

## MAINTENANCE INSPECTIONS

Inspections and tests are a necessary part of maintenance. Use them to determine the degree and rate of equipment deterioration. A good inspection program, aided by computer and maintenance engineering analysis, can predict the probable time of failure of a piece of equipment so that the equipment can be replaced or repaired prior to that time. Inspections and tests that reveal no deterioration may help avoid unnecessary maintenance.

Inspections are most effective when they are conducted by qualified, preferably certified, persons in accordance with a written procedure or protocol that has been proven to provide consistent and repeatable results. Nationally recognized certification programs are available for many types of inspections.

Inspection techniques are being developed continuously. Some newer techniques include:

- Ferrography and wear particle analysis — analyze the contaminants in a lubricating oil system. These tests are sensitive to changes caused by abnormal wear. If the composition of the various parts of the machine are known, the source of wear products can be identified and maintenance scheduled before a failure occurs.
- Vibration monitoring and analysis — detect gross problems such as imbalance, misalignment and looseness. When coupled with modern computer analysis, vibration analysis becomes an extremely effective tool for diagnosing and predicting machine ailments including some rotating element cracks.
- Acoustic emissions analysis — can detect incipient flaws and small leaks by detecting sound in a structure. Acoustic emissions analysis can often be performed on equipment while it is in service.
- Infrared inspection — allows the user to “see” the heat being radiated by an object. This technique is excellent for detecting incipient faults in electrical equipment, refractory and insulation. The same equipment can be used to locate heat imbalance in equipment such as engines, leaking valves in compressors, leaking steam traps, and a host of other adverse conditions. Under certain conditions, it can even locate leaks in roofs.

Because of the sophistication of some test methods, it may be advantageous to develop an inspection department. The inspection techniques that are used depend upon the type of equipment and materials that are being inspected, the condition of the equipment at the time of inspection, and, where applicable (generally for equipment such as cranes, elevators, boilers and pressure vessels), requirements of the governmental authority (jurisdiction). Operating equipment often requires different inspection methods than idle equipment requires.

Some inspection techniques, such as eddy current analysis, radiography or acoustic emission, may best be done through a contract service in all facilities except those with the very largest inspection departments.

Inspection results provide feedback to the maintenance system. Assign the inspection frequency based upon:

- The importance of equipment and its failure risk.
- Previous inspection results and failure history.
- Service conditions.
- Time in service.
- Legal requirements.
- Insurance company recommendations.

- Recommendations of standards bodies and manufacturers.

The inspection force may also provide quality control monitoring for work in progress. This includes audits to verify that plant and vendor personnel are adhering to written procedures, safety programs, corporate standards, jurisdictional requirements, and good engineering practice. One frequently-overlooked aspect of quality control is tool control. Strictly limit access to open machinery casings and maintain accountability of all tools and parts, so that nothing is inadvertently left in the machine.

Finally, maintenance of almost any piece of equipment requires abnormal configurations of some sort. Examples include gagged safety valves for hydrostatic tests, blanked flanges and missing valves for piping system isolation or flushes, and extra filters in steam and lubricating oil systems. Ensure normal conditions are restored before equipment is returned to service.