The Arab Contractors

OSMAN AHMED OSMAN & Co.

Electromechanical Sector
Department Of Consulting Engineering &
Technical Electro-Mechanic Services

المقاولون العرب

عثمان أحمد عثمان وشركاه

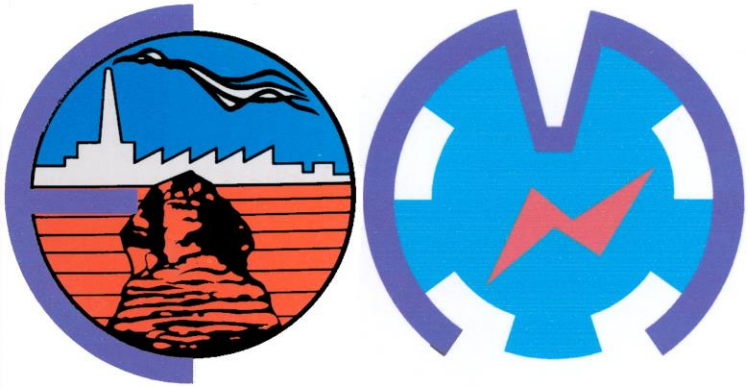
قطاع الأعمال الكهروميكانيكية

إدارة الاستشارات والتصميمات

والخدمات الفنية للأعمال الكهروميكانيكية

مكافحة الحريق

FIRE FIGHTING



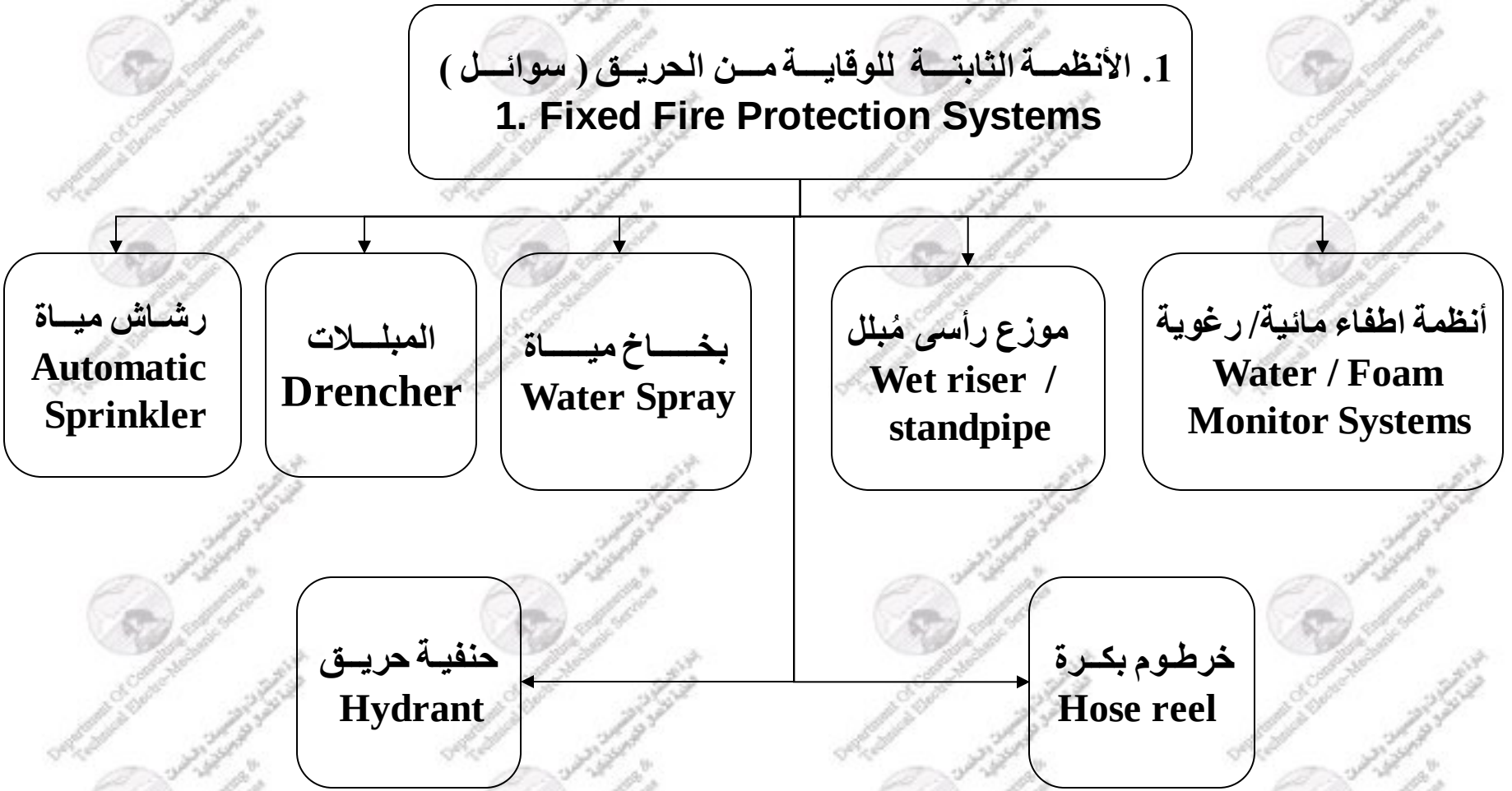
CONTENTS المحتويـــات

1. Fixed Fire Protection Systems- Liquids.
2. Pump Types Used In Fire Fixed Protection Systems.
3. Fire Suppression with Gaseous Clean Agents.
4. Dry Chemical Powders.
5. Foams.
6. Case Study.
7. Fire Alarm Standards, samples

1. الأنظمة الثابتة للوقاية من الحريق - سوائل
2. أنـــواع المضخات المستخدمـــة فى أنظمة الوقايـــة مـــن الحريق.
3. إخماد الحـريق بالمـــواد الغازيـــة النظيفـة (صديقة البيئة)
4. البـــودرة الكيمائيـــة الجافـــة.
5. الرغويـــــــــات
6. حالـــــة دراسيـــــة
7. بعـــض المواصفـــات القياسيـــة لنظـــم الإطفـــاء

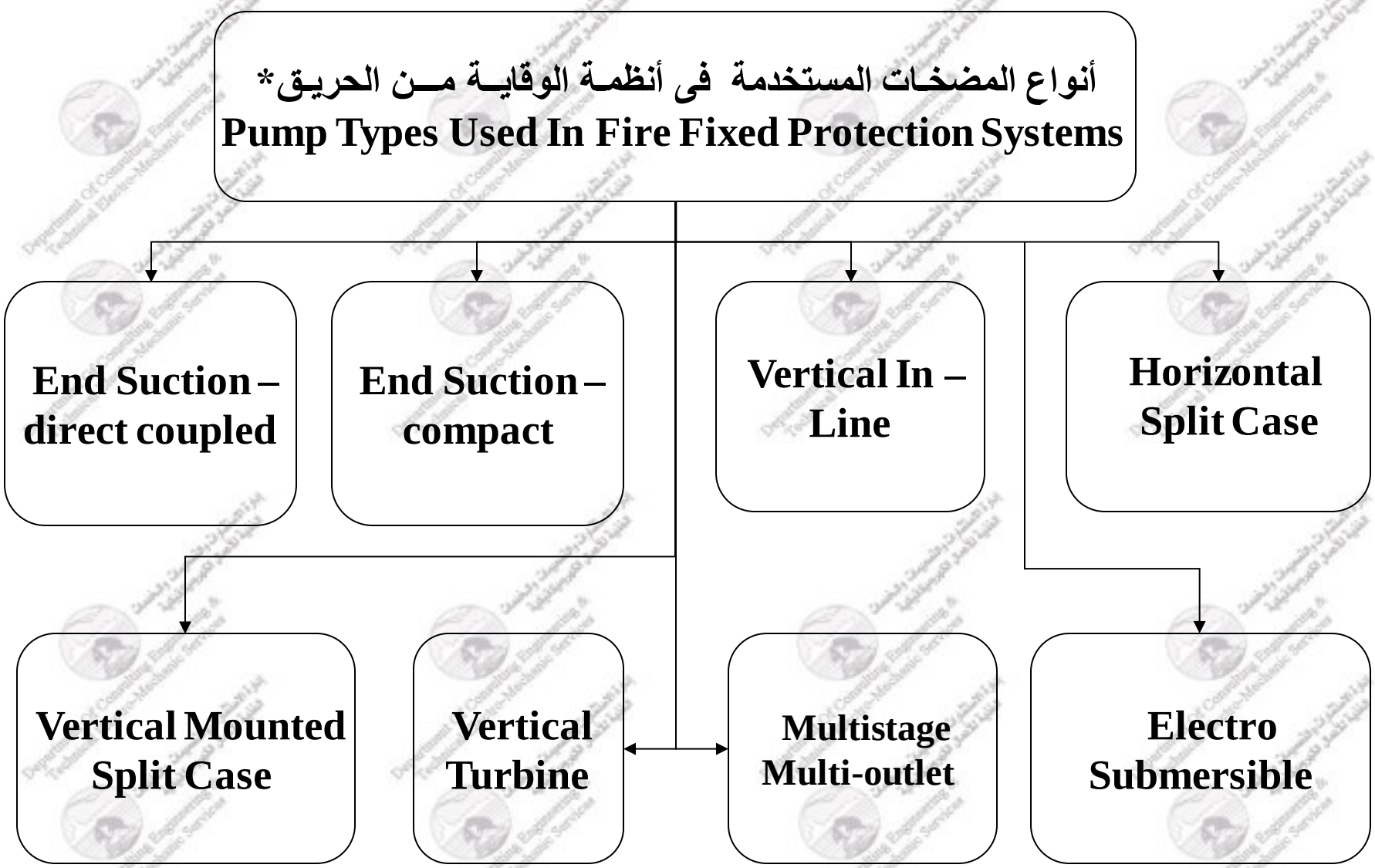
1. الأنظمــة الثابتــة للوقايــة مــن الحريــق (سوائــل)

1. Fixed Fire Protection Systems


1. الأنظمة الثابتة للوقاية من الحريق (سوائل)
1. Fixed Fire Protection Systems
رشاش مياة
Automatic Sprinkler
المبللات
Drencher
بخاخ مياة
Water Spray
موزع رأسى مُبلل
Wet riser / standpipe
أنظمة اطفاء مائية/ رغوية
Water / Foam Monitor Systems
حنفية حريق
Hydrant
خرطوم بكرة
Hose reel

2. أنواع المضخات المستخدمة فى أنظمة الوقاية من الحريق

2. Pump Types Used In Fire Protection Systems


أنواع المضخات المستخدمة فى أنظمة الوقاية من الحريق*
Pump Types Used In Fire Fixed Protection Systems
End Suction – direct coupled
End Suction – compact
Vertical In – Line
Horizontal Split Case
Vertical Mounted Split Case
Vertical Turbine
Multistage Multi-outlet
Electro Submersible

