Qualitative vs. quantitative inspections

White Paper

Thermography

Preventive maintenance inspections, especially thermal inspections thermal imagers and non-contact point infrared instruments can be used to satisfy both the qualitative and quantitative predictive maintenance requirements of most plants. As a rule, the majority of the equipment population of a manufacturing or process plant, as well as most facilities can be effectively evaluated, incipient problems identified and appropriate corrective maintenance tasks identified using relatively simple qualitative inspections. A smaller population of equipment, where specific absolute temperature values are critical, must be evaluated using exact temperature values or quantitative techniques. The majority, i.e., 75 % to 85 % of these requirements, both qualitative and quantitative, can be satisfied using only thermal imagers or non-contact point infrared thermometers.

Qualitative inspections

Tracking relative changes in the variables that define the operating condition of critical plant or facility assets is a proven means of scheduling corrective maintenance activities. The vast majority of critical plant systems can be effectively evaluated using this relatively simple, straightforward technique. Petrochemical, electric power generating and a variety of other industries have successfully used this method for more than 50 years. Prior to the development of microprocessor-based instrumentation and computer-based predictive maintenance systems, periodic monitoring was done by simply recording data from installed analog instruments, such as flow meters, pressure gauges and thermometers. As predictive technology evolved, these installed devices were replaced with portable instruments that acquired data from critical assets, uploaded the data to computer-based programs that developed trend charts that plotted the rate of change and projected or predicted when the monitored parameter would reach a level that could result in failure or loss of function of the asset. This type of analysis establishes the acceptable range for each variable and specific alert and alarm limits are designated that determine when corrective actions will be taken. Analysis of condition is limited to the rate that each variable changes and a determination of when it will reach the absolute fault limit when failure is probable.

To be an effective predictive maintenance tool, tracking of periodic measurements of variables, such as temperature, vibration, pressure and other parameters, must be accurate indications of changes in the asset's operating condition. As a result, its value is limited with some predictive technologies. For example, vibration levels vary widely with normal changes in load and process condition of critical process systems. As a result periodic measurement of vibration levels, without normalizing for load-induced changes, is not a viable evaluation technique.

This is not the case with temperature monitoring using infrared technologies. In most cases, the surface temperature at specific points of critical plant assets is a consistent indication of its operating condition. While changes in load, emissivity and other variables may cause a slight change in surface temperatures, these changes are not enough to skew the benefits that can be derived from the resultant trends and projections of probable failure. Therefore, qualitative analysis of infrared data can be used as an effective predictive maintenance tool.

Quantitative inspection

A few applications where an infrared or thermal inspection is the dominant technology, are not suitable for qualitative techniques. In these applications, the precise temperature or temperature distributions is an absolute requirement. As a result, the slight variations caused by changes in emissivity, atmospheric conditions and other factors that could distort the readings acquired by the thermal imager or non-contact point thermometer. In these applications, the accuracy needed for effective analysis is critical, and the response characteristics of the instruments used must provide the added accuracy need for proper analysis. In addition, the unit must have the ability to accurately define the spot size of the target object, to avoid distortion in the value measured, due to the environment in the background.

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