

Executive Summary

Planned maintenance has to begin with a plan in mind. Developing preventive maintenance tasks or procedures for your plant or facility without a solid plan will result in inconsistent and unreliable procedures. Because it is important to document the development process, build-in consistency, and develop a good understanding of expected results, the Equipment Maintenance Plan is a powerful tool.

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Equipment Maintenance Plans

The Equipment Maintenance Plan, or EMP as it is commonly called, is a document, in table format, that is used when developing the tasks needed to properly maintain facility, plant or process equipment. The EMP helps lead the person or persons developing the required maintenance tasks by ensuring that the development is done consistently for all equipment. Each EMP should include one or more maintenance tasks designed to ensure the continued operation and maintenance of an equipment item, process or system. Each of these tasks has the following characteristics:

- A *descriptive title* for each maintenance task to be performed
- A *frequency* assigned for performing of each task
- Assignment of a specific *craft* or workgroup and the number of each craft or workgroup required to perform the task
- *Equipment condition* required for performance of the task (i.e. running or shut down)
- *Type of Work* – Preventive Maintenance (PM), Predictive Maintenance (PdM), Corrective Maintenance (CM), Situational Maintenance (SIT), etc.
- *Procedure number* – Unique identifier for the task, or file name if linked to another document that gives the individual task instructions
- *Estimated time* to perform the task
- *Special tools, materials and equipment* required to perform the task

The EMP can also provide the following additional planning and budgeting information if set up properly in a spreadsheet format:

- Annualized hours for performing the task
- Annualized hours for shut down of the equipment during performance of the task
- Annualized hours for performance of the task by craft

Each EMP consists of the following defined sections that contain specific information (See example EMP at the end of this paper):

EMP Header

- *Equipment Type* – this identifies the equipment type or class to which the maintenance tasks apply, i.e. fans, centrifugal pumps, belt conveyors, etc.
- *Description* – identifies the specific equipment that is covered by the EMP, usually the equipment number and description, as listed in the CMMS is used here
- *Location* – number identifies the physical location of the equipment within the plant or facility
- *Documentation* – number lists what technical documentation is available and where it is stored or maintained
- *Validated* – this area requires a "yes" or "no" indication of whether or not the equipment nameplate data has been validated

Maintenance Task Description

- *Item number* – identifies each of the maintenance tasks listed on the EMP, giving each a line item number
- *Maintenance task description* - this area is where the very brief description of the work to be performed is entered, i.e. Clean and lubricate pump, inspect and lubricate fan, etc.
- *Frequency* - identifies the frequency at which the maintenance task is to be performed, i.e. 7 days, 30 days, 90 days, 180 days, 365 days, etc. Usually days are used, rather than weekly, monthly, quarterly, etc. Meter-based frequencies can also be used, i.e. 100 Hrs, 500 Hrs, etc. Situational frequencies based on inspection results can also be included

Task Support Information

- *Craft* - identifies the type of craft or skill required to perform the maintenance task, i.e. MECH, ELECT, CONTR, etc.
- *Craftsmen required* - indicates the number of crafts persons required to perform the maintenance
- *Equipment condition* – indicates if the equipment must be running or shut down when certain maintenance tasks are performed
- *Type* - the type of maintenance task is entered here, i.e. PM, PdM, CM, etc.
- *Procedure/Task number* – the unique procedure or task number is entered here; typically this will be the unique identifier used in a CMMS or a file name.
- *Est. time (Hrs)* – this is where the estimated time to complete the task is entered. This is an educated estimate based on previous experience or established estimating standards.
- *Special tools/Materials/Remarks* - identifies any special tools not usually carried in a craftsman's toolbox, i.e., torque wrenches, man-lifts, ladders, etc. or a hazardous waste container, personal protective equipment, etc., and any additional remarks that apply specifically to performing the task.