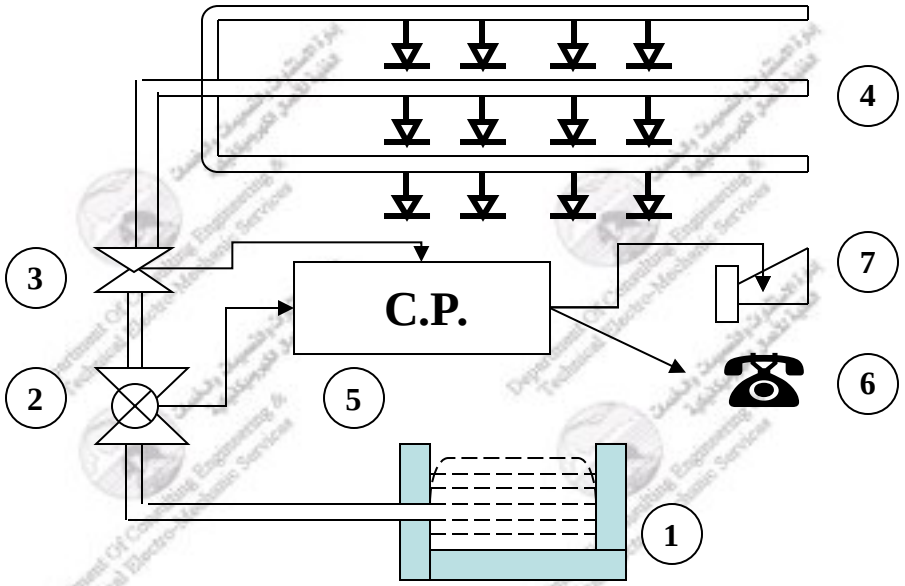
Fixed Fire Extinguishing System

WATER EXTINGUISHING INSTALLATIONS: -

SPRINKLER SYSTEMS: -

Typical Installations:

- **High rise buildings**
- **Large sales rooms, e.g. department stores**
- **Warehouses and factories with large fire loads**
- **Unprotected steel building structures**
- **Underground garages**

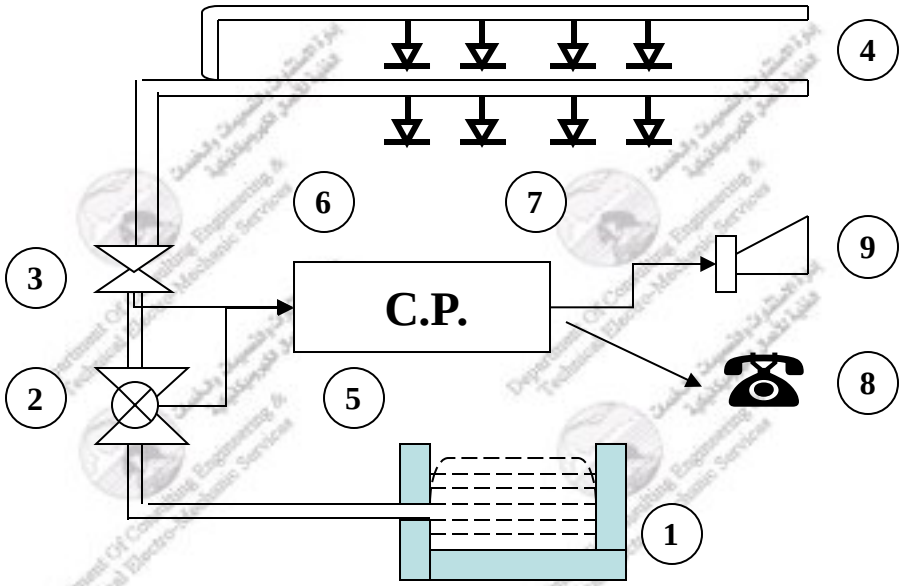


1. **Water supply**
2. **Control valve (monitored)**
3. **Valve station**
4. **Pipe network with sprinkler heads**
5. **Alarm transmission**
6. **External Alarm**
7. **Audible Alarm**

Deluge system / Water Curtain

A deluge system is suitable where early and rapid extinguishing with large quantities is essential. Possible applications are: -

- Wood chip silos
- Overload decks with doors that are not fire resistive
- Paint shops
- Water curtains for sectioning-off fire compartments
- Tanks used for storage of combustible liquids
- Transformers
- Cable ducts



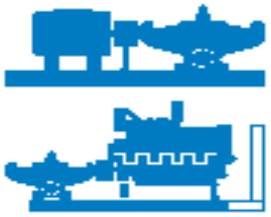
1. Water supply
2. Control valve (monitored)
3. Quick opening valve
4. Pipe network with sprinkler nozzles
5. Manual call point
6. Automatic fire detector
7. Control Panel
8. Remote Alarm
9. Audible Alarm

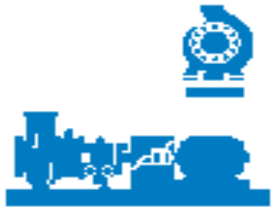
أنـواع المضخـات المستخدمـة فى أنظمـة الوقايـة مـن الحريـق

Pump Types Used In Fire Fixed Protection Systems

	 Vertical Industrial and Process Pumps	 Axial and Mixed Flow Pumps for Large Volume Pumping	 Encased (Can Type) Water and Process Liquid Pumps	 Vertical Turbine Pumps for Water Supply from Drilled Wells
Type	Vertical close coupled single or multi-stage turbine pumps.	Vertical pumps for handling water in large volumes. Mixed flow types, in single and multi-stage designs and propeller types (axial flow).	Vertical lineshaft multi-stage close coupled pumps with pumping unit encased. Excellent for low NPSH conditions.	Vertical lineshaft deep well pumps. Options of oil lubrication or water lubrication, underground or surface discharge. Column size 2 $^{1}/_{2}$" to 24".
Capacities	Up to 150,000 gpm (34,091 m^3/hr)	Up to 220,000 gpm (50,000 m^3/hr)	Up to 150,000 gpm (34,091 m^3/hr)	Up to 10,000 gpm (2,273 m^3/hr)
Head	Up to 2,300 feet (701 meters)	Up to 100 feet (30 meters)	Up to 6,930 feet (2,112 meters)	Up to 2,500 feet (760 meters)
Pressure	To fit the application.	To fit the application.	To fit the application.	Up to 1,500 feet (457 meters)
Horsepower	Up to 5,000 hp (3,730 kW)	Up to 5,000 hp (3,730 kW)	Up to 5,000 hp (3,730 kW)	Up to 5,000 hp (3,730 kW)
Drives	Vertical electric motors, engines with right angle gears, combination gear drives, or vertical motors and variable speed drives.	Vertical electric motors, engines with right angle gears, combination gear drives, or vertical motors and variable speed drives.	Vertical electric motors, engines with right angle gears, combination gear drives, or vertical motors and variable speed drives.	Vertical electric motors, engines with right angle gears, combination gear drives, or vertical motors and variable speed drives.
Liquids Pumped	Water, hydrocarbons, volatile liquids, and chemical solutions.	Water, fresh or sea.	Water, hydrocarbons, condensate and volatile liquids.	Water and clear liquids.
Temperature	Up to 450°F (232°C)	Up to 140°F (60°C)	Up to 450°F (232°C)	Up to 180°F (82°C)

	 Vertical Submersible Pumps	 Vertical Pre-Engineered Booster Pumps	 Industrial Sump Pumps	 Vertical Fire Pumps UL Listed, ULC Listed and FM Approved.
Type	Vertical deep well pumps with submerged motor.	Pre-engineered, close-coupled vertical turbine pumps with fabricated steel suction barrels. Packing or mechanical seals.	Heavy duty industrial sump pumps with interchangeability with the 8196 ANSI pump's wet ends. Series 8196 VSP.	Vertical turbine pumps with appropriate fittings for providing water supply to fire protection systems in buildings, plants and yards.
Capacities	Up to 8,000 gpm (1,818 m^3/hr)	80 to 500 gpm (18 to 114 m^3/hr)	30 to 1,600 gpm (7 to 365 m^3/hr)	250 to 5,000 gpm (57 to 1,136 m^3/hr)
Head	Up to 1,000 feet (305 meters)	69 to 474 feet (21 to 145 meters)	15 to 310 feet (5 to 95 meters)	92 to 1,176 feet (28 to 359 meters)
Pressure	To fit the application.	Up to 400 psi (28 kg/cm^2, 2,758 kPa)	To 20 feet sump depth in 6 inch increments.	To fit the application.
Horsepower	Up to 500 hp (373 kW)	Up to 100 hp (75 kW)	Up to 60 hp (45 kW)	Up to 600 hp (448 kW)
Drives	Submersible electric motors.	Vertical electric motors.	NEMA C faced electric motors, drip-proof and chemical and mill duty enclosures.	Vertical electric motors and diesel engines with right angle gears.
Liquids Pumped	Water and clear liquids.	Water.	Chemical and most process.	Water.
Temperature	Ambient within the limits for satisfactory equipment operation.	Up to 115°F (46°C)	Up to 180°F (82°C)	Up to 115°F (46°C)

	 Horizontal Fire Pumps, UL Listed, ULC Listed and FM Approved	 In-Line Fire Pumps, UL and ULC Listed	 End Suction Fire Pumps, UL Listed and FM Approved	 Horizontal Split Case Single Stage Pumps
Type	Horizontal centrifugal pumps with appropriate fittings for providing water supply to fire protection systems in buildings, plants and yards. Types AF, ABF, AEF, TUF, TUTF.	Compact in-line centrifugal fire pumps with appropriate fittings for providing water supply to fire protection systems in buildings, plants and yards. Type PVF.	End suction centrifugal fire pumps with appropriate fittings for providing water supply to fire protection systems in buildings, plants and yards. Type UNF.	Horizontal split case single stage centrifugal pumps. Packed and sealed types. 2" to 24" discharge sizes. Types A, AE, BT.
Capacities	250 to 5,000 gpm (57 to 1,136 m^3/hr)	50 to 500 gpm (11 to 114 m^3/hr)	Up to 500 gpm (114 m^3/hr)	Up to 25,000 gpm (5,682 m^3/hr)
Head	92 to 630 feet (28 to 192 meters)	Up to 406 feet (123 meters)	Up to 340 feet (104 meters)	Up to 660 feet (201 meters)
Pressure	Up to 640 psi (45 kg/cm^2, 4,414 kPa)	Up to 175 psi (12 kg/cm^2, 1,207 kPa)	Up to 147 psi (10 kg/cm^2, 1,014 kPa)	Up to 400 psi (28 kg/cm^2, 2,758 kPa)
Horsepower	Up to 800 hp (597 kW)	Up to 75 hp (56 kW)	Up to 75 hp (56 kW)	Up to 1,500 hp (1,119 kW)
Drives	Horizontal electric motors and diesel engines.	Vertical close coupled electric motors.	Horizontal electric motors and diesel engines.	Electric motors, diesel engines, steam turbines, combinations.
Liquids Pumped	Water.	Water.	Water.	Water and clear liquids.
Temperature	Ambient within the limits for satisfactory equipment operation.	Ambient within the limits for satisfactory equipment operation.	Ambient within the limits for satisfactory equipment operation.	Up to 300°F (149°C)

