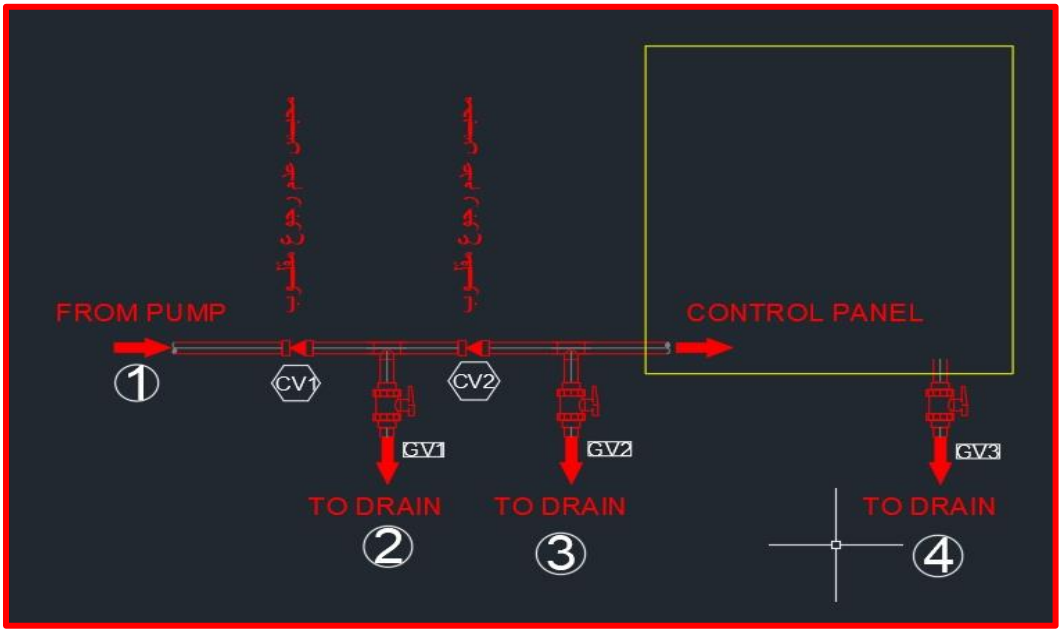
Differentiation must be made between nominal pipe sizes and nominal tube sizes. The nominal pipe sizes are based on the approximate inside diameters of the pipe, whereas tube sizes are based on outside diameters. For example, nominal ½ in. (15 mm) copper Type K, L, or M, or Series 300 stainless steel pipe would be equivalent to nominal ⅝ in. (16 mm) or 0.625 in. (15 mm) O.D. tube.

- القطر نص بوصة ويركب عليها مجموعة من المحابس كالاتي:
  عدد ٢ محبس عدم رجوع ويركب عكس اتجاة السريان
  ويتم عمل ثقب فيه بشنيور وبونطة مقاس ٢ ملم او ٢,٥ ملم
- يتم عمل DRAINبعد كل محبس عدم رجوع مقلوب

- **<u>لماذا يتم تركيب محبس الرجوع معكوس؟</u>**
  - يحافظ علي اغلي جزء بصندوق التحكم وهو TRANSDUCER
  - وظيفة TRANSDUSER هو تحويل ضغط المائع لضغط DEGITAL او بمعني اخر يحول الضـــغط الميكانيكي لإشـــارة كهربية ومنها يظهر علي الشاشة ضغط الشبكة كام بار
  - محابس عدم الرجوع المعكوسة في وضع افقي

شرح فكرة عمل SENSING LINE

- بعد تركيب عدد ٢ محبس عدم رجوع مقلوب يتم تركيب محبس للتصريف ولذلك لاختبار كل محبس عدم رجوع هل هو يعمل ام لا ولا حدث فيه انسداد
- توضيح لو تم فتح محبس GV1 وخرج منه مياة يبقي محبس CV1 سليم وشغال والعكس
- توضيح لو تم فتح محبس GV2 وخرج منه مياة يبقي محبس CV2 سليم وشغال والعكس
- يتم فتح محبس GV3 لتقليل ضغط وحدة التحكم وعمل تشغيل اجباري للمضخات للاختبار ومعرفة الاعطال والضغط وكمية التدفق والخ



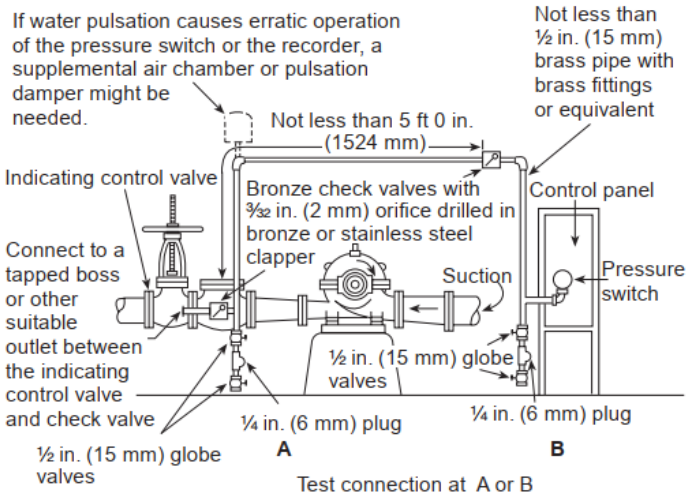
الصورة لتوضيح فكرة العمل والشرح وليست للمرجعية

صمام عدم الرجوع عدد اثنان يتم تركيبهم بعكس اتجاه الجريان بحيث لا تقل المسافة بينهما عن [ft] 5 أي ما يُعادل [m] 1.52، يكون من النوع القابل للفك من الأعلى، بحيث يتم فكه وإخراج اللسان الداخلي وثقبه بمقدار [mm] 2.4 لتمرير المياه مع اتجاه الجريان، والغاية من تركيب صمام عدم الرجوع بعكس اتجاه الجريان هو لامتصاص صدمة المطرقة المائية (تغيرات الضغط عند بدء عمل النظام)، الأمر الذي سيؤدي إلى جريان المياه ضمن الثقب بحيث يصل إلى جهاز قراءة الضغط ضغط ستاتيكي فقط.

محبس عزل بعد كل صمام عدم رجوع لغايات الصيانة، حيث أنّه مع الوقت فإنّ الثقب الموجود في صمام عدم الرجوع سيتعرض للانسداد الأمر الذي سنلاحظه من اختلاف قراءات الضغط على اللوحة الكهربائية، حيث نقوم بفتح محبس العزل الأول، وفي حال جريان المياه فإن صمام عدم الرجوع سليم ونجرب المحبس الآخر وهكذا.

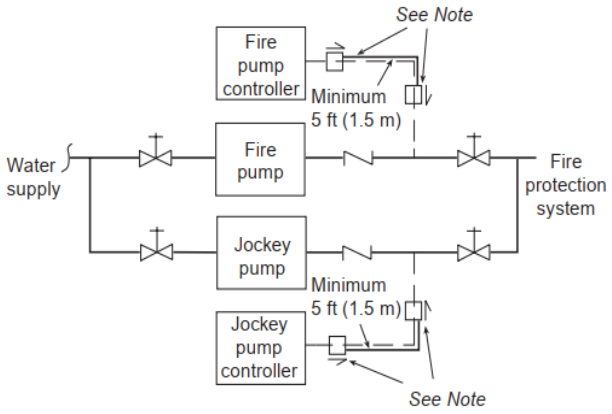
محبس تصريف على مدخل اللوحة الكهربائية، فائدته هو عمل فحص لآلية عمل المضخة، حيث عند فتح المحبس سيتم تصريف المياه الموجودة ضمن الخط وبالتالي سيقرأ الجهاز هبوطاً في الضغط ضمن الشبكة مما سيؤدي إلى عمل المضخة بشكل آلي دون الحاجة إلى تشغيلها عن طريق فتح أحد الأنظمة كخراطيم الكبائن لعمل تجربة عمل الشبكة بشكل آلي.

في نهاية الخط وعلى مدخل اللوحة الكهربائية يوجد جهاز Transducer يعمل على قراءة الضغط وتحويله



Notes:
(1) Solenoid drain valve used for engine-driven fire pumps can be at A, B, or inside controller enclosure.
(2) If water is clean, ground-face unions with noncorrosive diaphragms drilled for 3/32 in. orifices can be used in place of the check valves.

