



Maintenance Strategies

مجموعة من الفعاليات التي يقوم بها المختصون للمحافظة على أفضل ظروف ممكنة

صيانة

Maintenance: is a set of organized activity that are carried out to keep item and equipment in its best operational condition with minimum cost required. Activities of maintenance could be either repair or replacement activities which are necessary to perform for equipment to keep its productivity.

Objectives of Maintenance Management

اهداف الصيانة

The following are some of the objectives of maintenance management:

المحافظة على الجواز من العطل

1. Maximizing production or increasing facilities availability at lowest cost and at the highest quality and safety standard.
2. Reducing the breakdowns and emergency shutdown.
3. Improving equipment efficiency and reducing scrap rate.
4. Minimizing the energy usage.
5. Improving the usage life of equipment.
6. To minimize accidents through regular inspection and repair of safety devices.
7. To improve the quality of products and to improve productivity.

Maintenance types

انواع الصيانة

Maintenance can be classified as follow:

صيانة الطوارئ

يستعمل عند حدوث العطل مباشرة

1- Run to Failure Maintenance (RTF): The required repair, replacement or restore action performed on machine or facility after the occurrence of failure in order to bring this machine or facility to at least to it minimum acceptable condition. This type of maintenance can be divided into two types:

- *Emergency maintenance:* which is carried out as fast as possible in order to bring the failed machine or facility to a safe and operationally efficient condition.



- **Breakdown maintenance:** it is performed after the occurrence of the advanced considered failure for which advanced provision has been made in the form of repair method, spare, materials, labour and equipment.

Advantages of Run to Failure Maintenance (RTF):

- a- Useful when the failure of a component in a system is unpredictable.
- b- Low cost required comparing with other types.

Disadvantages of Run to Failure Maintenance (RTF):

- a- Very difficult to plane and schedule in advanced.
- b- The occurrence of failure in a component can causes failure in other component in the same equipment which causes low productivity

2- **Preventive Maintenance (PM):** It is a set of activities that are performed on plant, equipment, machine and system before the occurrence of a failure to protect them and to eliminated or prevent any degradation in their operation condition. This type is divided to:

- *Periodic Maintenance*
- *Running Maintenance*

The advantage of apply this type of maintenance is to satisfy most maintenance objectives.

3- **Corrective Maintenance (CM):** In this type actions such as repair, replace, restore will be performed after occurrence failure in order to eliminate the source of this failure or reduce the frequency of this occurrence.

This type is divided to:



- Remedial Maintenance: which is performed during the operation condition without interrupting the productive process
- Deferred Maintenance: Which are not immediately initiate in order to continue the productivity.
- Shutdown Maintenance: which is performed after the shutdown the system

4. ^{صيانة} ^{تحسين} Improvement Maintenance (IM): It is aim to reducing or eliminating the entirely the need for maintenance.

This type is divided to:

- Design-out Maintenance
- Engineering Services Maintenance
- Shutdown Improvement Maintenance

5- ^{تنبؤ} Predictive Maintenance (PDM): It is a set of activities that detect changes in physical condition of equipment (sign of failure) in order to carry out the appropriate maintenance work for maximizing the service life of equipment without increasing the risk of failure. This type is divided to:

- Condition – Based Maintenance
- Statistical – Based Maintenance

سما الفرق بين نوع و آخر



General Safety Practices

السلامة المهنية

The heating, air-conditioning, and refrigeration technician works close to many potentially dangerous situations: liquids and gases under pressure, electrical energy, heat, cold, chemicals, rotating machinery, the moving of heavy objects, and areas needing ventilation. The job must be completed in a manner that is safe for the technician and the public.

Personal Safety

السلامة الشخصية

Working on HVAC equipment demands several skills. A technician must be able to work with electricity, hand tools, and test equipment. Air conditioners also present the following hazards.