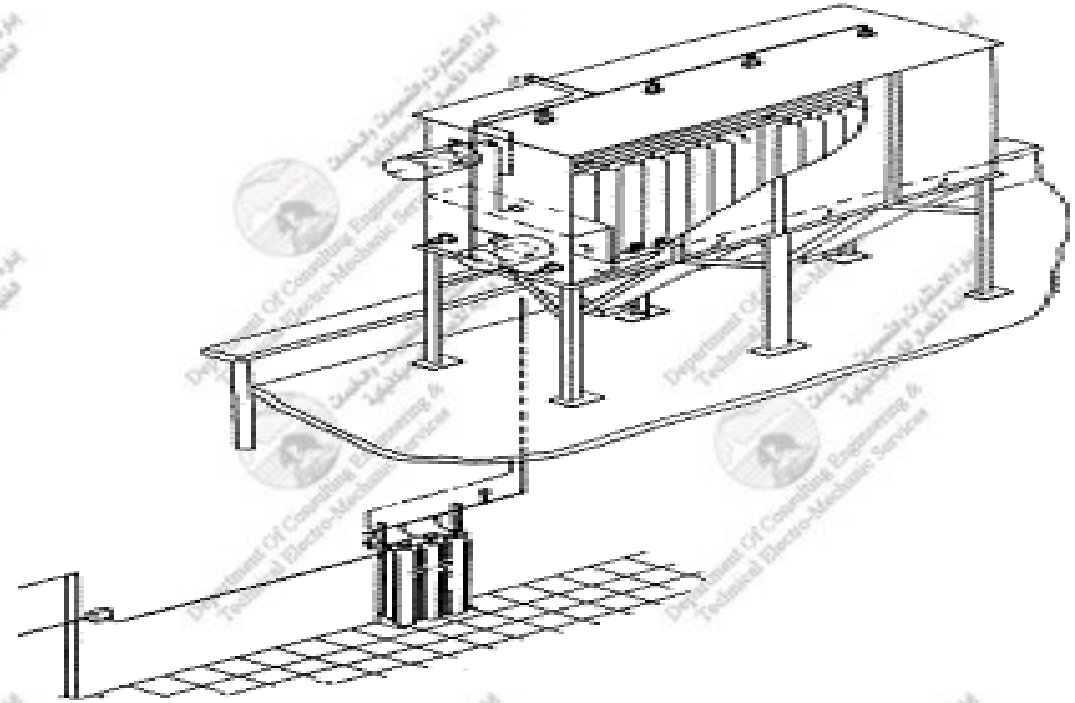
	 Horizontal Split Case Multi-Stage Pumps	 ANSI/ASME Standard Pumps	 Heavy Duty, Industrial, Paper Stock, Slurry Pumps	 Self-Priming Industrial Pumps
Type	Horizontal split case multi-stage centrifugal pumps. Packed and sealed types. Types TU, TUT.	Standard ANSI/ASME configuration, back pullout, heavy duty, industrial, process pumps. Packed and sealed types. Model 8196.	Heavy duty, industrial, paper stock process pumps. Packed and sealed types. Model 8175.	Integral self-priming pumps. Packed and sealed types. Model 8796.
Capacities	Up to 4,500 gpm (1,023 m^3/hr)	Up to 4,500 gpm (1,023 m^3/hr)	Up to 21,000 gpm (4,823 m^3/hr)	Up to 700 gpm (159 m^3/hr)
Head	Up to 1,600 feet (488 meters)	Up to 730 feet (222 meters)	Up to 350 feet (107 meters)	Up to 420 feet (128 meters)
Pressure	Up to 700 psi (49 kg/cm^2, 4,827 kPa)	From full vacuum to 375 psi (26 kg/cm^2, 2,586 kPa)	Up to 285 psi (20 kg/cm^2, 1,965 kPa)	Suction lift to 20 feet (6 meters)
Horsepower	Up to 800 hp (597 kW)	Up to 300 hp (224 kW)	Up to 750 hp (560 kW)	Up to 60 hp (45 kW)
Drives	Electric motors, diesel engines, steam turbines, combinations.	Electric motors, steam turbines and variable speed diesel engines.	Electric motors, steam turbines and variable speed diesel engines.	Electric motors, steam turbines and variable speed diesel engines.
Liquids Pumped	Water and clear liquids.	Chemical, pulp and paper, and all process.	Chemical, pulp and paper, and all process.	Clean liquid sumps, chemical transfers and petroleum transfers.
Temperature	Up to 300°F (149°C)	From -90°F to 500°F (-68°C to 260°C)	Up to 450°F (232°C)	Up to 500°F (260°C)

3. إخمـــاد الحـريق بالمـــواد الغازيـــة النظيفـة (صديقة البيئة)

3. Fire Suppression with Gaseous Clean Agents

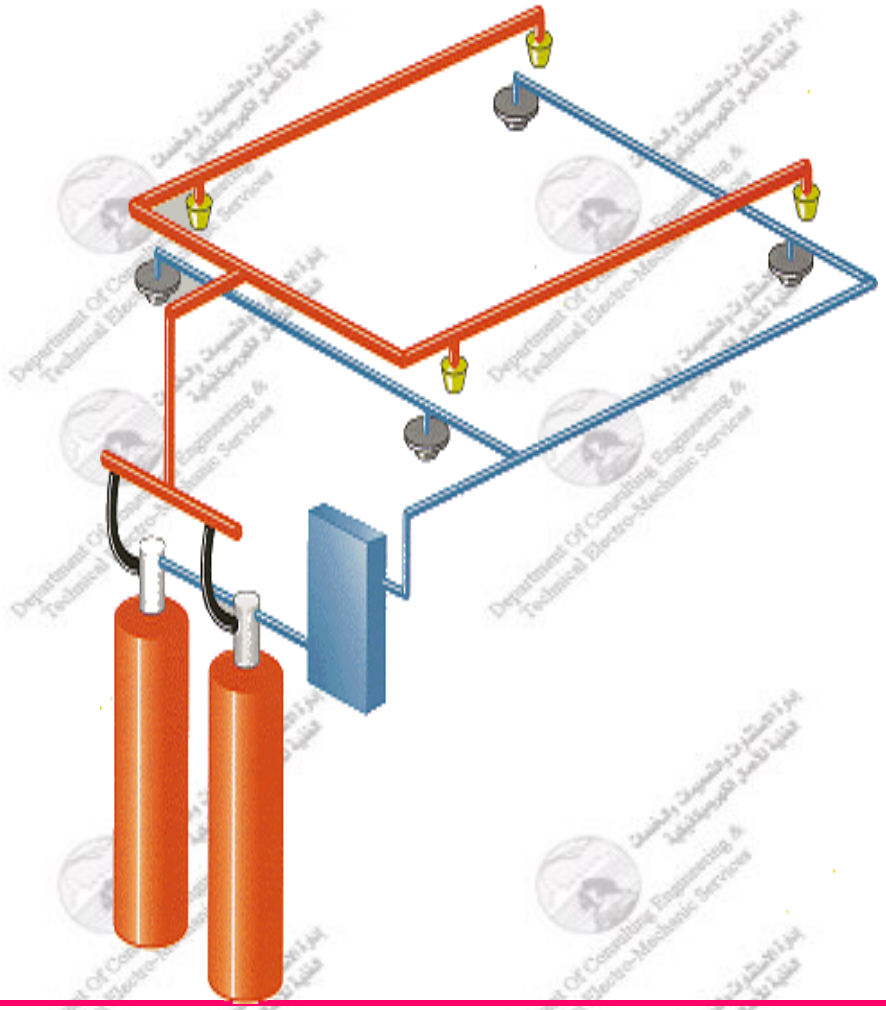
FM-200 is one of the new halon alternative agents now in use to protect essential applications traditionally protected by Halon 1301. This agent has many similar characteristics to Halon 1301 and is safe in normally occupied areas.

FM-200 systems are available in spheres or cylinders and can be designed as pre-engineered or more commonly, as engineered systems.



Carbon Dioxide Fire Suppression Systems

Clean agent carbon dioxide systems, have been an industry standard for many decades and are still the preferred agent in many applications. There are several common local application systems which are utilized to extinguish fires in dip tanks, quench tanks and industrial operations where spilled fuel is a possibility. Local application systems are also popular in the marine market, especially in engine compartments. Low pressure total flood systems are prevalent in steel manufacturing, press operations and other areas requiring large quantities of extinguishing agent.

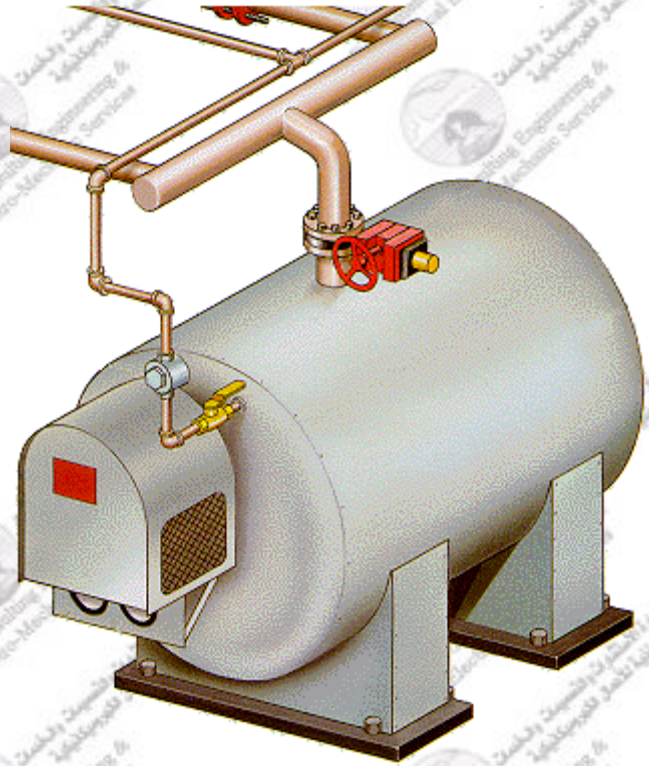


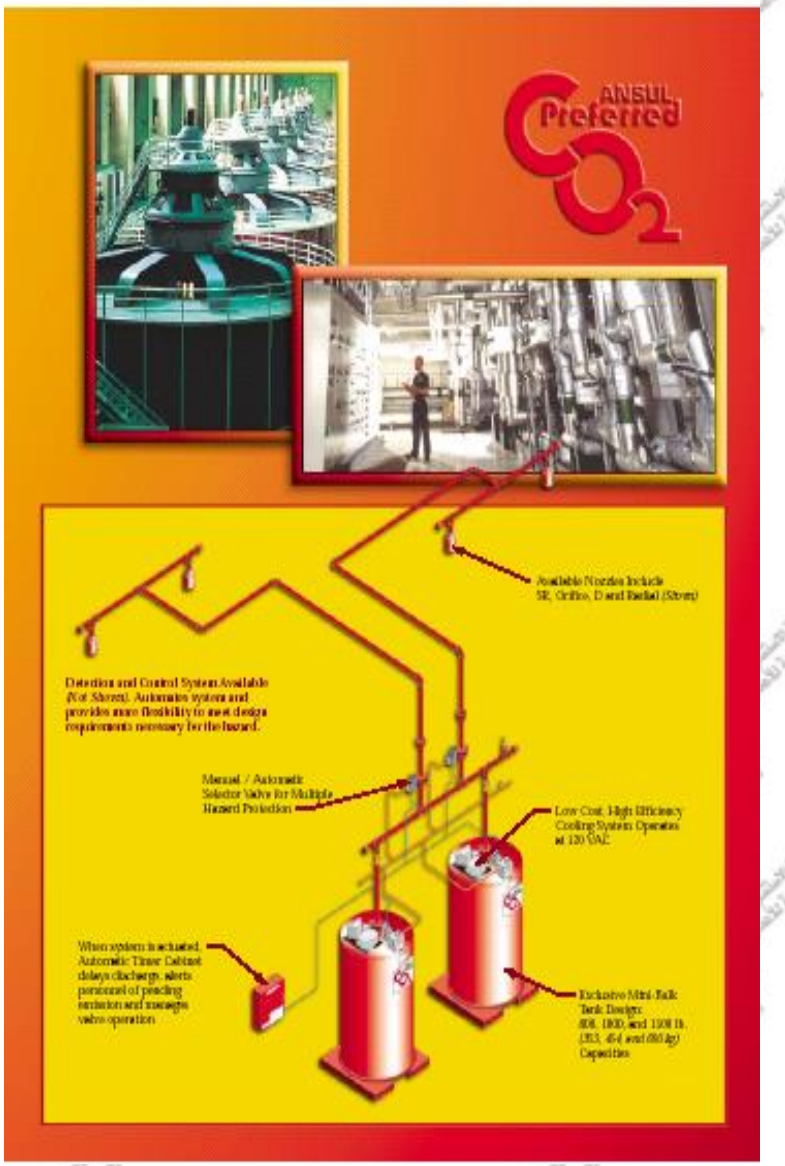
شبكة توزيع غاز CO_2 للإطفاء بطريقة الإغراق