FIGURE A.4.31(a) *Piping Connection for Each Automatic Pressure Switch (for Electric-Driven and Diesel Fire Pump and Jockey Pumps).*



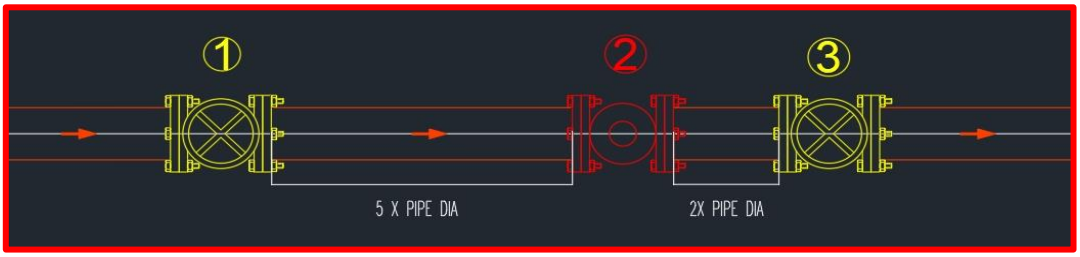
Note: Check valves or ground-face unions complying with 4.31.4.

FIGURE A.4.31(b) *Piping Connection for Pressure Sensing Line (Diesel Fire Pump).*

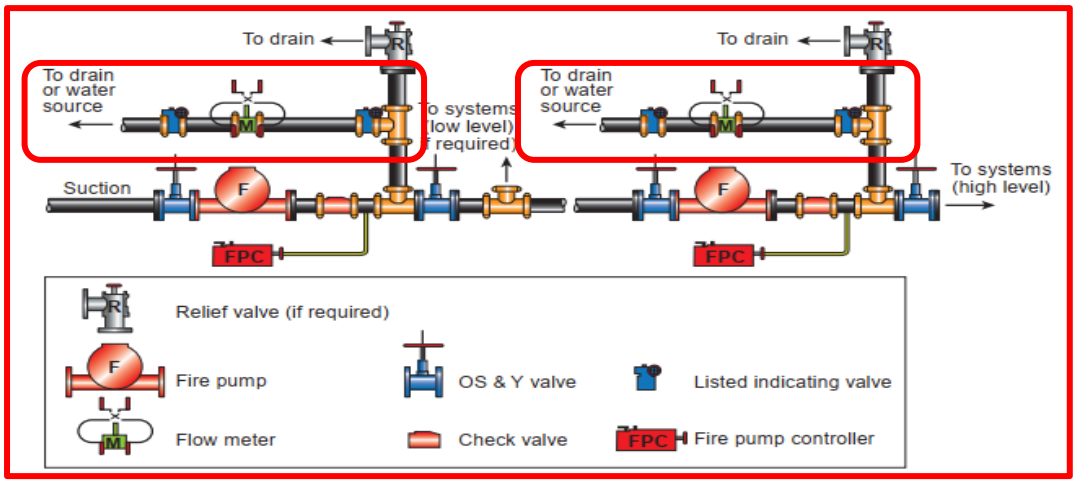
خط الاختبار للمضخات TESTING LINE

- هو خط يتم تركيب عليه مجموعة من المحابس بالترتيب كالاتي:
- محبس OS & Y Valve ثم عداد قياس التدفق FLOW METER ثم محبس OS & Y Valve
- لكن ليه بعض الشروط والمسافات التي يجب الالتزام بها كالاتي:

١. بين المحبس الاول وعداد التدفق يكون على الاقل ٥ اضعاف قطر الماسورة
٢. بين عداد التدفق والمحبس الثاني يكون على الاقل ٢ اضعاف قطر الماسورة
٣. تحديد قطر خط الاختبار من صفحة رقم ٩ بالملف حسب كمية GPM



- من الممكن استبدال محابس OS & Y Valve بمحابس BUTTERFLY



A.4.21.1.2 Outlets can be provided through the use of standard test headers, yard hydrants, wall hydrants, or standpipe hose valves.

The following notes apply to Figure A.4.21.1.2(a) and Figure A.4.21.1.2(b):

(1) The distance from the flowmeter to either isolation valve should be as recommended by the meter manufacturer.
(2) For horizontal split-case fire pumps, there should be a distance of not less than 10 diameters of suction pipe for side connection (not recommended) to the fire pump suction flange. *(See 4.15.6.3.1.)*
(3) Automatic air release should be provided if piping forms an inverted "U," trapping air.
(4) The fire protection system should have outlets available to test the fire pump and suction supply piping. *(See A.4.21.3.1.)*
(5) The closed loop meter arrangement will test only net pump performance. It does not test the condition of the suction supply, valves, piping, and so forth.
(6) Return piping should be arranged so that no air can be trapped that would eventually end up in the eye of the pump impeller.
(7) Turbulence in the water entering the pump should be avoided to eliminate cavitation, which would reduce pump discharge and damage the pump impeller. For this reason, side connection is not recommended.
(8) Prolonged recirculation can cause damaging heat buildup, unless some water is wasted.
(9) The flowmeter should be installed according to manufacturer's instructions.
(10) Pressure sensing lines also need to be installed in accordance with 10.5.2.1. *[See Figure A.4.31(a) and Figure A.4.31(b).]*

- الكود أشار انك تراجع الكتالوج وشروط عمل FLOW METER بطريقة صحيحة ويقال ان المسافات دي من كتالوج المحبس فلو عاوز تتأكد منها رجاء تأكد بنفسك كتالوج محبس.

MECH AHMED RADWAN +20 1021738384

Pressure Relief Valve خط

- يركب على خط طرد المضخة الديزل فقط وبعدها الي نقطة تصريف او خزان المياة مرة اخري لتفادي ظاهرة ارتفاع الضغط كثيرا مرة واحدة عند بداية تشغيل المضخة.
- يركب علي طرد مضخة الكهرباء إذا كانت مضخة متغيرة السرعة (التوضيح في اخر فقرة في الشرح)
- لكن فالغالب مضخات الحريق ثابتة السرعة.
- مكان تركيبه بعد مسلوب طرد المضخة وقبل محبس CHECK VALVE

4.19.3 Location. The relief valve shall be located between the pump and the pump discharge check valve and shall be so attached that it can be readily removed for repairs without disturbing the piping.

- ركز معايا بختار قطر خط دخول Relief Valve من الجدول ال اخترنا منه قطر سحب المضخات وHEADER صفحة رقم ٩ وموجود تحت اهو
- يتم تحديد قطر دخول Relief Valve
- يتم تحديد قطر خروج Relief Valve ويكون أكبر من قطر الدخول وقد تتطلب تركيب مسلوب

Table 4.27(a) Summary of Centrifugal Fire Pump Data (U.S. Customary)

	Minimum Pipe Sizes (Nominal) (in.)						
Pump Rating (gpm)	Suction[a,b,c]	Discharge[a]	Relief Valve	Relief Valve Discharge	Meter Device	Number and Size of Hose Valves	Hose Header Supply
25	1	1	¾	1	1¼	1 — 1½	1
50	1½	1¼	1¼	1½	2	1 — 1½	1½
100	2	2	1½	2	2½	1 — 2½	2½
150	2½	2½	2	2½	3	1 — 2½	2½
200	3	3	2	2½	3	1 — 2½	2½
250	3½	3	2	2½	3½	1 — 2½	3
300	4	4	2½	3½	3½	1 — 2½	3
400	4	4	3	5	4	2 — 2½	4
450	5	5	3	5	4	2 — 2½	4
500	5	5	3	5	5	2 — 2½	4
750	6	6	4	6	5	3 — 2½	6
1000	8	6	4	8	6	4 — 2½	6
1250	8	8	6	8	6	6 — 2½	8
1500	8	8	6	8	8	6 — 2½	8
2000	10	10	6	10	8	6 — 2½	8
2500	10	10	6	10	8	8 — 2½	10
3000	12	12	8	12	8	12 — 2½	10
3500	12	12	8	12	10	12 — 2½	12
4000	14	12	8	14	10	16 — 2½	12
4500	16	14	8	14	10	16 — 2½	12
5000	16	14	8	14	10	20 — 2½	12

Notes:
(1) The pressure relief valve is permitted to be sized in accordance with 4.19.2.1.
(2) The pressure relief valve discharge is permitted to be sized in accordance with 4.19.6.2.
(3) The flowmeter device is permitted to be sized in accordance with 4.21.2.3.
(4) The hose header supply is permitted to be sized in accordance with 4.21.3.4.
[a]Actual diameter of pump flange is permitted to be different from pipe diameter.
[b]Applies only to that portion of suction pipe specified in 4.15.3.3.
[c]Suction pipe sizes in Table 4.27(a) are based on a maximum velocity at 150 percent rated capacity to 15 ft/sec (4.6 m/sec) in most cases.

- طرد Relief Valve لازم يكون ليه بعض الخصائص، اقرا الصورة التالية

4.19.5* Discharge.

A.4.19.5 The relief valve cone should be piped to a point where water can be freely discharged, preferably outside the building. If the relief valve discharge pipe is connected to an underground drain, care should be taken that no steam drains enter near enough to work back through the cone and into the pump room.

