Nondestructive Testing and Engineering

Our inspectors and engineers have been involved in developing an using nondestructive inspection methods throughout a wide range of the civil, industrial and process industries. Working to established standards or developing procedures for new applications, they have been the leading edge in providing reliable and cost effective inspection.

With inspectors qualified in ultrasonics, penetrants, magnetic particles, visual, acoustic emission and radiographic inspections, TISEC offers the conventional inspections as well as advanced methods with automatic data acquisition and imaging. Our experienced, hands-on inspection personnel and engineering staff have access to advanced test equipment and leading-edge analysis techniques including our proprietary ICEPak signal interpretation software.

A sound knowledge of construction and pressure vessel codes and a library of standard procedures provides an audit trail where required for quality and regulatory requirements.

Ultrasonic Inspection
TISEC is equipped to carry out field inspections for corrosion and lamination mapping, pulse-echo and time-of-flight diffraction weld inspection and special purpose inspections. Where required, advanced inspection methods can be used to produce images such as 3-D weld defect displays and digital equipment is available to record raw data for post test analysis and display.

For large volume shop inspections, TISEC can provide automated, multi-axis immersion scanning with imaged output.

Needs Analysis
TISEC provides a comprehensive engineering backed up by field experience to analyze customer requirements. This may include development and documentation of inspection procedures with reference to applicable codes, specifications and recommended practices.

Training
TISEC provides training in ultrasonic and acoustic emission inspection methods.
**Acoustic Emission Monitoring**

*TISEC* specializes in *acoustic emission monitoring*. This inspection technique detects elastic waves generated within a test specimen by such mechanisms as plastic deformation, fatigue and fracture. It differs from ultrasonic inspection, which actively probes the structure; acoustic emission “listens” for emissions from active defects and is very sensitive to defect activity when a structure is loaded beyond its service load in a proof test. This process can detect flaws and imperfections such as the initiation and growth of fatigue cracks in steel structural members; the failure of bonds, fibres and filaments in composite materials and the appearance of potentially hazardous flaws in metal or synthetic pressure vessels.

We use acoustic emission monitoring as an advanced, cost-effective, sensitive technique for detecting and locating potential problem areas. We then follow up this process with other nondestructive test techniques to quantify problems in the areas identified by acoustic emission testing.

At *TISEC*, we have acquired many years of experience in applying acoustic emission monitoring to assessing the integrity of a wide variety of civil structures including:

- Railroad and highway bridges
- Large pressure and storage vessels butane, propane and various chemicals
- Tube trailers for the transport of compressed gases.
- Low pressure and high pressure containers for the storage and transport of compressed gases.
- Fiberglass reinforced plastic storage tanks.

Bridges contain a large number of joints, welds and connections that are potential initiation points for fatigue cracks. *TISEC* uses acoustic emission monitoring for early detection of fatigue cracks in fracture critical tensile bridge members and to monitor the relative activity of existing fatigue cracks. Advanced signal processing and correlations to parametric measurements are used to isolate noise from dynamic loading, loose connections, rivets and corrosion crack growth.

To discuss your specialized field or plant inspection requirements and to discuss the benefits of acoustic emission monitoring, please contact us at:

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The economic climate of the late 20th Century and our aging infrastructure have forced us to rethink our maintenance management strategies. **TISEC** personnel have extensive field testing experience on steel bridges. They have applied acoustic emission (AE) testing as the primary monitoring method with backup using visual, magnetic particles, liquid penetrants and ultrasonics on some of the largest bridges in North America including over one hundred steel railroad and highway bridges.

Bridges contain a large number of welded, bolted or riveted connections and that are potential initiation points for fatigue cracks. AE detects cracks growth in fracture critical tensile bridge members and monitors crack activity.

Placing advanced computer systems and data acquisition equipment right on the bridge is highly effective allowing data collection from structures which often experience loading close to their maximum level with every passing train. In many cases only a few hours of monitoring is sufficient for witnessing the necessary critical load cycles on a structure.

**TISEC** provides integrated bridge evaluation, including working with the bridge owner/operator on pre-test structural analysis, followed by visual inspection, AE, strain measurement and other nondestructive testing methods. Preliminary test results can be made available on-site for timely decision making.

This combined approach - correlating analysis and field results - significantly enhances the degree of confidence in bridge rating. Improved inspection results cut costs by laying the foundations for managed infrastructure maintenance – ensuring that rehabilitation and repair work is planned and accounted for, and effected only when it is needed. **TISEC**’s inspection services can be an integral part of safe and cost-effective system planning.
As a pioneer in structural integrity monitoring, TISEC has successfully integrated more than a decade of bridge testing and monitoring experience with over a quarter century in fracture mechanics, materials science and solid state physics. Its testing personnel have extensive field experience on steel bridges including the application and use of the latest in safety systems, scaffolding and bridge inspection vehicles.

TISEC has a variety of multichannel digital AE equipment available for bridge inspection as well sophisticated signal analysis techniques combined with advanced data interpretation methods. These address noise problems to ensure that collected AE data represent fatigue crack sources. The multichannel units can be deployed in many combinations to provide coverage of large structures.