Planning/Budgeting Section

- *Annual (Hrs)* – used to calculate the total annual hours required to perform each specific maintenance task
- *Annual Scheduled Maintenance Hrs* – used to total all the annual hours required to perform all the maintenance tasks listed on the EMP
- *Annual Shutdown Hrs* – Used to calculate the required hours of shutdown needed to perform all the maintenance tasks listed on the EMP
- *Annual Operator Hrs* – Used to calculate the total hours of operator time needed to perform the maintenance tasks listed on the EMP
- *Annual Mechanic Hrs* – Used to calculate the total hours of mechanic time needed to perform the maintenance tasks listed on the EMP
- *Annual Electrician Hrs* – Used to calculate the total hours of electrician time needed to perform the maintenance tasks listed on the EMP
- *Annual Contractor Hrs* – Used to calculate the total hours of contractor time needed to perform the maintenance tasks listed on the EMP.

You can develop an EMP for each equipment item, type of equipment or system. It is generally best to develop the EMP for each type or class of equipment and then apply the identified maintenance to all the equipment you have that is of the same type or class. When you have the same type of equipment, but in different operating environments, you may want to develop separate EMPs for each of them and apply different frequencies, man-hours and special tools/materials to each. The EMP is a very flexible document and can be used to accommodate almost any need for maintenance requirement development. Use it the way it best fits your needs and specific requirements.

When developing EMPs you are defining the tasks or procedures and all associated information needed for to properly maintain your equipment. You must first determine what equipment you want to include in the maintenance program and develop EMPs for those equipment items. Consider the criticality of your equipment before you start and develop EMPs for the most critical equipment first.

Once you know what equipment you will be including in the maintenance program you need to gather the needed information to develop the required maintenance. Gather the equipment information that you want to include in your maintenance records. This generally includes the equipment nameplate data, including manufacturer, model number, serial number, electrical characteristics, specifications, operating parameters, etc. It is always best to get as much information directly off the equipment nameplate as possible because vendor manuals, equipment drawings, etc. do not usually provide all the useable information and many times it is not accurate.

Next, you need to gather the documentation available for the equipment. This is generally vendor operation and maintenance manuals, catalog cuts, shop drawings, construction drawings, P&IDs, parts lists, and exploded views. You need these to develop the equipment-specific maintenance tasks, and special tools and materials list.

It is always best to consider the manufacturer's recommended maintenance for equipment, but you must also consider the equipment's operating environment and the frequency of operation. You would not want to change the oil in the pedestal of a pump on a quarterly frequency if the pump is in a clean environment and is operated very infrequently. Nor would you want to change the oil in an engine on an annual basis if the engine runs very frequently and is in a harsh environment. You must consider the operating context of the equipment and make informed decisions on maintenance needs.

After you have determined the maintenance tasks that need to be performed, the next thing to include on the EMP is the skilled craft required to perform the maintenance. These crafts or skills are generally the same as those employed at the facility or plant. It is not unusual, though, to include maintenance tasks that require skills that are not available in house and must be contracted out. For these you may enter "CONT" or another code for the contracted craft designation.

The number of craftsmen needed is also important. If more than one person is needed it must be identified and included so the man-hours calculated for the year will reflect using the extra personnel. Although some tasks must be multi-craft, it is recommended that each maintenance task be developed for a specific craft. Develop single craft requirements, and then schedule multi-crafts together as required.

Identify and include in the "TYPE" column the type of maintenance, for example, preventive (PM), corrective (CM), predictive (PdM) and situational (SIT) (based on meter hours, analysis results, special events, etc.)

If you are assigning unique procedure/task codes or numbers to each maintenance procedure the first thing to decide is the format for these numbers or codes. It is extremely important to only use codes that can be accepted by your computerized maintenance management system or work order system. Even if you do not have to meet the criteria for a computer program it is important to use a consistent and logical number or code that is easily recognized.

An estimated time required to perform the maintenance task is used to determine what the annual man-hour requirement will be for planning and budgeting. This estimated time should include the total time it will take to perform the maintenance action. Only enter the time it would take for one person to do his part of the work. If you are using a spreadsheet to develop the EMP, and the formulas are set up correctly, the time will be multiplied by the number of craftsmen and the frequency to determine the annual man-hours.

The special tools and materials that are required to perform the maintenance also need to be captured and included on the EMP. These can be as simple as the need for a torque wrench that is not normally found in the mechanics toolbox. These can also be major items like a man-lift, refrigerant recovery machine, boiler combustion test kit, etc.