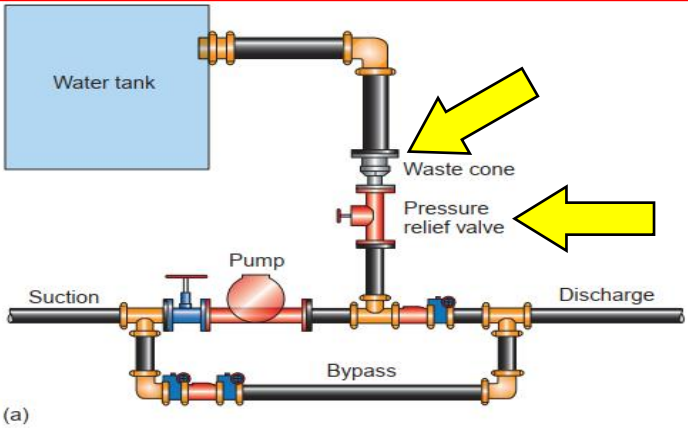
The discharge of the relief valve should preferably be piped to a water storage tank for safe discharge or to the outside to discharge at a safe point. If discharge to a tank or a safe point outside is not possible, discharge to a drain of adequate size and capacity to accept the maximum flow from any discharge should be arranged.

4.19.5.1 The relief valve shall discharge into an open pipe or into a cone or funnel secured to the outlet of the valve.

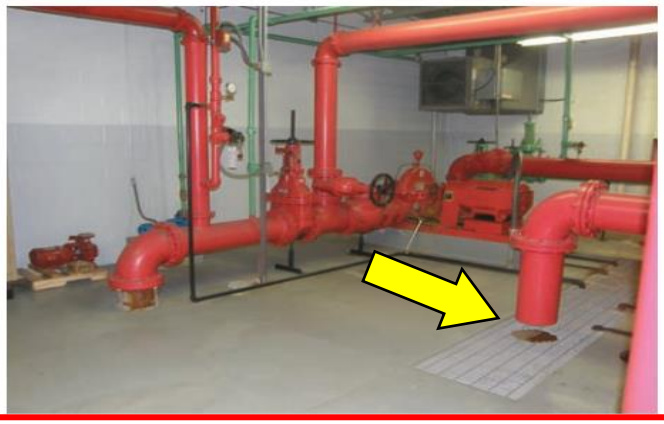
4.19.5.2 Water discharge from the relief valve shall be readily visible or easily detectable by the pump operator.

4.19.5.3 Splashing of water into the pump room shall be avoided.

4.19.5.4 If a closed-type cone is used, it shall be provided with means for detecting motion of water through the cone.



(a)



- في حالة خط الطرد Relief Valve يحتوي علي عدد من ELBOW FITTING نستخدم المقاس الأكبر درجة من الذي اخترناه

4.19.6.2.1 If the pipe employs more than one elbow, the next larger pipe size shall be used.

نوضــح بالأرقام عند ٧٥٠ جالون/دقيقة خط الطرد Relief Valve يكون ٦ بوصــة ونختار المقاس الأكبر يبقي ٨ بوصة طرد Relief Valve و٤ بوصة سحب Relief Valve

- لا يجب ان يكون طرد مضختين او أكثر على خط واحد ويكون كل طرد Relief Valve بمفرده

4.19.6.3 Relief valve discharge piping returning water back to the supply source, such as an aboveground storage tank, shall be run independently and not be combined with the discharge from other relief valves.

- يوجد بعض الحالات الخاصة، اقرا الصورة التالية

4.19.7* Discharge to Source of Supply. Where the relief valve is piped back to the source of supply, the relief valve and piping shall have sufficient capacity to prevent pressure from exceeding that for which system components are rated.

A.4.19.7 Where the relief valve discharges back to the source of supply, the back pressure capabilities and limitations of the valve to be used should be determined. It might be necessary to increase the size of the relief valve and piping above the minimum to obtain adequate relief capacity due to back pressure restriction.

4.19.7.1 Where a pressure relief valve has been piped back to suction, a circulation relief valve sized in accordance with 4.12.1.7 and 4.19.7 and discharged to atmosphere shall be provided downstream of the pressure relief valve. The circulating relief valve shall actuate below the opening set point of the pressure relief valve to ensure cooling of the pump during churn operation.

Where a pressure relief valve discharge is piped back to the suction side of a fire pump (closed loop), a circulation relief valve must be installed for cooling purposes (see A.4.19.1 and its commentary for additional detail). The pressure setting of the circulation relief valve should be well below the pressure relief valve setting but above the maximum suction pressure.

4.19.7.2 Where pump discharge water is piped back to pump suction and the pump is driven by a diesel engine with heat exchanger cooling, the controller shall provide a visual indicator and audible alarm and stop the engine when a high cooling water temperature signal as required by 11.2.4.4.8 is received, provided there are no active emergency requirements for the pump to run.

High water temperature supply to the diesel engine should not occur with proper design and operation but may occur when improper design or pressure relief valve failure causes water to recirculate through the pressure relief valve. This requirement is intended to prevent damage to the engine under nonemergency conditions; under emergency conditions the engine should continue to run even if it results in damage to the engine.

4.19.7.2.1 The requirements of 4.19.7.2 shall not apply when pump discharge water is being piped back to a water storage reservoir.

The temperature change from energy added by the fire pump to water that is recirculated through a water storage tank should be minimal.

4.19.8* Discharge to Suction Reservoir. Where the supply of water to the pump is taken from a suction reservoir of limited capacity, the drain pipe shall discharge into the reservoir at a point as far from the pump suction as is necessary to prevent the pump from drafting air introduced by the drain pipe discharge.

A.4.19.8 When discharge enters the reservoir below minimum water level, there is not likely to be an air problem. If it enters over the top of the reservoir, the air problem is reduced by extending the discharge to below the normal water level.

4.19.9 Shutoff Valve. A shutoff valve shall not be installed in the relief valve supply or discharge piping.

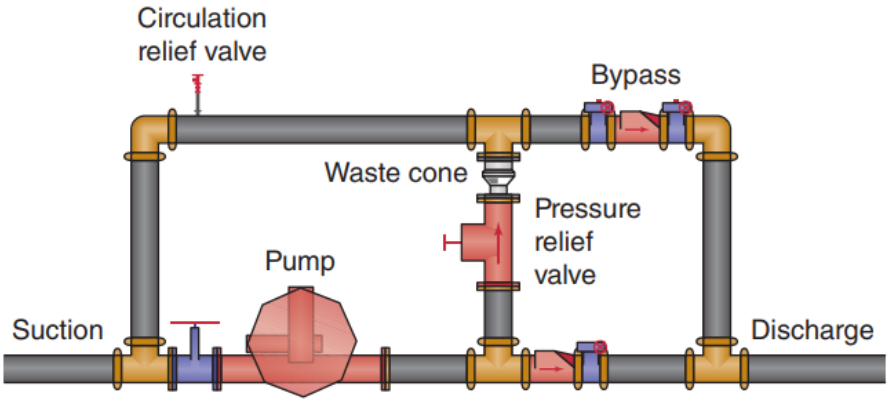


EXHIBIT I.4.27 *Pressure Relief Valve Piped to Pump Suction (Closed). (Courtesy of Stephan Laforest, Summit Sprinkler Design Services, Inc.)*

- لا تحتاج جميع المضخات الديزل لتركيب محبس Relief Valve
- أي مضخة لا تعطي أكثر من ١٢,١ بار عند ضغط يكافئ ١١٠% من ضغطها لا يتم تركيبه
- نوضح الكلام عندنا مضخة ١٠ بار نحسب ليها ١١٠%*١٠ بار يكافئ ١٠,١ بار اقل من ١٢,١ بار
- دا الشرح والمختصر المفيد للفقرة دي في الكود
- موجود مثال للحسابات وازاي تحسب ضغط Relief Valve

The maximum discharge pressure for a variable speed pump is the churn pressure at rated speed plus the maximum suction pressure. It is not expected that a diesel engine governor will fail and cause over-speed conditions at the same time that the variable speed driver fails; therefore, the maximum pressure for the diesel engine drive fire pump should be evaluated at rated speed.

A fire pump rated for 1500 gpm (5677 L/min) and 100 psi (6.9 bar) at 1750 rpm has a shutoff pressure of 120 psi (8.3 bar). If a maximum of 45 psi (3.1 bar) static pressure is available from the city water supply, the total pressure when the pump is running at churn at rated speed is 165 psi (13.1 bar).

Pressure increase at rated speed = 120 psi (8.3 bar)
120 psi + 45 psi (8.3 bar + 3.1 bar) = 165 psi (11.4 bar)

In this case, a pressure relief valve is not required if the fire protection system components are rated at 175 psi (12.1 bar).