- High-pressures ضغط عالٍ
- High temperatures درجات حرارة عالية
- Extremely low temperatures درجات حرارة منخفضة للغاية
- High voltage جهد عالي
- High electrical current تيار كهربائي عالي
- Moving parts أجزاء متحركة

Safety Equipment Required

معدات السلامة المطلوبة

Awareness of all electrical components and connections and moving parts. Lock out tags, safety glasses, thermal gloves, Volt meter, refrigerant gauges and several hand tools needed to complete these jobs.

Safety rules for employees

قواعد السلامة للموظفين

Provide the following tips to your employees to help them avoid injury and protect you bottom line:



ارتداء الملابس المناسبة للوظيفة **Wear the right clothing for the job.** Winter cold and summer heat can present problems on the job. Shirts should be worn at all times.

ارتداء الأحذية المناسبة للوظيفة **Wear appropriate safety shoes for the job.**

استخدم معدات الحماية الشخصية المناسبة **Use the right personal protective gear, including safety glasses, hard hats, and safety shoes.**

لا ترتديك أبدًا الخواتم والقلادات وغيرها من المجوهرات **Never wear rings, necklaces, and other jewelry if it can pose a hazard.**

اعلم أن اللهب المكشوف أو الشرارة يمكن أن تضيء المواد القابلة للاشتعال **Be aware that open flames or sparks can ignite combustible materials.**

المعدات القابلة للحرق والقطع، مع اقترانها مع السجائر المرفوضة، تشكل أكبر أخطار.

الحماية الشخصية Personal Protection

Everyone in the technical field knows that wearing protective gear will prevent injuries. In spite of that, many people have chosen not to wear protective equipment. This results in many injuries and even deaths every year! Take a moment to think about some of the consequences of an accident or injury.

الموتة المفقودة في العمل **Lost time at work**

الربح المفقود **Lost income**

أقسام تأمين أعلى **Higher insurance premiums**

Not only do the employees suffer, but their families do as well.

معدات السلامة المناسبة Proper Safety Equipment

A- Eye Protection **حماية العين**

Certainly one of the most important safety concerns a technician should have is protecting the eyes against impact from debris and chemicals. While working on equipment, whether balancing a refrigerant charge, adjusting gas pressure, drilling, or brazing, always wear the safety glasses that are approved for the specific task you are performing see Figure below. Safety



glasses are made of shatter-resistant plastic side shield will protect your eyes from splashing and flying debris. Regular glasses cannot function as safety glasses.

المنظارات مصنوعة من بلاستيك مقاوم للكسر يحمي عينك من تناثر الحطام وتطايرها. لا يمكن استخدام النظارات العادية. يمكنك



Protective side-shield eye goggles

تقنية الدفع الجانبية

B- Proper Lifting Technique

The leading injury in the work place usually has to do with injuries to the back. While most back injuries are minor, there can be severe damage that can result in permanent injury.

* Here are some tips that can help reduce the possibility of back injury.

- While working on a system that causes your body to be arched, crouched or stooped, it is best to take frequent breaks. Stand up and stretch your body forward and backwards and side to side.
- Never lift or carry anything that is beyond your limits. Get someone to help.

C- Head Protection

When working in an environment where falling objects are a possibility, you should wear a hard hat. Head injuries can be life threatening! While many residential technicians, as well as parts personnel, have the opinion that only commercial sites present a hazard, this should be reconsidered. It is definitely better to be safe than sorry. Hard hats come in many types

تأتي القبعات الصلبة بأشكال عديدة تتحتم على منها النفل

Maintenance of Air-conditioning Systems/ Third years

depending on the work environment. Plastic, composite, and metal are among the materials used. The wearing of a hard hat is strictly to prevent all types of head injuries. Never wear a metal hard hat when working on electrical components. * كما قد تؤدي قبيحة صلبة وهو تربة عند العمل على المكونات الكهربائية.

