

Matrix Inspection & Engineering, Inc.

Acoustic Emission Testing

Metal Tanks and Vessels

Acoustic Emission testing detects cracking and other defects from the high frequency sounds generated by sharp discontinuities under stress. The method is most commonly used to detect service related damage (stress corrosion cracking, wet H₂S damage, fatigue etc.) in process equipment. New or repaired vessels are also tested with this method for detection of fabrication defects or verification of repairs.

Sensitive acoustic sensors and specialized instrumentation are used to detect AE activity as a vessel is loaded. Data is analyzed to determine where there are areas of significant activity. A complementary inspection method such as ultrasonic testing is needed to locate and evaluate the source of emission.

In-service equipment is generally tested to 10% (minimum 5%) over the maximum operating load for the previous six months. Pressure may be increased on-stream, with nitrogen or other gas pressure, or by hydrotest. Each has its advantages but in all cases the pressurization must be controlled and produce minimal noise from liquid or gas flow.

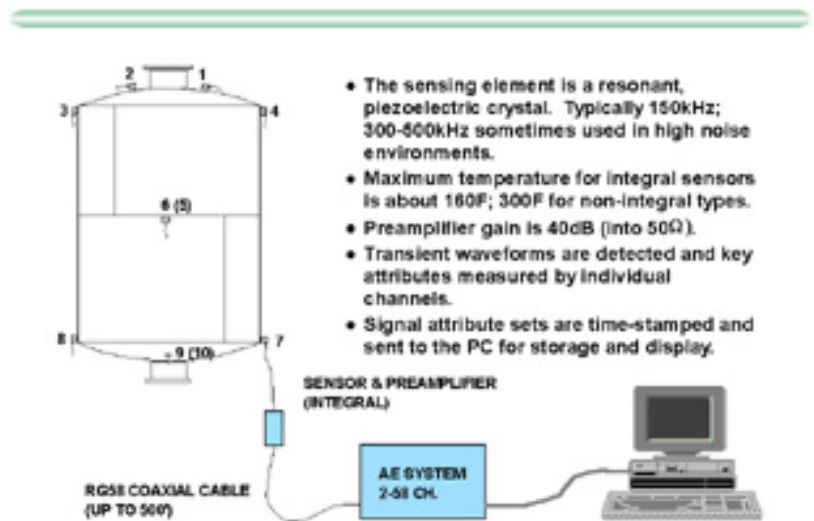
AE testing remains a 'new' test method but the technology is well enough established to be incorporated in ASME, ASTM and other codes of practice. For instance, the DOT now allows AE testing for high pressure gas cylinders and rail tank cars.

TEST PROCEDURE

A successful acoustic emission test relies on close cooperation between the testing company and the equipment owner. This is particularly important in the planning and preparation of an AE test. The other stages are equipment set up, testing, and data evaluation.

Planning and Preparation: This includes collecting information about the equipment to be tested including its fabrication details, operating conditions, and history. Preparation includes making provisions for parking and power for the AE trailer and equipment; attachment of AE sensors

AE SIGNAL DETECTION



(manlift or scaffold, insulation cut-outs etc.); and preparation for the pressurization or other means of loading of the vessel.

Equipment Set Up: Park the trailer, connect power and set up the instrumentation. Attach sensors to the vessel (magnets, clips, tape) and run signal cables back to the trailer. The final step is to check the sensitivity of each sensor and instrument channel.

Pressurize the Vessel: Start by monitoring at constant load (90% of operating pressure or less). Raise the pressure (or level for a tank) in steps with load holds at 90%, 100%, 105% and 110%. This process usually takes between three and six hours. AE data and pressure (level) readings are monitored in real time to check for excessive noise or signs of a serious problem with the vessel. A full analysis is conducted after completing the test.



Analyze the Test Data: This generally means filtering out noise (frictional, flow or other non relevant acoustic activity) then applying the evaluation criteria and intensity analysis to determine whether and approximately where there are significant activity levels. Further analysis may be done to locate the sources of AE activity and narrow down the areas in need of follow-up inspection.

FOLLOW-UP INSPECTION

The results of the AE test will generally be reported on the next day. Areas of significant AE activity are reported in terms of their intensity and inspection priority. Intensity levels range from 'A' through 'E' and most users of AE will investigate areas of 'C' intensity or higher.

AE is a volumetric test method: that is to say it detects defects that are surface breaking (I.D. or O.D.) or embedded. With this in mind, ultrasonic testing is the best method for evaluating reported AE sources. Other methods may also be used (penetrant, magnetic particle) provided the limitations of a surface exam are acceptable.

Differences in the test methods must be borne in mind when evaluating AE and conventional inspection results. The AE test will detect defects that are of structural significance; small, blunt or laminar flaws including HIC damage generally will not show up. Thus a wet magnetic particle exam will usually reveal more indications than an AE test. It is therefore very important to understand these differences when considering an AE test. AE is a good method for detecting structural damage but will not map out all flaws, regardless of their significance, in the manner of more conventional inspection methods.