Pumps that create pressures less than the pressure rating of the fire protection system components [typically 175 psi (12.1 bar)] at 110 percent of rated speed do not need a pressure relief valve. The example calculation that follows illustrates the procedure used to determine if a pressure relief valve is needed.

A fire pump rated for 1500 gpm (5677 L/min) and 100 psi (6.9 bar) at 1750 rpm has a shutoff pressure of 120 psi (8.3 bar). The shutoff pressure produces 145 psi (10 bar) at 110 percent of rated speed. If a maximum of 45 psi (3.1 bar) static pressure is available from the city water supply, the total pressure when the pump is running at churn at 110 percent of rated speed is 190 psi (13.1 bar).

Pressure increase at 110 percent of rated speed = $110\%^2 = 121\%$
120 psi (8.3 bar) × 1.21 = 145 psi (10 bar)
145 psi + 45 psi (10 bar + 3.1 bar) = 190 psi (13.1 bar)

In this case, a pressure relief valve (see Exhibit I.4.25) is needed if the fire protection system components are rated at 175 psi (12.1 bar). A pressure relief valve is not required if the fire protection system components are rated for 200 psi (13.8 bar) or higher.

i

Prior to the 1996 edition, NFPA 20 required the installation of pressure relief valves for all diesel engine fire pumps. This requirement was based on the assumption that, if engines ran too fast (a condition known as overspeed), the fire protection system would be exposed to pressures in excess of the pressure ratings of the system components. Because an overspeed shutdown device is required, the technical committee believes that a pressure relief valve is not needed on all diesel fire pump installations.

4.19.1.1* Pressure relief valves shall be used only where specifically permitted by this standard.

FAQ Does NFPA 20 permit the installation of main pressure relief valves in electric fire pump systems?

No section in this standard specifically permits the use of a main pressure relief valve on an electric fire pump, except where a variable speed driver is used. Variable speed drivers are required to default to constant rated speed operation in the event the variable speed driver fails. If operating at constant rated speed can result in system overpressurization, a pressure relief valve is required. The pressure relief valve setting must be above the set pressure of the variable speed driver. The use of a main pressure relief valve to trim excess pressure is considered to be poor design and should be avoided. Several methods are available to cope with excessive pressures, such as the following:

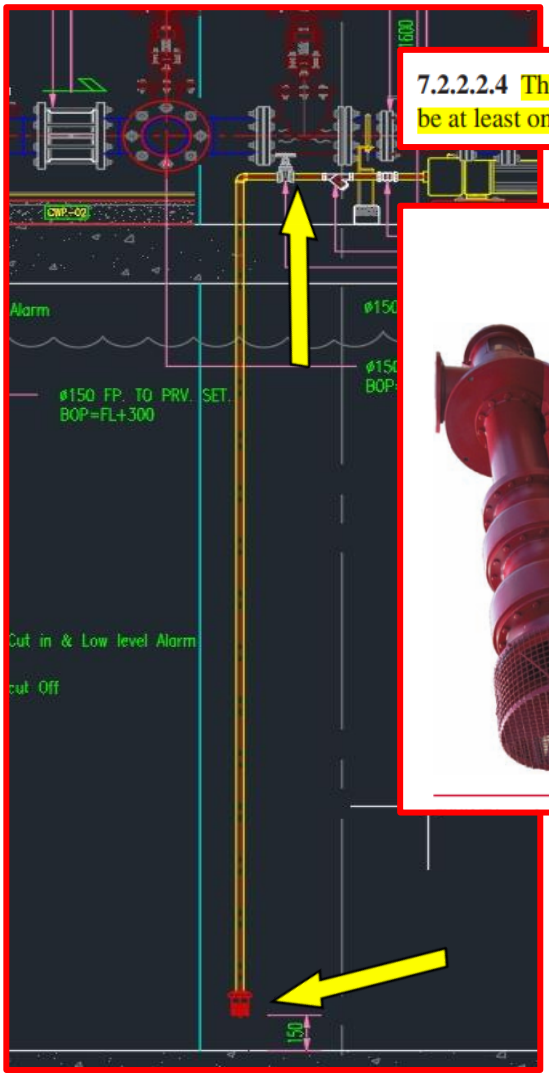
1. A break tank
2. A variable speed pressure limiting control device (see 11.2.4.3)
3. Other pressure regulating devices downstream of the fire pump discharge control valve

مصفاة خط السحب Suction Strainer

ملحوظة مهمة: يتم التركيب فقط مع المضخات الرئيسة ويفضل عدم تركيبه الا مع أصعب الحالات مثل السحب من المستنقعات او الانهار او مياه بها شوائب.

في حالة تركيبه يجب الالتزام بالكود لكي لا تنسد وتؤثر علي سحب المضخة كالاتي:

- يجب ان يكون قطر المصفاة علي الاقل ٤ اضعاف سحب المضخة
- حسبنا فوق ان سحب مضخة الكهرباء ٦ بوصة يبقي قطر المصفاة علي الاقل ٢٤ بوصة
- الفتحات في المصفاة تكون فتحات دائرية وقطرها ٠,٥ بوصة
- يلزم ان يكوم المصفاة تبعد ١٠ اضعاف قطر الماسورة من بداية سحب المضخة
- حسبنا فوق ان سحب مضخة الكهرباء ٦ بوصة يبقي بعد المصفاة علي الاقل ٦٠ بوصة



7.2.2.2.4 The distance between the bottom of the strainer and the bottom of the wet pit shall be at least one-half of the pump bowl diameter but not less than 12 in. (305 mm).

7.3.4 Suction Strainer.

7.3.4.1 A cast or heavy fabricated, corrosion-resistant metal cone or basket-type strainer shall be attached to the suction manifold of the pump.

Cone strainers are used on well installations because their smaller diameter enables them to fit down the well casing. Basket strainers are larger in diameter but shorter in height, enabling vertical turbines to use the maximum available water in a wet pit (see Exhibit I.7.2).

7.3.4.2 The suction strainer shall have a free area of at least four times the area of the suction connections, and the openings shall be sized to restrict the passage of a 0.5 in. (12.7 mm) sphere.

The openings in the strainer are sized to prevent clogging of the impeller, thus protecting the pump from potentially damaging debris in the wet pit or well.

7.3.4.3 For installations in a wet pit, this suction strainer shall be required in addition to the intake screen. *(See Figure A.7.2.2.2.)*

The suction strainer is required in addition to the intake screen because the intake screen alone could allow passage of objects with sphere sizes larger than 0.5 in. (12.7 mm). Screens serve to protect the pump from objects falling into the wet pit or biological growth that may occur in an open pond or stream. These objects may clog the impeller or suction strainer.

8.5.5* Suction Strainer.

Positive displacement pumps are more susceptible than other types of pumps to damage from debris in the pumped fluid; therefore, a strainer in the suction piping is required for all positive displacement pumps.

A.8.5.5 Strainer recommended mesh size is based on the internal pump tolerances. *(See Figure A.8.5.5 for standard mesh sizes.)*

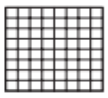
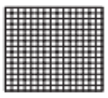
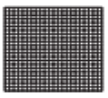
					
Mesh	20	40	60	80	100
Opening (in.)	0.034	0.015	0.0092	0.007	0.0055
Opening (μ)	860	380	230	190	140

FIGURE A.8.5.5 *Standard Mesh Sizes.*

8.5.5.1 Pumps shall be equipped with a removable and cleanable suction strainer installed at least 10 pipe diameters from the pump suction inlet.

8.5.5.2 Suction strainer pressure drop shall be calculated to ensure that sufficient NPSH is available to the pump.

See 3.3.25.1 for the definition of NPSH and the commentary following 8.2.2 for more detailed information on the term and the requirements for sufficient NPSH.

8.5.5.3 The net open area of the strainer shall be at least four times the area of the suction piping.

8.5.5.4 Strainer mesh size shall be in accordance with the pump manufacturer's recommendation.

8.5.6 Water Supply Protection. Design of the system shall include protection of potable water supplies and prevention of cross connection or contamination.

The system designer must plan for backflow prevention devices in the design of the system. Many water purveyors require protection of water supplies when chemicals such as foam/additives are used in a fire protection system. NFPA 20 permits the use of a backflow prevention device or a break tank (see Chapter 4) when water supply protection is required by local authorities.

مكونات خزان المياه Water Tank

- في حال استخدام خزان واحد لمياه الشرب ونظام الإطفاء:

خط المليء Filling Lineأو Make Up Line.

خط الفائض Over Flow Line.

خط الفحص Test Line.

خط الهواية Vent Line

خط سحب مياه التغذية Domestic Section Line.