With 150 m (600 ft) cables, the system can span 300 m (1000 ft) long bridges. Load monitoring is accomplished with parametric data acquisition modules connected to the AE system. A variety of strain transducers are available including technologies that require very little surface preparation and calibration. Units are available for continuous, on-line remote monitoring of critical structures. In the latter cases, data can be transmitted to either TISEC offices or a customer facility for interpretation and decision making.

The TISEC bridge testing program has benefited from several years of on-going R&D. This has led to new equipment development, new methods and advanced technologies to provide faster, more reliable results and, most recently, new analysis methods based on plate wave modal analyses.

To discuss your requirements for inspection of railroad and highway bridges, contact TISEC at:

In North America: **TISEC Inc.**

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Industrial processing equipment used in the manufacture of chemical and petroleum products requires scheduled inspection as part of routine preventative maintenance and often as part of local or national regulatory requirements. TISEC engineers have developed comprehensive inspection procedures, based on recognized test standards, for mechanical integrity inspection of a variety of processing equipment. Whether it is assessing your equipment for compliance with US Occupational Safety and Health Administration (OSHA) requirements for Process safety management of highly hazardous chemicals, or inspection as a part of routine maintenance, TISEC can meet your needs.

TISEC’s inspection capabilities include detailed engineering assessments, which range from re-rating of processing vessels to determining the life expectancies of processing components, based on test data analysis using current vessel codes and standards. TISEC test technicians are trained and experienced in processing plant inspection methods and test techniques, with appropriate certification in the required inspection techniques. They are familiar with plant safety procedures and are well trained in on-site inspection protocol.

TISEC has developed detailed inspection and assessment procedures for a range of processing equipment including:

- Storage Tanks
- Pressure Vessels
- Piping Systems
- Aboveground Fiberglass Reinforced Plastic Storage Tanks

These procedures are based on standards and recommended practices from standards development organizations such as:

- The American Petroleum Institute
- The American Society of Mechanical Engineers
- The National Board of Boiler & Pressure Vessel Inspectors
- The American Society for Testing and Materials
- The Canadian Standards Association
- Underwriters Laboratories Inc.
In performing mechanical integrity inspections, TISEC staff are trained and experienced in a variety of test methods including:

- Internal visual inspection of tanks and vessels
- External visual inspection
- Weld inspection
- Videoprobe and boroscopic inspection
- Spark testing of glass tank liners
- Pressure testing of vessels and piping
- Ultrasonic thickness measurements
- Ultrasonic flaw detection
- Magnetic particle techniques
- Die penetrant techniques
- Acoustic emission measurements

To discuss your processing plant inspection requirements please contact us at:

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A systematic approach to the regular inspection, testing, and replacement or repair of load bearing equipment; such as cranes, booms or weight handling equipment; rotating machinery, such as pumps, motors; and fluid containment systems, such as process vessels and piping, is essential in any cost-effective manufacturing or process operation.

Inspection and monitoring systems are the key to prevention of breakdowns and failures through adjustment, repair or replacement of equipment before major breakdown or failure occurs.

These preventive maintenance programs also ensure that responsible approaches are in place to meet environmental protection concerns.

**TISEC** is your single source for a comprehensive range of inspection services and monitoring technologies for predictive and preventive maintenance programs including conventional nondestructive testing such as:

- **Vibration Monitoring**
- **Acoustic Emission**
- **Ultrasonic Inspection**
- **Eddy Currents**
- **Radiography**
- **Visual**
- **Magnetic Particle**
- **Liquid Penetrant**
- **Infrared**

*Vibration monitoring* and *acoustic emission* are often used as early predictors of problems and the other methods used as follow up to evaluate the part condition in terms of remaining life and to schedule repair or replacement.
Our Services

On-Request: Our personnel can provide monitoring services when a system or component is thought to have a problem.

Scheduled: Our personnel can monitor key plant systems at regularly scheduled maintenance periods.

Continuous: TISEC can instrument key plant systems for continuous monitoring and transmit the data to TISEC offices for interpretation and retransmit reports to the client.

Comprehensive: Our engineering and technical staff work together with the client to implement a comprehensive preventive maintenance program. Beginning with a client-supplied inventory of machines and tools or an inventory data base developed jointly as a part of the program, a comprehensive program consists of two components; planning and reporting.

Planning:
The planning component provides a preventive maintenance schedule for each machine and tool to track scheduled and unscheduled repairs and replacements. It defines scheduled preventive maintenance for each machine and tool, estimates time and cost to complete the preventive maintenance, provides an alert to impending preventive maintenance by issuing work tickets for monitoring and inspection and for repairs. It defines parts lists and costs for repair/replacement actions and estimates inventory costs.

Reporting and Records:
This component keeps a history of costs of repair in a Machine or Tool Condition Report including outside repairs, and generates management reports on required actions and a summary of costs of maintenance and repairs for each machine or tool. It maintains baseline and historical data archives for data interpretation and maintenance decision making.