CO_2 Total Flood Distribution Network

خزان غاز CO_2 ذو ضغط منخفض

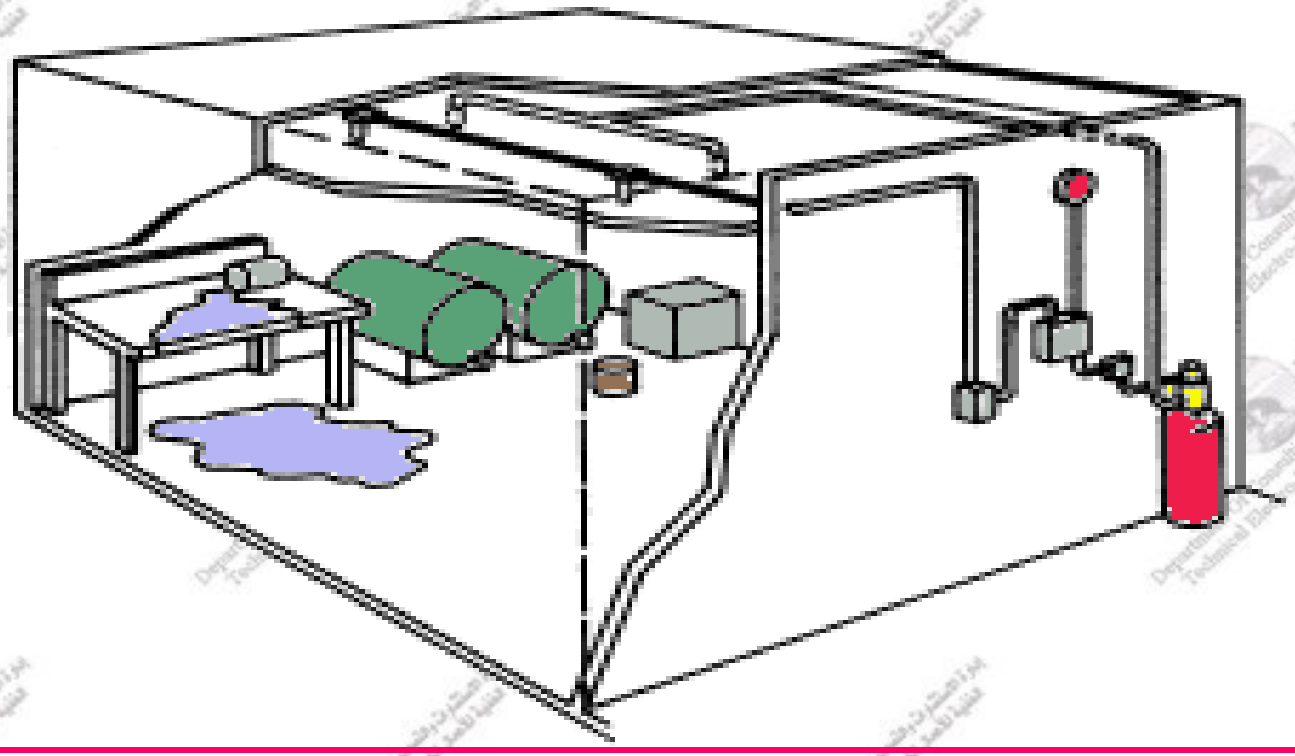
Low Pressure CO_2 Tank




ANSUL
Preferred
CO_2
Available Nozzles Include SR, Griffin, D and Radial (Shown)
Detection and Control System Available (Not Shown). Automates system and provides more flexibility to meet design requirements necessary for the hazard.
Manual / Automatic Selector Valve for Multiple Hazard Protection
Low Cost, High Efficiency Cooling System Operates at 120 VAC
When system is actuated, Automatic Timer Cabinet delays discharge, alerts personnel of pending evacuation and manages valve operation
Exclusive Mini-Bulk Tank Design: 808, 1800, and 1908 lb. (363, 454 and 865 kg) Capacities

Inergen is another new alternative agents replacing traditional **Halon 1301** areas. Inergen is a high pressure agent and is stored in cylinders similar to Carbon Dioxide. This agent is comprised of three naturally occurring gases - Nitrogen, Argon and Carbon Dioxide.

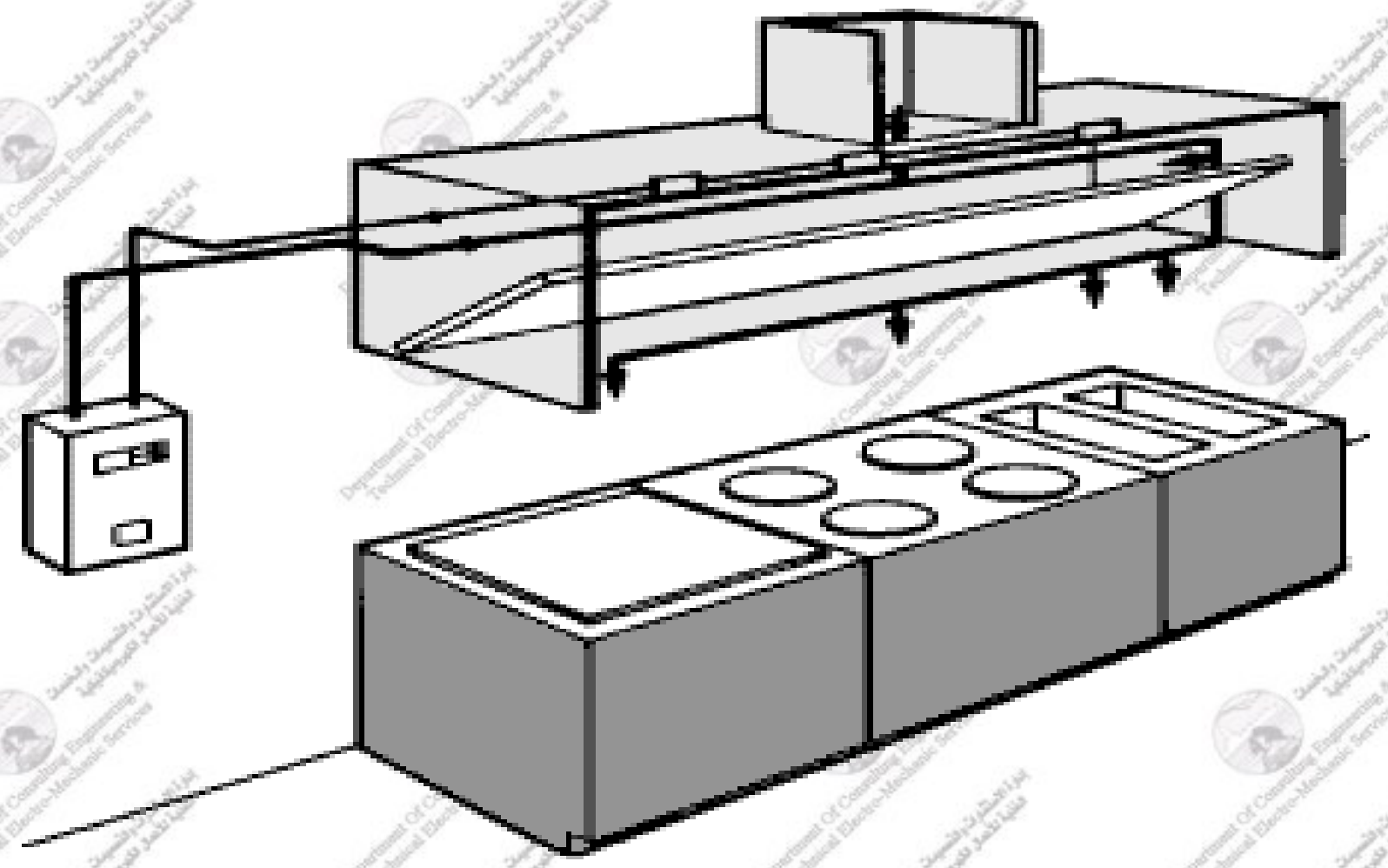
The system is laid out with a central bank of cylinders manifolded together and the agent is dispersed through a pressure reducer and a piping system



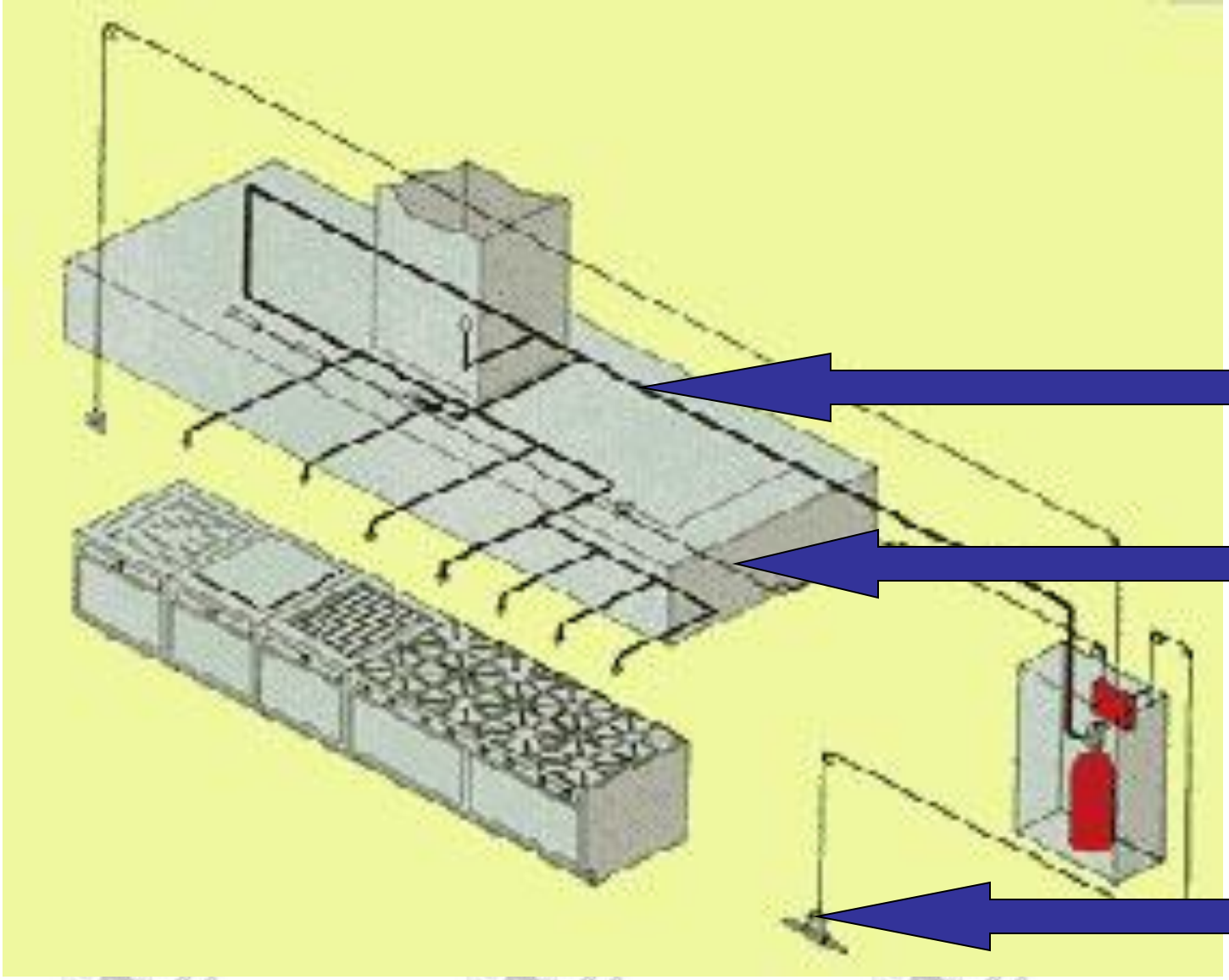
Industrial Systems

Industrial Systems are commonly installed for the protection of paint spray booths, dip tanks, pumps, and other industrial equipment. Most systems of this type feature either Purple-K dry chemical, ABC dry chemical, or regular dry chemical.