خط سحب المضخات Fire Pump Section Line .

١) خط المليء Make-Up Water

- لو متاح تختار بمزاجك ... الجدول متاح اهو ... لكن فالغالب بيكون موجود مأخذ من تغذية المبني او مياه العمومية قد تكون أكبر او اقل من الجدول وتتوفق علي الماخذ من الشركة الرئيسية للمياة
- هتفرق فقط في وقت مليء الخزان
- يتم تركيبه فوق مستوي سطح المياة ب ٥٠ سم داخل الخزان
- يتم تركيب عليه عوامة Float Valve

٢) خط الفائض Over-Flow Line

- قطر ماسورة الفائض يكون ٣/٢ من قطر المليء معلومة لا اعرف مصدها
- يتم تركيبه فوق مستوي سطح المياه ٥ سم او ممكن تستخدم الجدول
- ويكون تحت مستوي خط الملئ

606.5.7 Tank drain pipes. A drain pipe with a valve shall be provided at the lowest point of each tank to permit emptying of the tank. The tank drain pipe shall discharge as required for overflow pipes and shall not be smaller in size than specified in Table 606.5.7.

TABLE 606.5.7
SIZE OF DRAIN PIPES FOR WATER TANKS

TANK CAPACITY (gallons)	DRAIN PIPE (inches)
Up to 750	1
751 to 1,500	$1^1/_2$
1,501 to 3,000	2
3,001 to 5,000	$2^1/_2$
5,000 to 7,500	3
Over 7,500	4

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L.

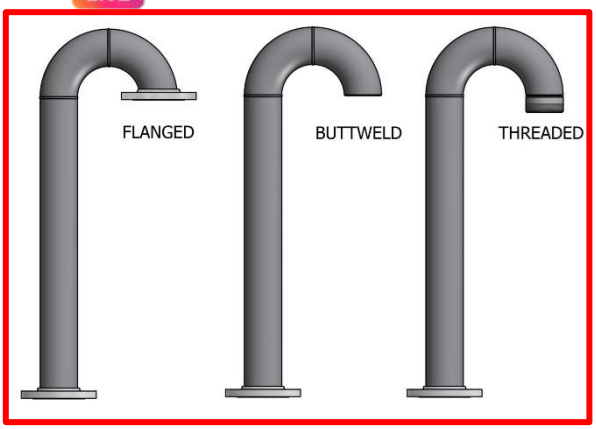
TABLE 606.5.4
SIZES FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS

MAXIMUM CAPACITY OF WATER SUPPLY LINE TO TANK (gpm)	DIAMETER OF OVERFLOW PIPE (inches)
0 – 50	2
50 – 150	$2^1/_2$
150 – 200	3
200 – 400	4
400 – 700	5
700 – 1,000	6
Over 1,000	8

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

٣) خط الهواية VENT LINE

- قطر ماسورة التهوية يكون ٣/٢ من قطر المليء
  معلومة لا اعرف مصدها
- تم تركيبه في أعلى نقطة للخزان مع كوعين متصلين Goose Neck
- لا تستخدم لو الخزان مفتوح



٤) خط الفحص Test Line

- سبق وشرحناه

٥) خط سحب مياه التغذية Domestic Section Line

- يتم السحب اعلي منسوب كمية المياة الخاصة بالحريق في الخزان
- مثال نحتاج حجم ٢٠٠ متر مكعب للحريق، وفرضا مساحة القاعدة ٥٠ متر مربع، يبقي هنحتاج ٤ متر ارتفاع من الخزان للحريق، والمياة الباقية من منسوب ٤ متر فاعلي للخدامات الاخري للتغذية والري وغيره

٦) خط سحب المضخات Fire Pump Section Line

- سبق وشرحناه

- لا يتم رمي راجع خط السحب اعلي موقع خط السحب من الخزان حتي لا يولد دوامات

١. خزان الوقود للمضخة الديزل FUEL TANK

- حجم خزان الوقود لازم يكفي لمدة ٦ ســـاعات عند تشـــغيل المضخة الديزل عند حمل للتشغيل
- حجم الخزان =

قدرة المضخة بالحصان = ١ جالون وقود + ١٠%

In addition to the requirements of NFPA 25 for engine-driven pumps, the engine should be kept clean and dry. The fuel tank should be kept at a level at least capable of running the engine for 6 hours at peak load. The crankcase oil should be checked to see that it is at the proper level, that it has not become fouled, and that it has not lost its viscosity. Additionally, the strainers in the cooling water system should be cleaned, and the specific gravity of the battery electrolyte should be checked monthly.

FAQ How is a fuel storage tank sized?

An example of how to size a fuel storage tank follows.
What is the required fuel tank capacity for a 120 hp (89.5 kW) engine driving a fire pump?

Solution: The initial calculations based on 11.4.2.1 are 1 gal/hp × 120 hp = 120 gal (5.07 L/kW × 89.5 kW × 454 L).

Total capacity is determined by adding the allowances for fuel expansion and sump to the answer obtained in the preceding equation:

120 gal + [120 gal × (5% + 5%)] = 120 gal + 12 gal = 132 gal

Or 454 L + [454 L × (5% + 5%)] = 454 L + 45.4 L = 499.4 L

Therefore, the minimum size fuel tank for a 120 hp (89.5 kW) engine driving a fire pump is 132 gal (499.4 L).

The 5 percent sump in the fuel tank is provided for any sediment or condensation that may be in the tank. By positioning the supply connection to the engine on the side of the tank at an elevation no lower than the engine fuel pump, the plumbing to the engine is always under a small head pressure. In the event of a leak, fuel will escape and be observed. This method is preferable to air being drawn in, which could result in the possible loss of engine prime, if the supply line is under negative pressure. A tank that is too high above the fuel pump can create a serious problem because a spring-loaded check valve can become overwhelmed and allow a massive amount of fuel to top load the engine. If this takes place, the engine will not start.

Also, the fuel return line should not have any valves associated with it because approximately 75 percent of the fuel is returned to the tank as it acts as a cooling medium for the fuel injectors.

٢. تهوية غرفة المضخات

11.3.2.1 Ventilation shall be provided for the following functions:

(1) To control the maximum temperature to 120°F (49°C) at the combustion air cleaner inlet with engine running at rated load
(2) To supply air for engine combustion
(3) To remove any hazardous vapors
(4) To supply and exhaust air as necessary for radiator cooling of the engine when required

11.3.2.2 The ventilation system components shall be coordinated with the engine operation.

11.3.2.3.1 The air supply ventilator shall be considered to include anything in the air supply path to the room.

11.3.2.3.2 The total air supply path to the pump room shall not restrict the flow of the air more than 0.2 in. water column (5.1 mm water column).

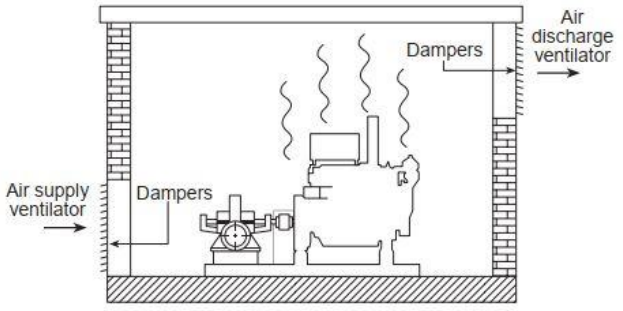
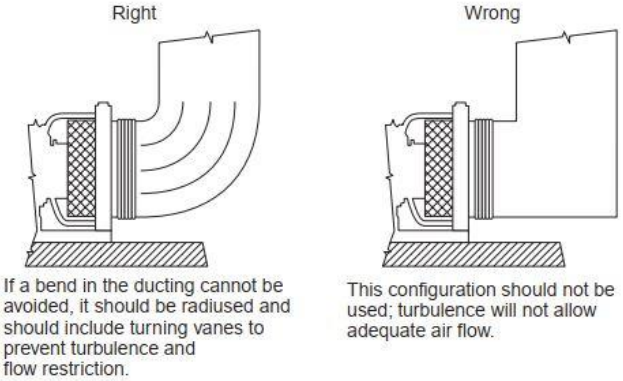


FIGURE A.11.3.2(a) Typical Ventilation System for a Heat Exchanger–Cooled Diesel-Driven Pump.



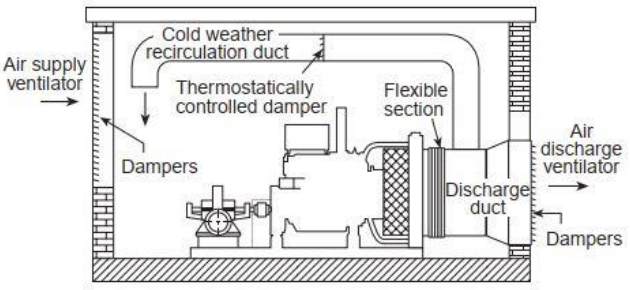


FIGURE A.11.3.2(b) Typical Ventilation System for a Radiator-Cooled Diesel-Driven Pump.

