

Manual: 5.1. Condition Monitoring

In operating technical equipment in an industrial plant, we are concerned whether this equipment is in good working order at any one time. Activities concerned with determining this health status are grouped under the term condition monitoring. This is generally approached by installing sensors on the equipment measuring quantities like vibration, temperature, pressure, flow rate and so on. These measurements are transmitted to the control system and usually stored in a data historian.

In between the control system and the historian, the data is analyzed to determine the health status of the equipment. For this purpose, one usually defines an upper and lower alarm limit for each tag of importance. If the measurement ever goes above the upper limit or below the lower limit, an alarm is released.

When an alarm is released, a maintenance engineer looks at the data and determines what, if anything, must be done. If the engineer determines that nothing must be done, the alarm is a false alarm. If the equipment is not in good working order but this status is not alarmed, this is called a missing alarm. Both are problematic. The false alarm is unwanted because it wastes time and resources. The missing alarm is dangerous because it will most likely result in an unplanned outage that may cause collateral damage and production loss.

The reason for both false and missing alarms is usually due to the simplistic nature of the analysis. The static nature of the upper and lower limit is not able to capture the complexity of diverse operating conditions of industrial equipment. In addition, the fact that each measurement is analyzed individually is a major drawback. All measurements on a single piece of equipment are obviously connected. By ignoring this natural connection, the analysis is throwing away a major source of information.

One may try to overcome the first defect by what is known as event framing. This is where one defines certain operating conditions of the equipment as belonging to one group and then supplies an upper and lower limit only for that group. For example, one may divide the data from a turbine into full load, half load and idle conditions by defining a condition on the rotation rate. While this is a certain improvement, it also increases the amount of manual work that must be done to setup and maintain the analysis. With plants having tens of thousands of measurements, this quickly becomes overwhelming and error prone.

We conclude that normal condition monitoring defines the health of a piece of equipment measurement-by-measurement through specifying limiting values based on human engineering expertise. This definition of health is limited in its effectiveness and requires significant human effort both initially as well as continually.