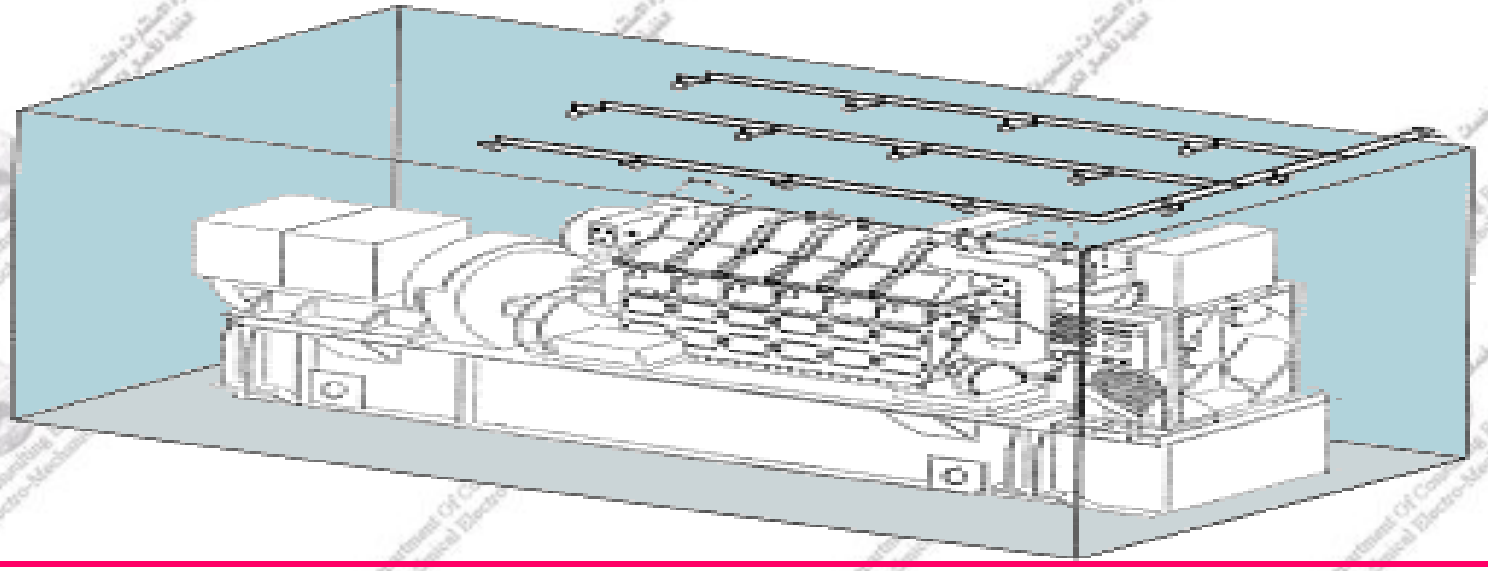
Industrial systems are often combined with different kinds of fire detection--heat detectors, optical flame detectors, or smoke detectors



Restaurant System النظـام المستخـدم بالمطاعـم

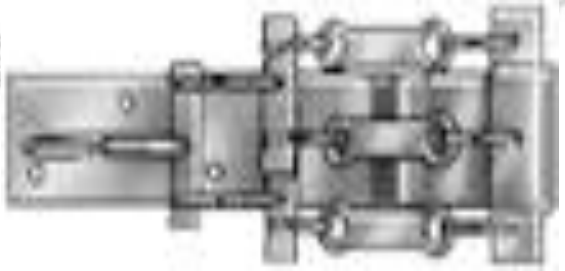


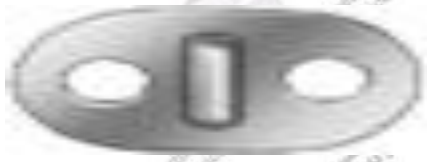
الكاشف الهيدروليكي / أنبوب الإطفاء مثبت أعلى معدات الطبخ & المدخنة



Water Mist Fire Suppression Systems

Fine water mist systems extinguish fires primarily by removing heat from the materials involved in the combustion process. Water is applied to the fire in very fine droplets which appear to the observer as a dense fog. The ratio of droplet surface area to water volume is large and conversion to steam occurs very efficiently. The latent heat of vaporization, which is a physical phenomena associated with the change of state of water to a gas (steam), removes many BTUs of heat from the fire and the steam produced also helps to smother the fire by displacing oxygen in the vicinity of the fire.





Listed Fusible Links **وصـلات حـراريـة قياسيـــة**

FIRE ALARM DETECTORS كاشفـــات الحريـــق

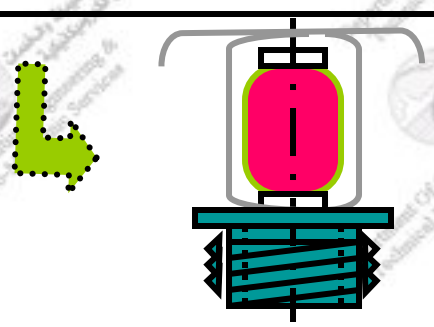
MECHANICAL DETECTOR كاشــف ميكانيكــي

تبخـــر سائـــل

A LIQUID EVAPORATION

رشاشـــات مـــاء ... الخ

Water, ... Sprinklers

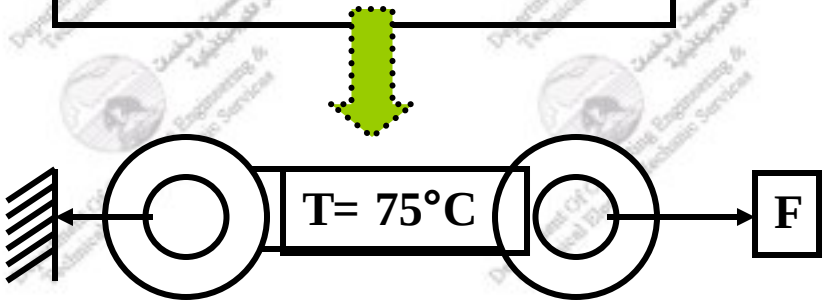


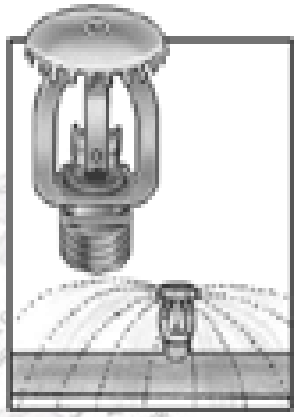
انصهـــار/ تمدد جسـم صلـــب

A SOLID BODY MELTING / EXPANSION

وصلـــة حراريـــة

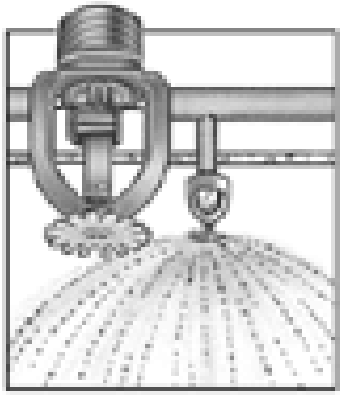
Thermal Link





Upright رأســى

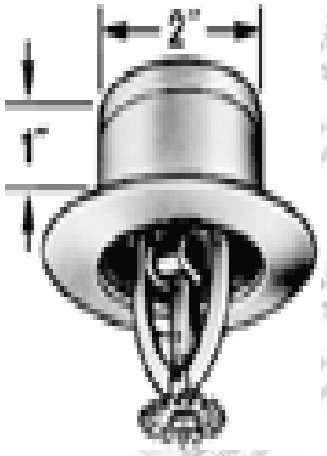
Concealed مغطــى



Pendent معلــــق

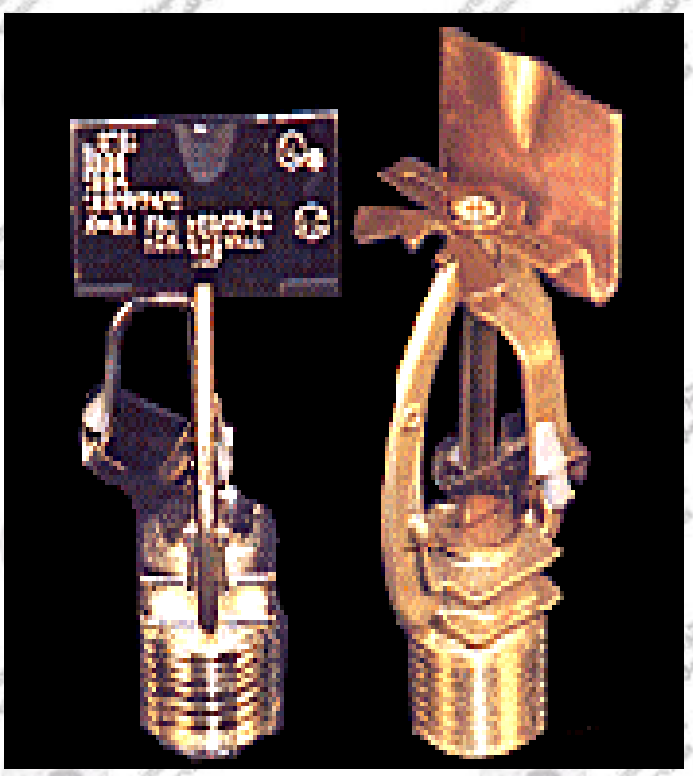
سريــع الإستجابــة
Quick-Response

رشاشـــــات مـــــاء
Water, ... Sprinklers



Recessed غاطــس

Sprinklers رشاشـــات الميـــاة



نظـــــام الإطفـــاء بالضبـــاب المائـــــى
WATER MIST FIRE FIGHTING SYSTEM

WATER MIST NOZZLE فوهــة ضبــاب مائــى

4. البـــودرة الكيمائيـــة الجافـــة

4. Dry Chemical Powder

Dry Chemical Extinguishing Systems — نظـــم الإطفـاء بالبـــودرة الكيمائيـــة

Dry Chemical Extinguishing System: -

In this type of system extinguishing agents in the form of powder are used. The primary extinguishing mechanism is smothering, and in some cases chemical reaction.