بعض الصور من الكود ربما تحتاجها

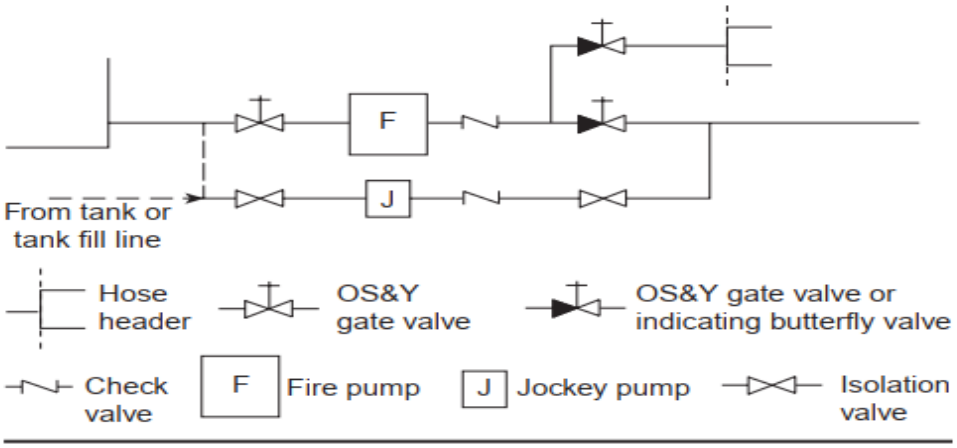


FIGURE A.4.26.6.5 *Jockey Pump Installation with Fire Pump.*

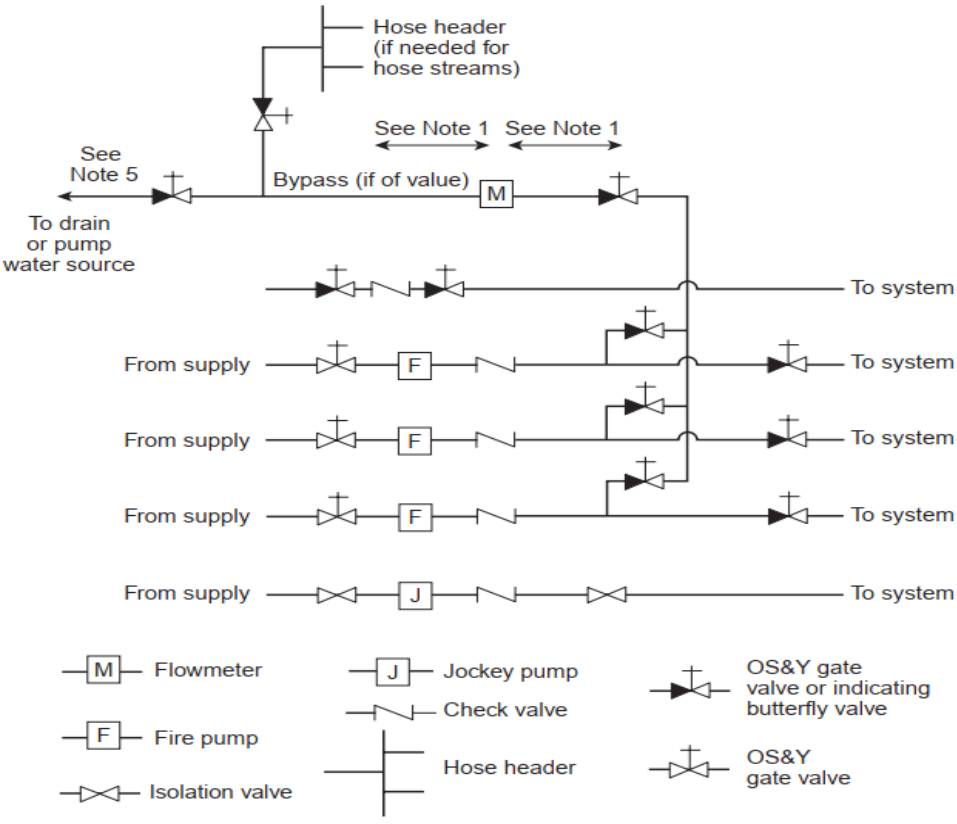
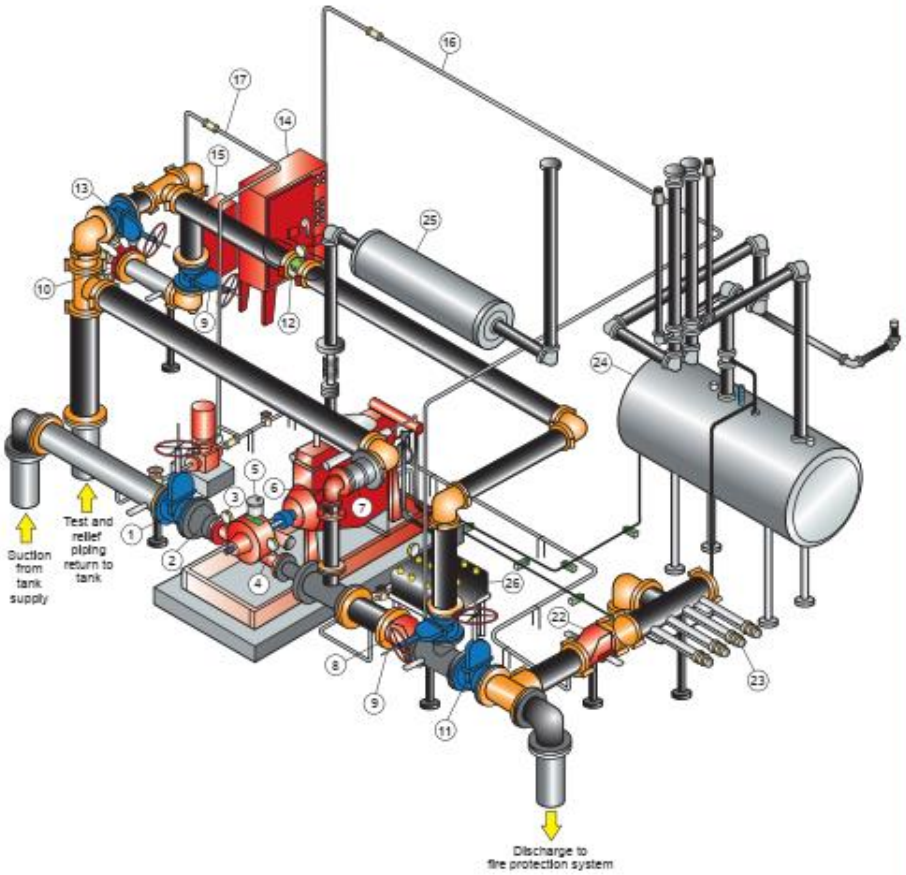


FIGURE A.4.21.1.2(a) *Preferred Arrangement for Measuring Fire Pump Water Flow with Meter for Multiple Pumps and Water Supplies. Water is permitted to discharge to a drain or to the fire pump water source. (See the text for information on the notes.)*