D-Hearing Protection

Hearing protection is important because your ears are composed of very delicate structures. Whenever a sound produces air is set into motion as sound waves. If the wave enters the ear with high pressure damage to the structure of the ear can result

Some of the situations requiring hearing protection include:

- Using a skill saw, reciprocating saw, or high speed drill. حماية السمع
مخاطر عالية السرعة
- Using high-pressure air tools. استخدام أدوات الهوائية عالية
الضغط
- Being exposed to moderate levels of noise for an extended period of time. التعرض لمستويات متوسطة
واعتداله من الضوضاء
لفترة طويلة بلوح من
الزمن

The two types of protection generally used are earplugs and earmuffs. Headphones designed for use with a radio are not suitable for hearing protection.

صدوات الأذن، وواقيات الأذن



Hearing Protection

حماية الرئة Importance of Air-Conditioning Systems / 1st year

E- Lung Protection :The purpose of our lungs is to deliver the proper amount of oxygen to the blood stream. Without the correct oxygen level, bodily systems will begin to fail.

توفير كمية مناسبة من الاوكسجين الى مجرى الدم

The lack of oxygen can be caused by the inhalation of contaminants such as the pollutants

as: غاز فوسفورين (غازات او الابخرة السامة)
 Toxic gases or fumes (for instance, phosgene gas, which is produced when a flame or extreme heat comes in contact with refrigerant and causes it to burn)

غاز الفوسجين ينتج من تلامس اللهب او الحرارة الشديدة مع مادة التبريد
 Toxic chemicals (coil cleaners or brazing flux)

مواد التبريد الغازية
 Gas supplies to heat systems



Disposable face mask

حماية اليد والقدم

F-Hand and Foot Protection

Gloves: In our industry we deal with a lot of sheet metal and materials with sharp edges. Studies indicate that up to 30% of all work-related injuries have to do with injured fingers, hands, and arms. The majority of these could have been avoided if the use of gloves was a common practice. As always, you must choose the proper type of glove for the application. Here are a few recommendations:

بعض التوصيات

When working with lumber or steel, use leather gloves.

When working with chemicals, use rubber gloves.

من العمل بالخشبة او الصلب

عند العمل بالمواد الكيميائية

استخدم قفازات

صناعية

- عند العمل عند العمل في التوليد
ار اسبار د ن
- When welding, use long gauntlet leather gloves. قفازات عازلة للحارة
 - Working with hot or cold substances, use thermally insulated gloves.
 - Electrical work requires the use of rubber gloves. تتطلب الاعمال الكهربائية استخدام قفازات مطاطية



اهوية السلامة

Safety Shoes: Below are a few recommendations

that are important when choosing the right pair of shoes for non-office employees.

- اصبح الفوم المصلي عن استعمال في المواد
- Steel toe - when handling materials. قفازات ك كهربائية
 - Rubber soles - when working on any part of an electrical system. نعال مطاطية
 - Electric shock resistant - when working on live high power devices. مقاوم للصدمات الكهربائية
 - Ankle support - when climbing ladders. دعم الكاحل عن صعود السلالم



السلامة الكهربائية

Electrical Safety

Many accidents are the result of carelessness. It is easy for a person to focus on the work and forget about safety. Therefore, you must train yourself to always do things in a safe manner. Look for the hazards around you and understand the safe work practices required to do the job properly.

قبل العمل عن المعدات الكهربائية يجب علينا

Prior to working on electrical equipment, you must:

- De-energize the equipment by unplugging it and shutting off the circuit breaker or the disconnect switch. فصل الجهاز عن الطاقة عن طريق فصله وإغلاق قاطع الدارة أو فصل الفصل

- Lock out the breaker or disconnect so no one else can restore power

while you are working. This can be accomplished with a lock system at the power panel or taping the panel shut. اغلق
المنفذ القاطع او فصله حتى لا يتمكن اي شخص
اخذ من الطاقة

- Verify with a voltmeter that the power has been disconnected.

تحقق باستخدام الفولتميتر من فصل الطاقة