Such systems are suitable for: -

- **Kitchens (Grease fires).**
- **Certain drying ovens.**
- **Distillation towers.**
- **Tanker cars / loading terminals.**
- **Aircraft hangar / engine test bays.**
- **Oil Separators.**

These systems are normally actuated manually and/or automatically by fire detectors (including fusible links)

نظـــم الإطفـاء بالبـــودرة الكيمائيـــة: -

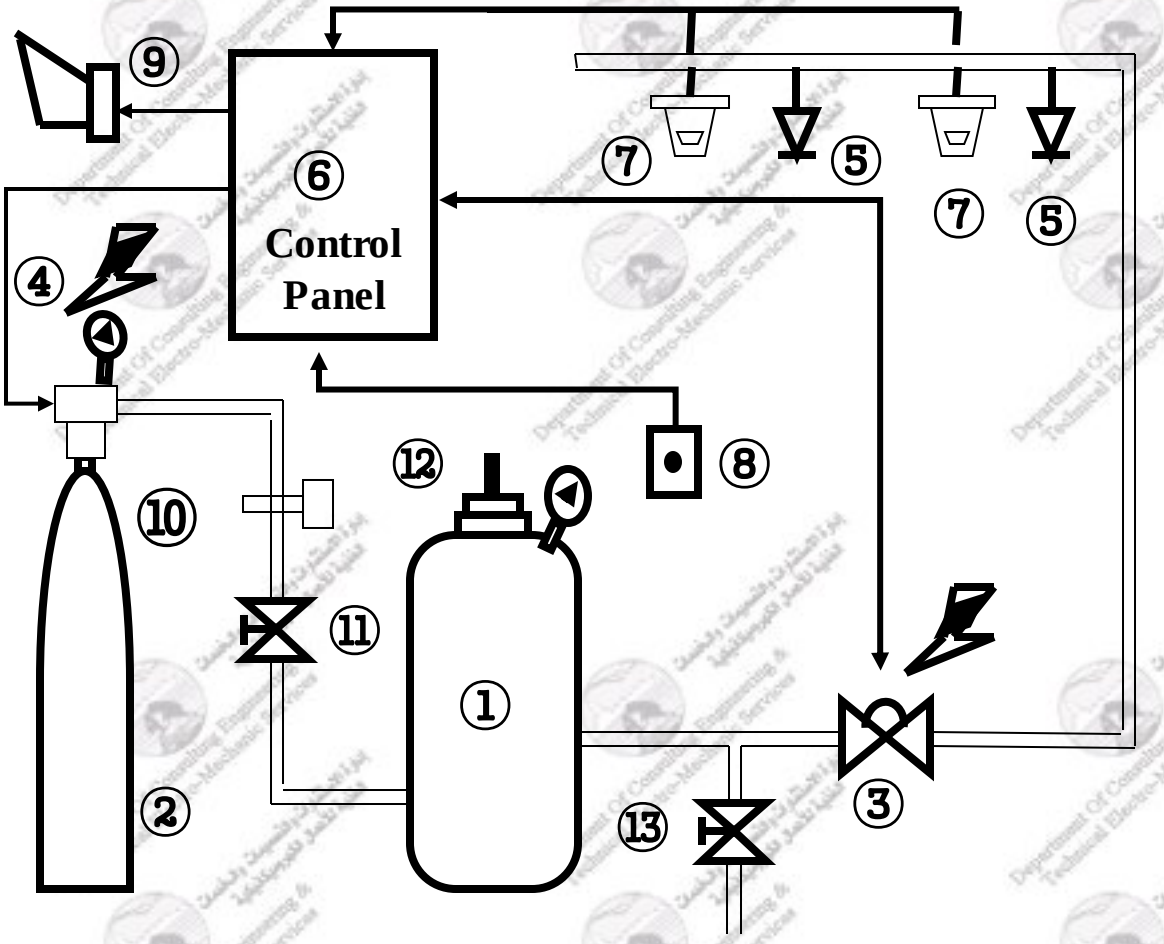
هـذه الطرز من نظم الإطفاء مـادة الإطفاء تكـون على صورة بودرة كيمائية . الآلية الإبتدائيـة للإطفاء هو خنق النيران و فى بعض الحالات بالتفاعل الكيمائى معهـا.

هذه الأنظمـة تكـون ملائمـــة للتـــالى: -

- **المطابـــخ (حرائـــق الدهـــون)**
- **بعـــض أنـــواع أفـــران التجفيـــف**
- **أبـــــراج التقطيـــــر**
- **الخـزانـــات المتحمولـــة / أرصفـــة الشحـــن**
- **حظائـر الطائـرات / أرصفـة إختبار المحركات**
- **عـــازلات الزيـــوت**

هـذه النظـم يتـم تشغيلهـا يدويـا / أو آليـا عن طريق كاشفات الحريق (يشمل ذلك الوصلات المنصهرة)

Dry Chemical Extinguishing Systems نظـــم الإطفـاء بالبـــودرة الكيمائيـــة



① مستـودع تخزيـن الكيماويـــات الجافـة
Dry chemical storage container

② أسطوانـة غـاز النيتروجين المضغوط
Compressed gas (N2) cylinder

③ Main Valve الصمـام الرئيسـى

④ Actuator مشغل النظـام

⑤ شبكـــة توزيـع مـزودة بالفوهـــات
Pipe network with nozzles

⑥ لوحـــــة الإنـــــذار بالحريـــق
Fire detection Control Panel

⑦ Fire detectors كاشفـات الحريـق

⑧ Manual call point مفتاح إنـذار يـدوى

⑨ Alarm sounder سارينة إنـذار صوتى

⑩ Pressure reducer مخفض لضغط الغاز

⑪ Booster valve رافـع الضغـط

⑫ Filling opening فتحـة الشحـن

⑬ فتحـــة الإختبـــار و الغســيل
Test and rinsing port

نظـــم الإطفـاء بالبـــودرة الكيمائيـــة
Dry Chemical Extinguishing Systems

5. الرغويـــات
5. FOAMS

أنظمـــــــة الإطفـــــــــاء بالرغويـــــات
FOAM EXTINGUISHING SYSTEMS

Foam extinguishing systems are water based systems that combine with foam concentrate for smothering a fire.

Typical applications are: -

- Outdoor tanks containing combustible liquids:
  1. Internal foam flooding for fixed-roof storage tanks.
  2. Perimeter ring foam flooding for floating-roof storage tanks.
  3. Foam flooding for tanks with a sump
- Tank storage areas inside of buildings:
  1. Foam flooding of rooms with foam sprayer
  2. Aircraft Hangars
  3. Solvent storage areas (light foam)

These systems are normally actuated manually, unless they are part of a sprinkler system (e.g. Aircraft hangars …etc).

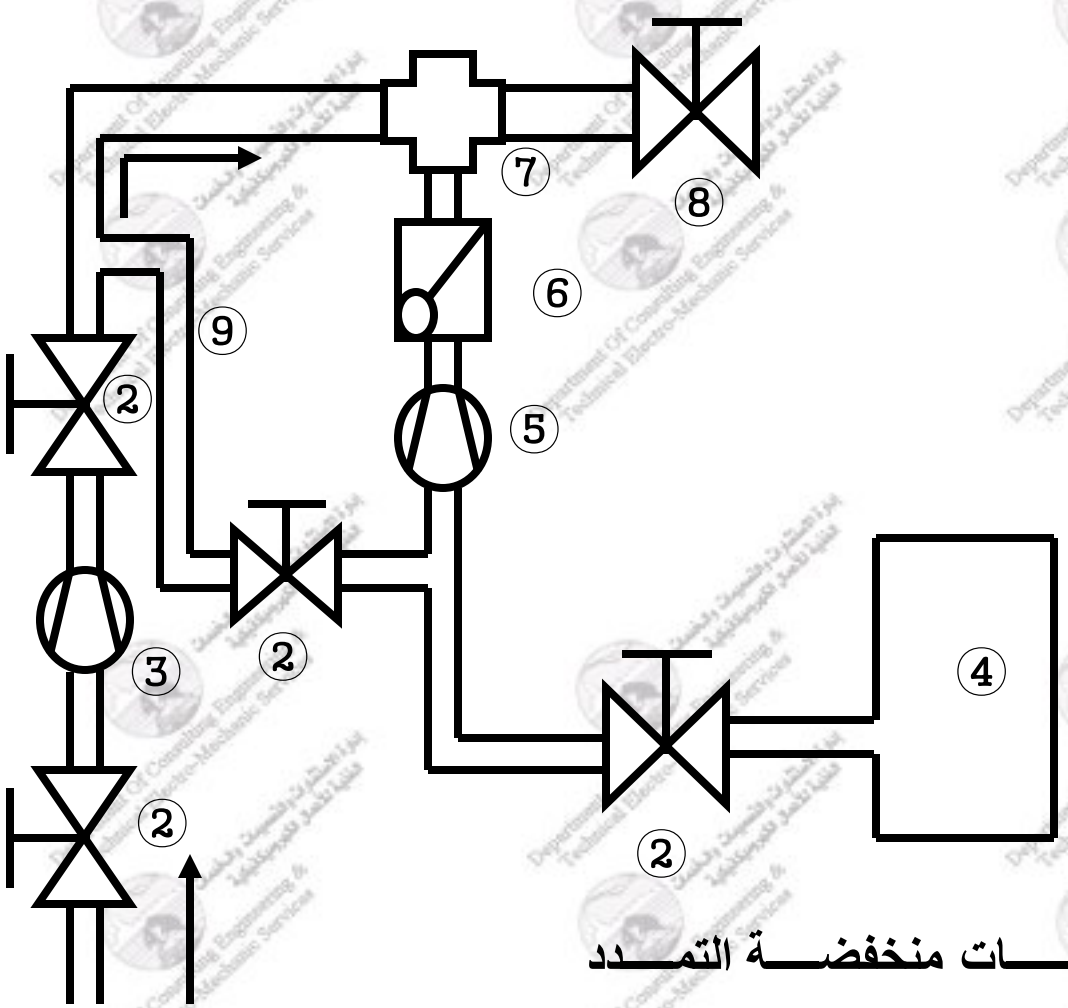
أنظمـة الإطفـاء بالرغويـات هـى نظـم ذات مكـون أساسى من الماء والتى تتحد مع المُركـز الرغوى لإطفاء النيران.

بعض الحـالات التطبيقيـة : -

- الخزانـات المكشوفـة للسوائـل القابلـة للإحتـــراق:
  1. الغمـر الداخلـى بالرغويـات للخزانات ذات السقف الثابت.
  2. الغمـر المُحيطى بالرغويـات للخزانات ذات السقف العائـم.
  3. الغمـــر بالرغويـات للخزانـــات ذات البالوعـــة.
- الخزانـات الموجـودة داخـل المبانـــى :
  1. غمـر الغرف بواسطـة البخاخـــات.
  2. حظائـــر الطائـــرات.
  3. مساحـات تخزيـن المذيبـات الكيمائيـة (رغوى خفيف)

هذه النظـم يتـم تشغيلهـا يدويـا إلا إذا كانـت جزءا مـن نظـام رشاشـات (مثـل حظائـر الطائـرات ...الخ).