Diesel-Driven Horizontal Split-Case Fire Pump Assembly



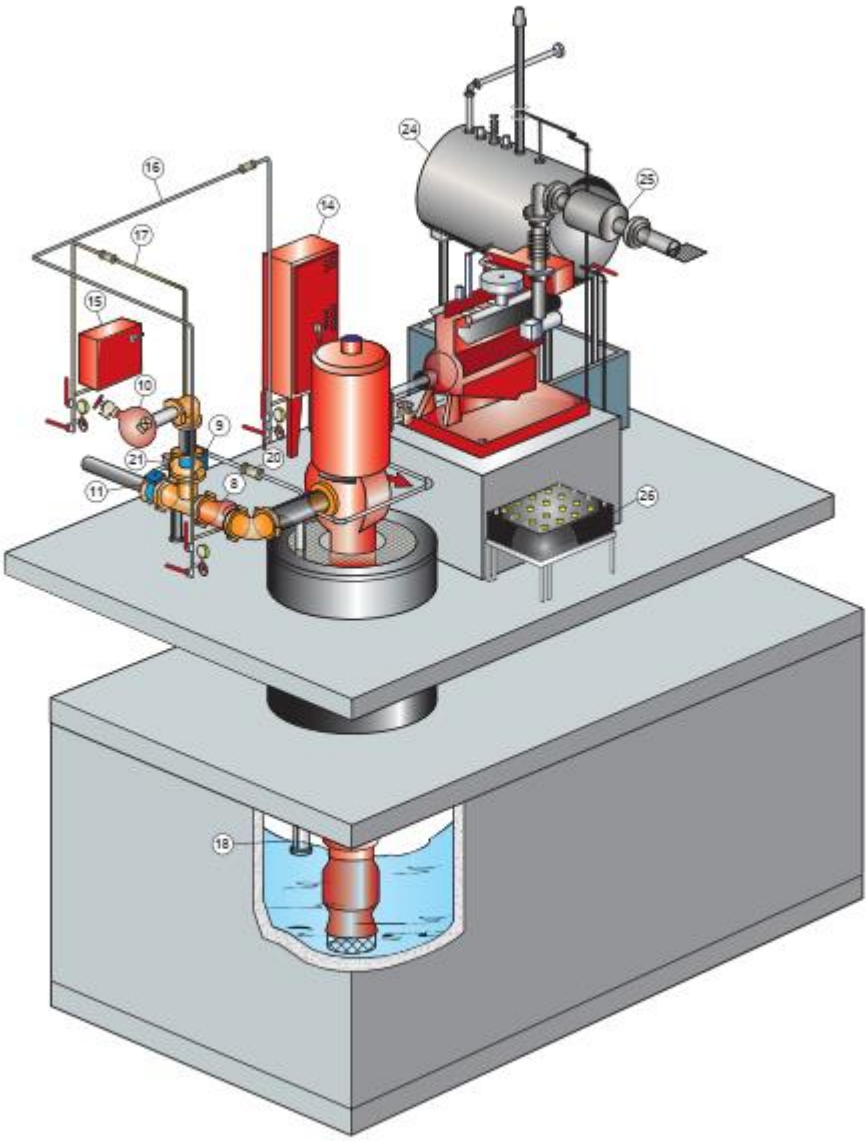
Courtesy of Stephan Laforest, Summit Sprinkler Design Services, Inc.

Stationary Fire Pumps Handbook 2016

Legend

8	Check Valve (Pump Discharge)	17	Pressure Sensing Line (Jockey Pump)
9	Indicating Gate Valve or Butterfly Valve (Test Header)	18	Submersible Pressure Maintenance Pump (Jockey Pump)
10	Test Header	20	Check Valve (Jockey Pump Discharge)
11	Indicating Gate Valve or Butterfly Valve (Discharge Control Valve)	21	Isolation Valve (Jockey Pump Discharge)
		24	Diesel Fuel Tank
14	Fire Pump Controller	25	Diesel Drive Exhaust
15	Pressure Maintenance Pump Controller (Jockey Pump)	26	Batteries
16	Pressure Sensing Line (Fire Pump)		

Diesel-Driven Vertical Turbine Fire Pump Assembly



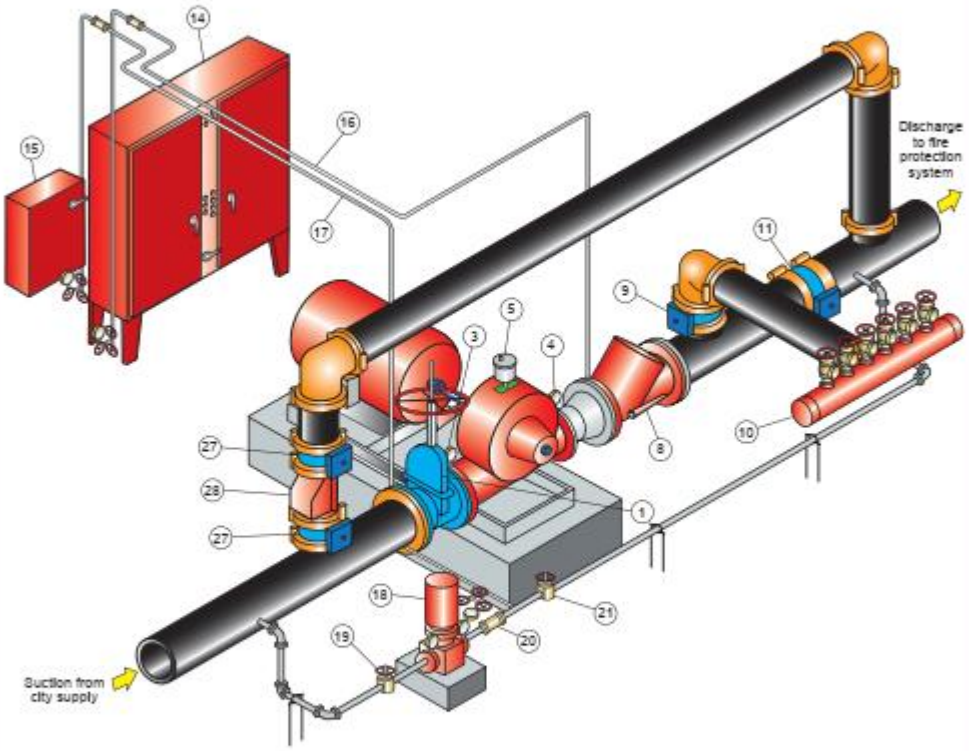
Courtesy of Stephan Laforest, Summit Sprinkler Design Services, Inc.

Stationary Fire Pumps Handbook 2016

Legend

1	OS&Y Gate Valve (Suction Control)	15	Pressure Maintenance Pump Controller (Jockey Pump)
3	Suction Pressure Gauge	16	Pressure Sensing Line (Fire Pump)
4	Discharge Pressure Gauge	17	Pressure Sensing Line (Jockey Pump)
5	Automatic Air Release	18	Pressure Maintenance Pump (Jockey Pump)
8	Check Valve (Pump Discharge)	19	Isolation Valve (Jockey Pump Suction)
9	Indicating Gate Valve or Butterfly Valve (Test Header)	20	Check Valve (Jockey Pump Discharge)
10	Test Header	21	Isolation Valve (Jockey Pump Discharge)
11	Indicating Gate Valve or Butterfly Valve (Discharge Control Valve)	27	Indicating Gate Valve or Butterfly Valve (Bypass)
14	Fire Pump Controller	28	Check Valve (Bypass)

Electric Motor–Driven Horizontal Split-Case Fire Pump Assembly



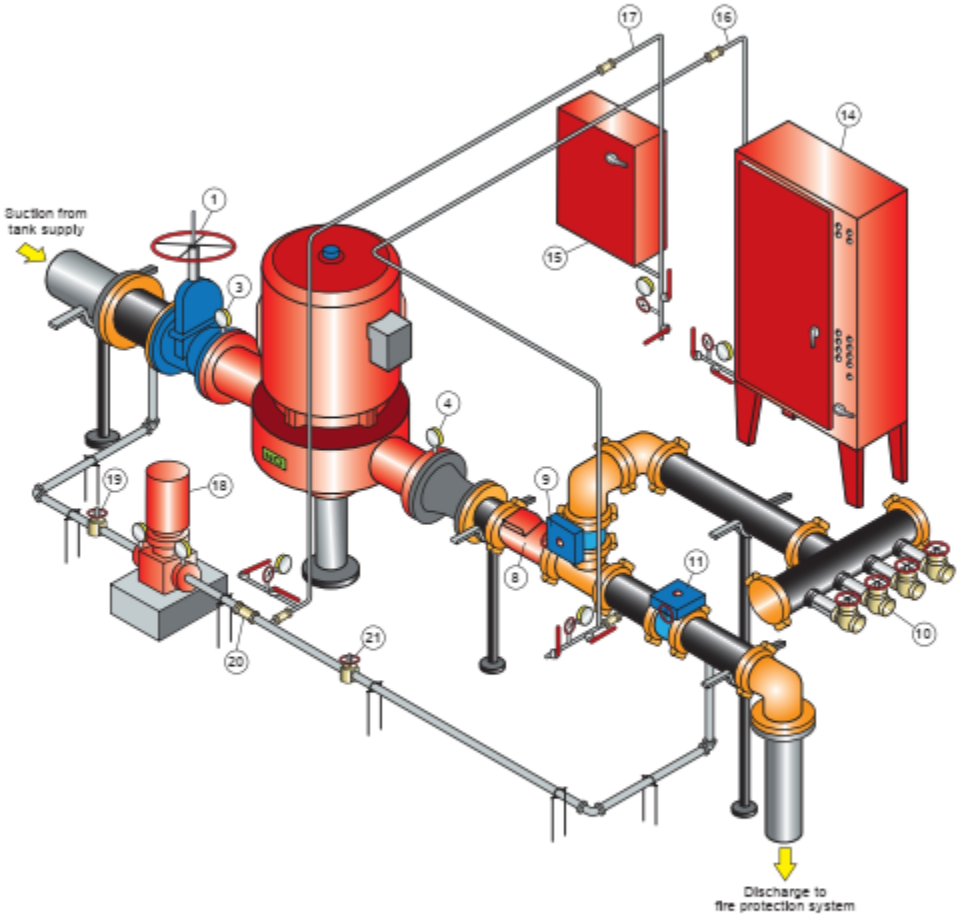
Courtesy of Stephan Laforest, Summit Sprinkler Design Services, Inc.