أنظمـــــــة الإطفـــــــــاء بالرغويـــــات
FOAM EXTINGUISHING SYSTEMS



① Water supply منبـع المـاء

② Control Valve صمـام تحكـم

③ Main pump المضخـة الرئيسيـة

④ Foam container مستودع الرغوى

⑤ Foam pump مضخـة المادة الرغـوية

⑥ Non-return valve صمام عدم رجوع

⑦ Mixer خـلاط

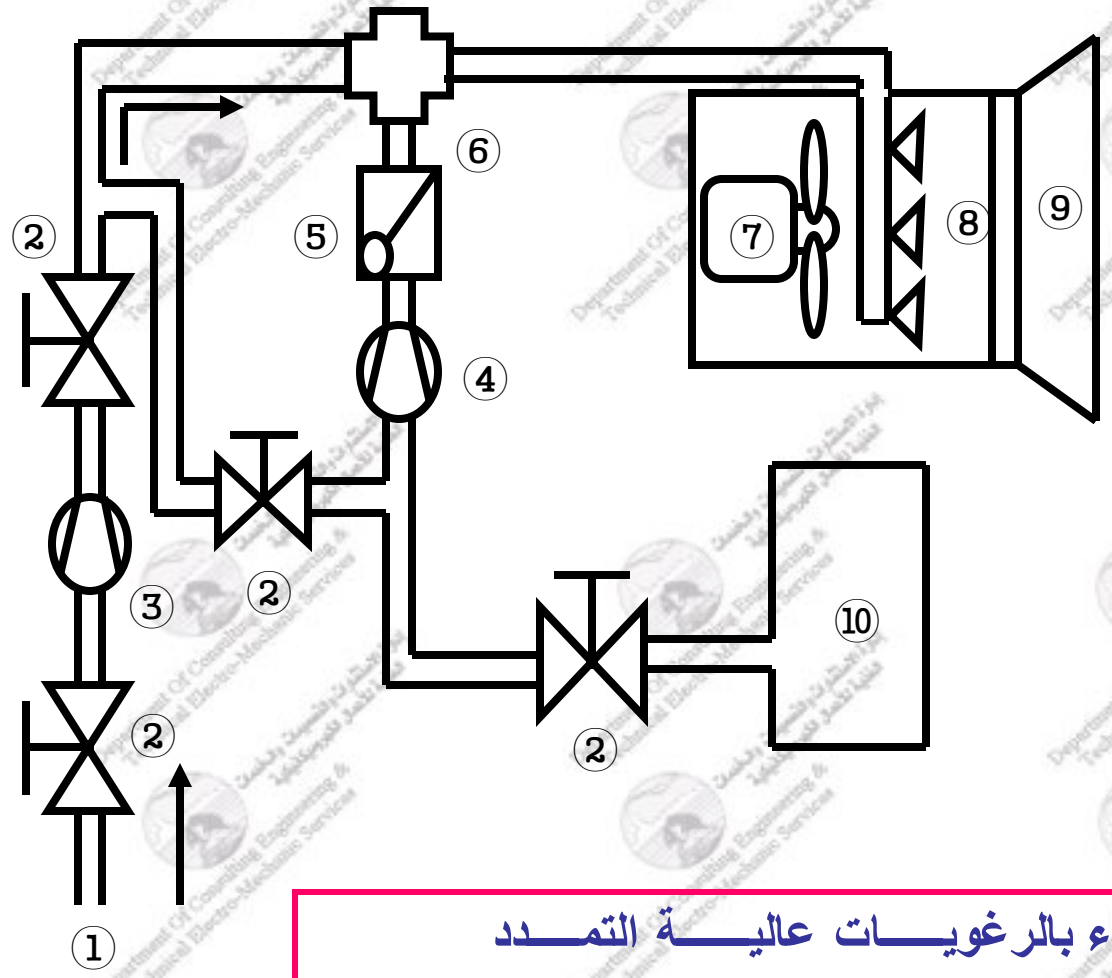
⑧ Foam generator, foam pipe

مُولـد الرغويـات

نظـــام إطفـــاء بالرغويـــات منخفضـــة التمـــدد

Low Expansion Foam Extinguishing System

أنظمـــــــة الإطفـــــــــاء بالرغويـــــات
FOAM EXTINGUISHING SYSTEMS



① Water supply منبـع المـاء

② Control Valve صمـام تحكـم

③ Main pump المضخـة الرئيسيـة

④ Foam pump مضخـة المادة الرغوية

⑤ Non-return valve صمام عدم رجوع

⑥ Mixer خـلاط

⑦ Blower نفـاخ هـواء

⑧ بخاخة إستخراج الرغوى المائى
Water Foam extract atomizer

⑨ شبكـة تمـدد الرغـويـات
Foam expansion mesh

⑩ Foam expansion خـزان الرغوى

نظـــام إطفـــاء بالرغويـــات عاليـــة التمـــدد

High Expansion Foam Extinguishing System

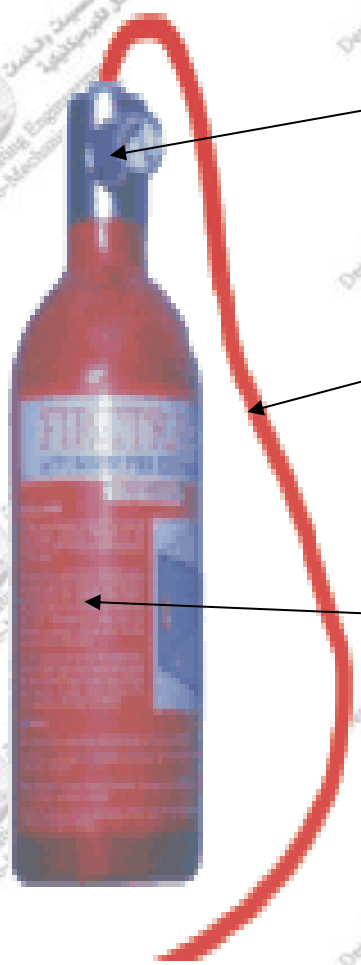
6. حالـــــة دراسيـــة

6. Case Study

مطفـأت آليـــة هيدروليكيـــــة
فـى غرفـــة المعدات بمشـروع
أبـــــراج الماليـــة

MODULAR PNUEMATIC AUTOMATIC FIRE EXTINGUISHERS AT THE FINANCE TOWERS PROJECT

كواشـــف هيدوليكيـــة / حراريـــة & مطفـــأت
Pneumatic / Heat Fire Detectors & Extinguishers

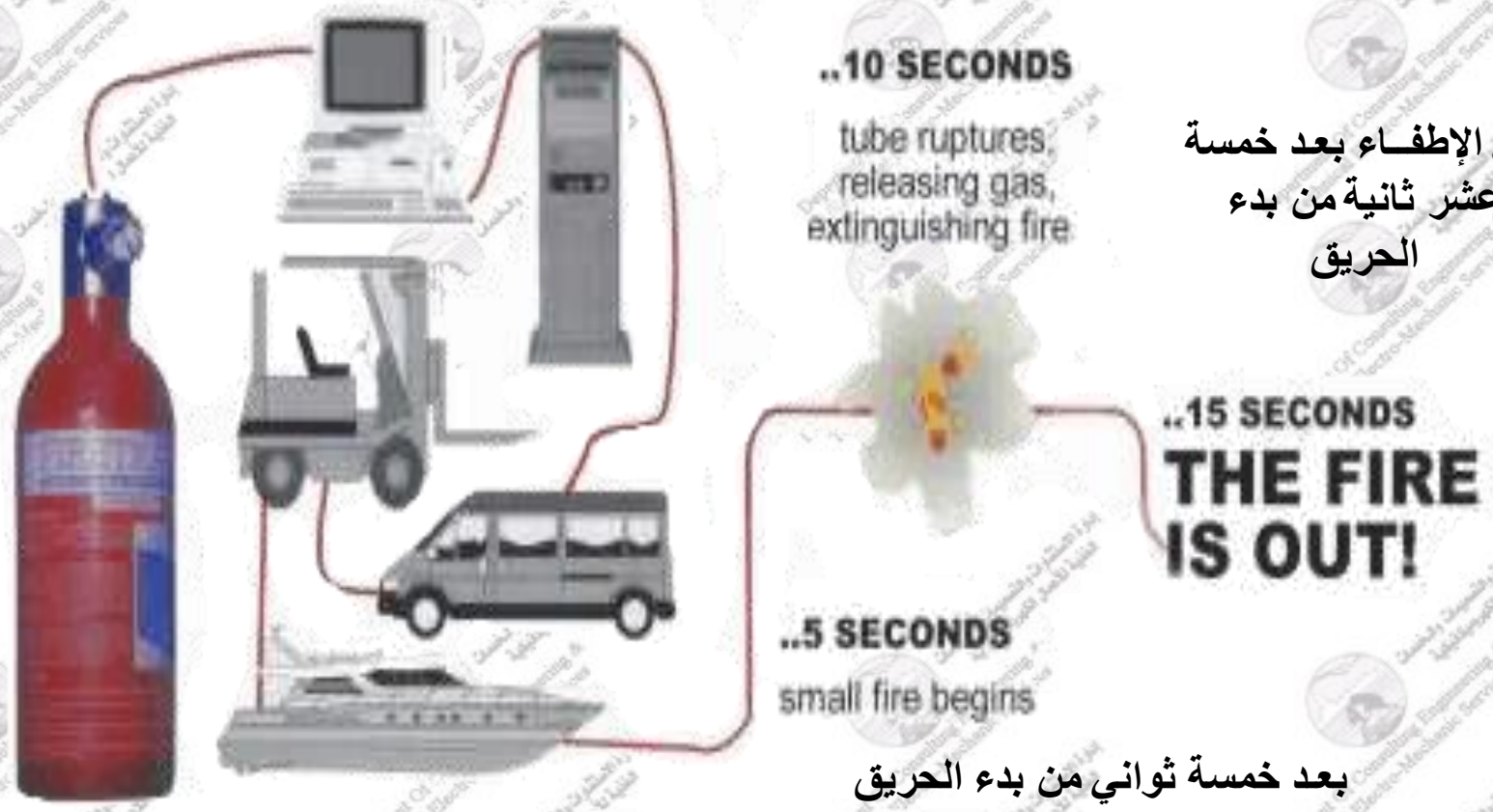


رأس تحكـم تعمل بضغط الغـاز
Pneumatic Control Head

كاشف حريق يعمل بالحرارة و ضغط الغـاز
Pneumatic Heat Fire Detector

مطفئـة حـريق (طـراز غـاز محبوس)
Fire Extinguisher (Pressurized Type)

بعد عشرةثواني من بدء الحريق



تـم الإطفـاء بعد خمسة عشر ثانية من بدء الحريق

بعد خمسة ثواني من بدء الحريق

مجـالات الإستخـدام المختلفـة

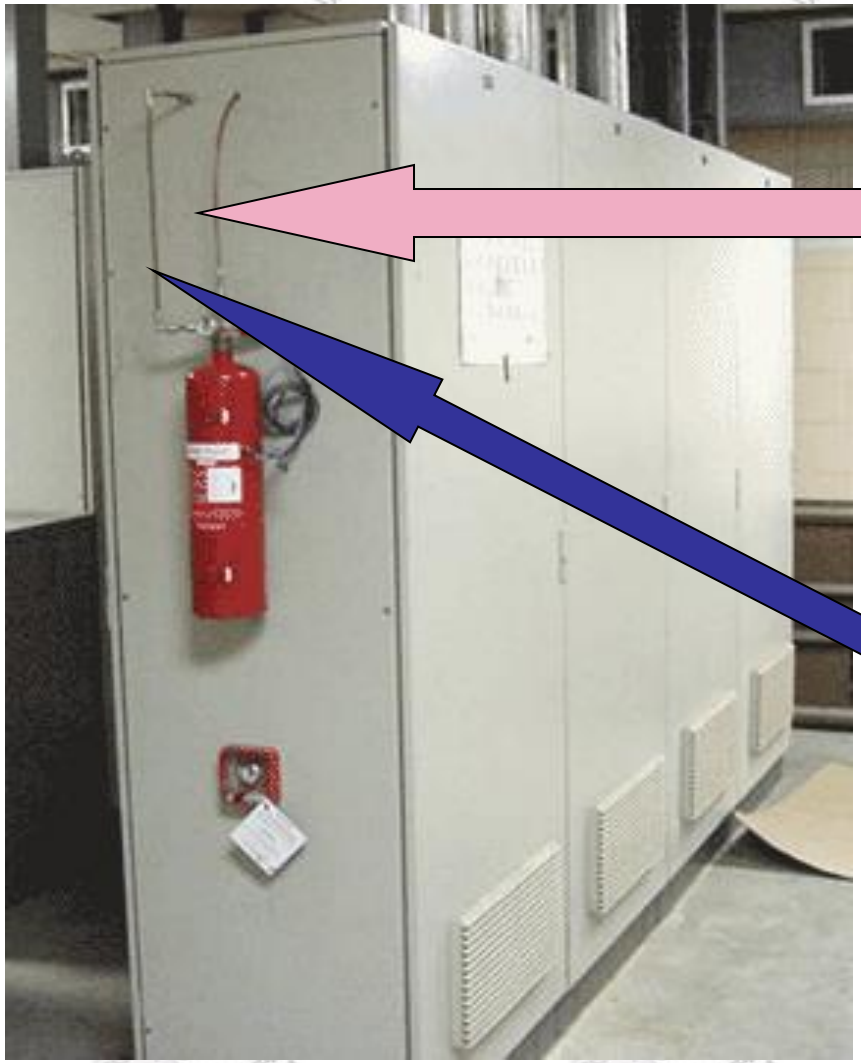
الكاشف الهيدروليكي/

أنبوب الإطفاء

بعد خمسة ثواني من بدء الحريق

بعد عشرةثواني من بدء الحريق

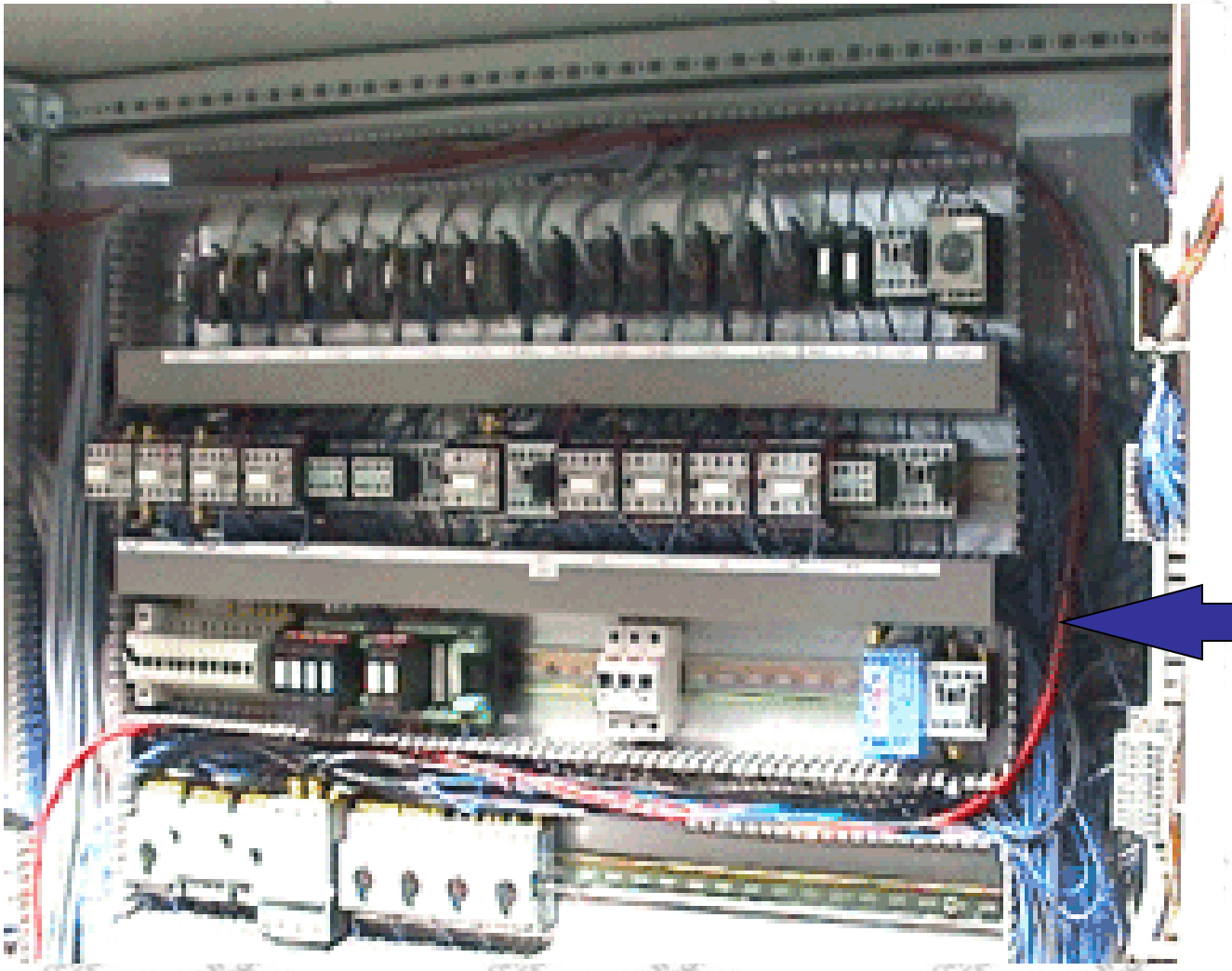
تـم الإطفـاء بعد خمسة عشر ثانية من بدء الحريق



الكاشف الهيدروليكي / أنبوب الإطفاء داخل لوحة التوزيع

الكاشف الهيدروليكي/
أنبوب الإطفاء

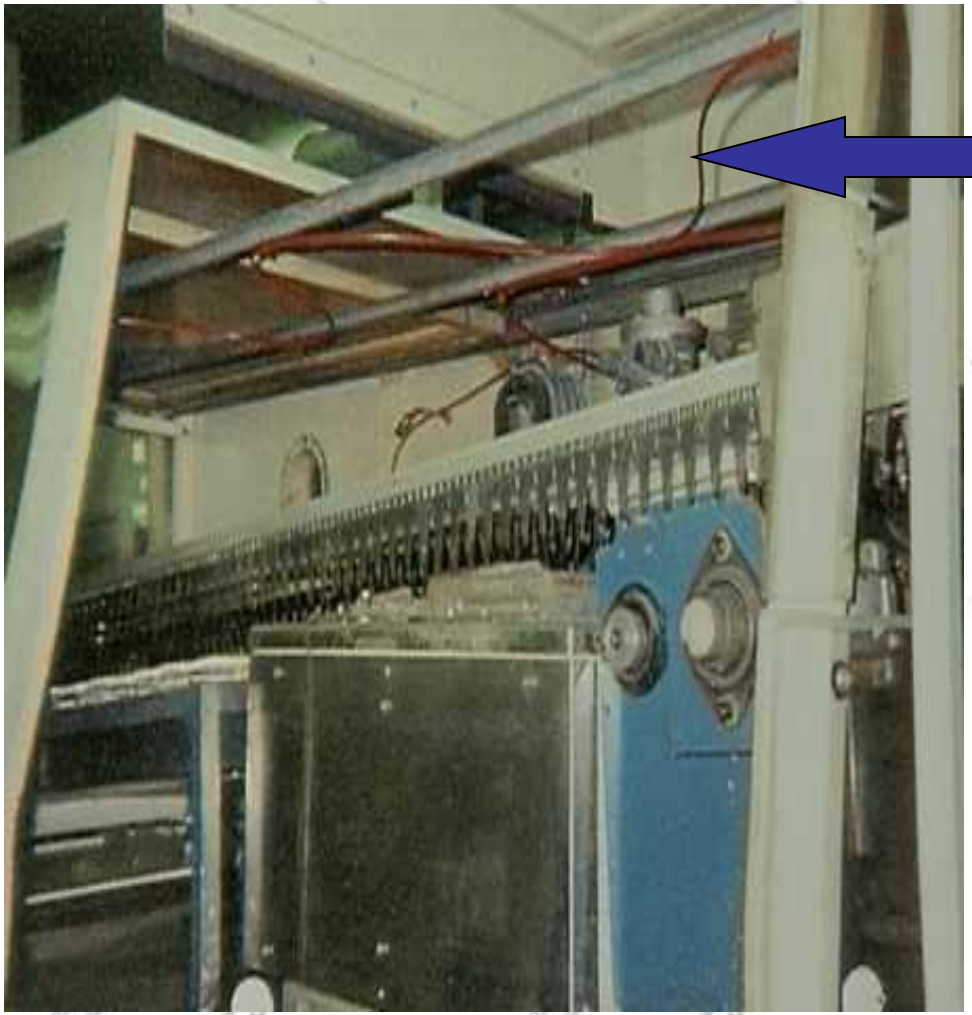
الكاشف الهيدروليكي / أنبوب الإطفاء داخل لوحة التوزيع



الكاشف الهيدروليكي/
أنبوب الإطفاء

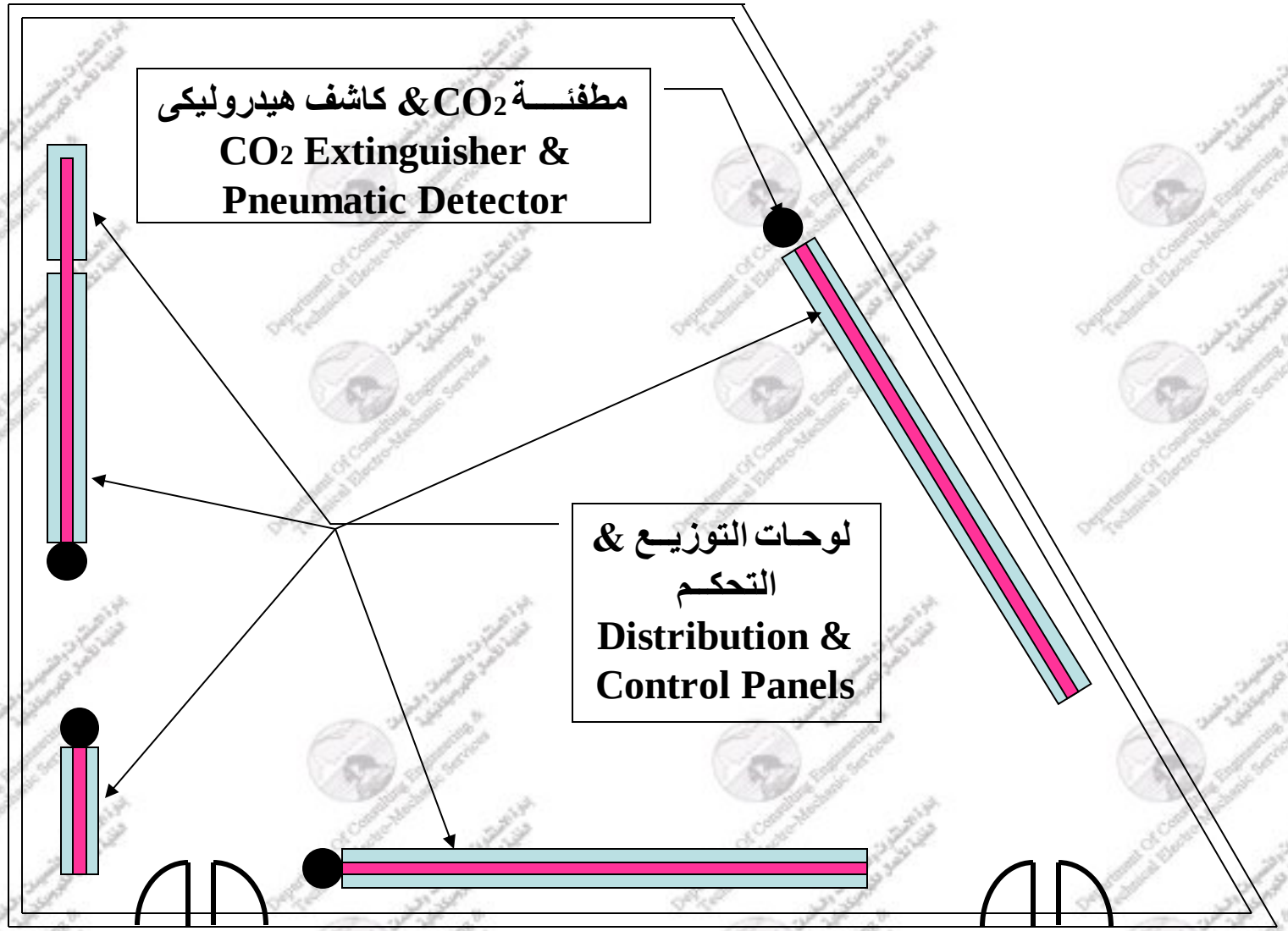
الكاشف الهيدروليكي / أنبوب الإطفاء داخل لوحة التوزيع

الكاشف الهيدروليكي / أنبوب الإطفاء داخل لوحة التوزيع



الكاشـف الهيدروليكي/
أنبوب الإطفـاء

الكاشـف الهيدروليكي / أنبــوب الإطفــاء
داخــل لوحــة التوزيــع



رسـم كروكـى للمطفئـات ذات الكاشـف الهيروليكـى المثبتـة فى غرفة المعدات بموقـع مشروع أبراج الماليـة

Schematic Drawing for the Pneumatic detector automatic extinguishers at the Site

الكاشف الهيدروليكي
/أنبوب الإطفاء

الكاشف الهيدروليكي / أنبوب الإطفاء مثبت أعلى محرك السيارة

7. بعـــــض المواصفـــات القياسيـــة لنظـــم الإنـــذار ضـد الحريـــق

7. Fire Alarm Standards, samples

FIRE PROTECTION RULES & REGULATIONS