Stationary Fire Pumps Handbook 2016

Legend

1	OS&Y Gate Valve (Suction Control Valve)	15	Pressure Maintenance Pump Controller (Jockey Pump)
3	Suction Pressure Gauge	16	Pressure Sensing Line (Fire Pump)
4	Discharge Pressure Gauge	17	Pressure Sensing Line (Jockey Pump)
8	Check Valve (Pump Discharge)	18	Pressure Maintenance Pump (Jockey Pump)
9	Indicating Gate Valve or Butterfly Valve (Test Header)	19	Isolation Valve (Jockey Pump Suction)
10	Test Header	20	Check Valve (Jockey Pump Discharge)
11	Indicating Gate Valve or Butterfly Valve (Discharge Control Valve)	21	Isolation Valve (Jockey Pump Discharge)
14	Fire Pump Controller		

Electric-Driven Vertical Inline Fire Pump Assembly



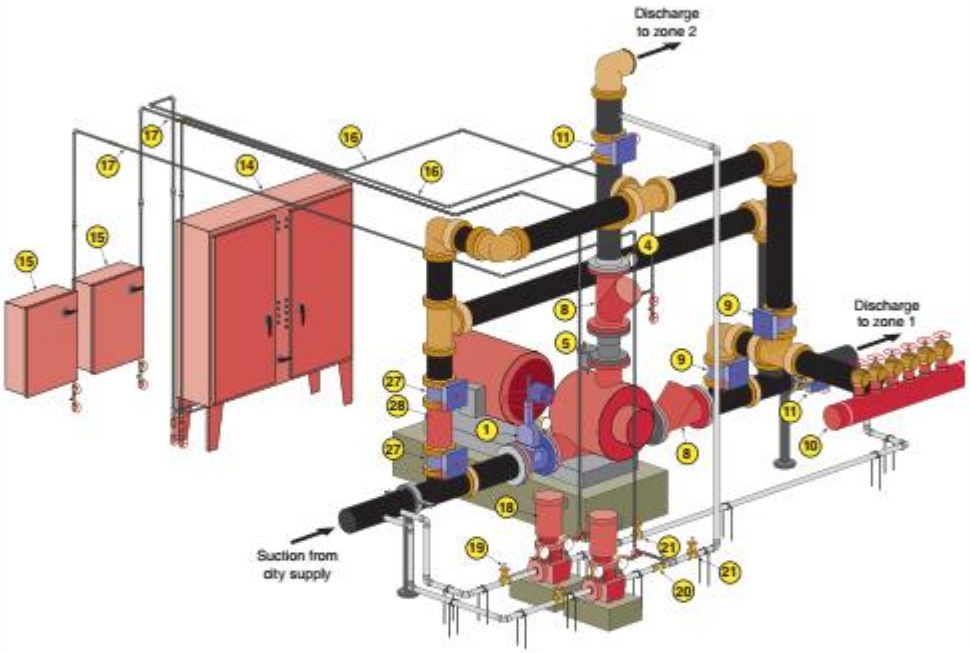
Courtesy of Stephan Laforest, Summit Sprinkler Design Services, Inc.

Stationary Fire Pumps Handbook 2016

Legend

1	OS&Y Gate Valve (Suction Control)	16	Pressure Sensing Line (Fire Pump)
5	Automatic Air Release	17	Pressure Sensing Line (Jockey Pump)
8	Check Valve (Pump Discharge)	18	Pressure Maintenance Pump (Jockey Pump)
9	Indicating Gate Valve or Butterfly Valve (Test Header)	19	Isolation Valve (Jockey Pump Suction)
10	Test Header	20	Check Valve (Jockey Pump Discharge)
11	Indicating Gate Valve or Butterfly Valve (Discharge Control Valve)	21	Isolation Valve (Jockey Pump Discharge)
14	Fire Pump Controller	27	Indicating Gate Valve or Butterfly Valve (Bypass)
15	Pressure Maintenance Pump Controller (Jockey Pump)	28	Check Valve (Bypass)

Electric Motor–Driven Multistage Multiport Fire Pump Assembly



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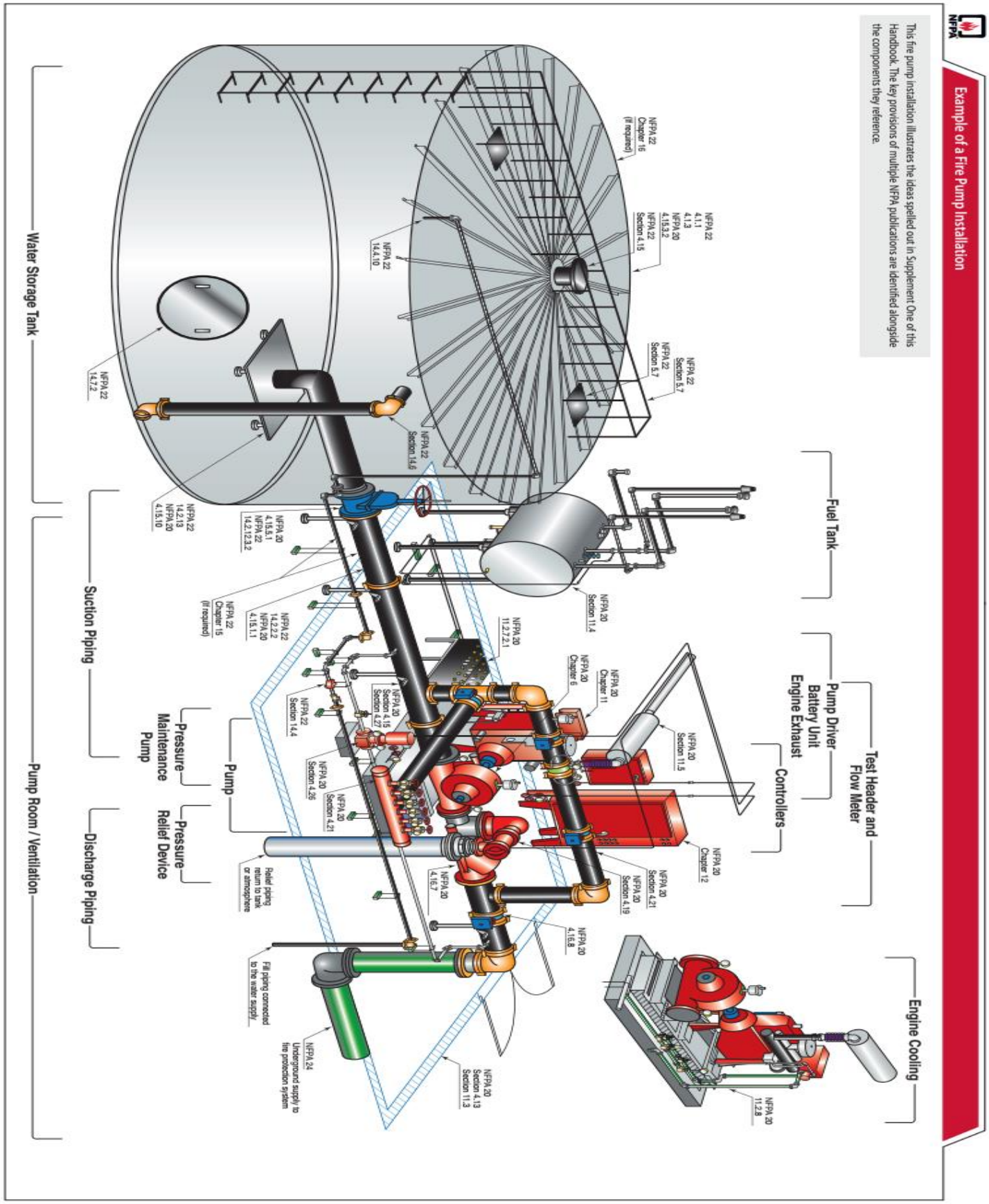

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هذا ما وفقني اليه ربي

اللهم اجعل هذا العمل خالصا لوجهك الكريم

تحت امرك في اي استفسار في مجال MEP في اي وقت

السؤال غير مقتصر علي الحريق فقط

لا يتم استخدام هذا الملف باي وسيلة للتربح المادي

غرفة المضخات النسخة الاولي

كتبه مهندس احمد رضوان ٢٠٢٣