

## ABOUT THE EXPERIENCE OF OUR ACOUSTIC EMISSION EQUIPMENT APPLICATION IN VARIOUS INDUSTRIES

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### Abstract:

The Eltest corporation designs and produces different modifications of AE instrumentation during ten years. This one successfully has passed check in field and industrial conditions at examination of numerous industrial objects. This article describes our last experience of acoustic emission examination of different objects in Russia, Italy, Turkey and Canada.

## Introduction

Acoustic emission (AE) technique starts to be applied more widely in different industries to a non-destructive examination of industrial objects: pipe lines and pressure vessels during hydrotest, pneumotest, including in an operation mode, without a stop of the product transfer; tanks; heat exchangers; bridges; cranes; winchs and other metallical structures. AE technique is an convinient tool for the structural integrity evaluation of pressurised systems during a pressure test. The unique capability of the technique lies in its ability to monitor active defects in the real time. There are a lot of reason for disturbing of pressure vessel structural integrity, like residual humidity and low purity of media within objects under examination. So, as a result, it is necessary to have accurate and safer examination method for structural integrity evaluation, like acoustic emission technique.

A lot of different pressure equipments for the storage and transportation of industrial gas, oil and other liquids have to be tested during last ten years by Eltest's engineers. Some industrial objects were tested before they go into service, another ones were tested periodically during repairation period.

## Hardware details.



AE system manufacturer's name :  
ELTEST Inc., Russia.  
Model number : Computerized 40-  
channel AE system LOCUS-4400D.

This hardware makes positioning of AE signals (on a difference time of arrival of elastic waves on three probes for square positioning) and according to the received data allows to classify the defects on a level of their danger. Multichannel sources locations accuracy is a maximum of two times wall thickness or 5% of the sensor spacing distance whichever is greater.

## Test procedure

AE examination were carried out according to ASME Standards Section V Article 12. After the surface preparation (rust and paint removing), on a surface of vessel with the help of integrated magnetic fastenings were established 40 piezoelectric sensors. These sensors are placed on cleaned places with using an appropriate couplant – LITOL-24. The developed triangular scheme of AE sensors positions allow to diagnose the whole area of vessel during one cycle of examination.

After installation of AE sensors, on-site calibration of the system is carried out by an artificial acoustic signal from Hsu-Nielsen AE simulator (break 0,3 mm 2H leads) located on certain distance from each probe. The measured peak amplitude does not vary more than 3 dB from the average of all channels.

After performance of preparatory and adjusting works, internal pressure of the vessel started to increase under the control of experts. The speed of pressure increase was not more than 1 bar per minute. AE measurements are carried out in process of increasing of vessel internal pressure up to beforehand chosen level and during endurance of pressure at the certain levels.

The different kinds of noise are the main restricting factors for using of acoustic emission. Pressurizing equipment noise was removed by the system threshold.

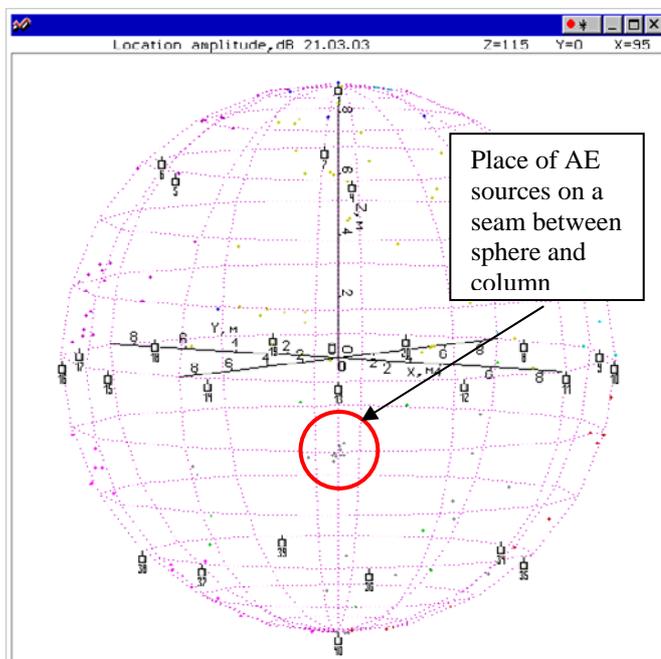
In postprocessing we filter some noise by using combination of different data filters, based on event amplitude, duration and rising time criterions. For classification the ordering of sources on event amplitude, MARSE, duration, rising time by stages of examination was made. Analysis of AE sources parameters dynamics versus of pressure increasing was made.

### AE examination in Turkey

Acoustic emission test of several vessels for liquid propan gas storage in Turkey refinery was made in 2003. The volumes of objects under examination were different: from 1000 m<sup>3</sup> up to 5000 m<sup>3</sup>. The form of vessels were cylindrical and spherical. For spherical vessels it was necessary to check not only spherical surface, but the columns also. The places of special interest were seams between spherical surface and columns. One place of AE sources on a seam between sphere and column was shown on a picture below.



Sphere for liquid propan gas storage.

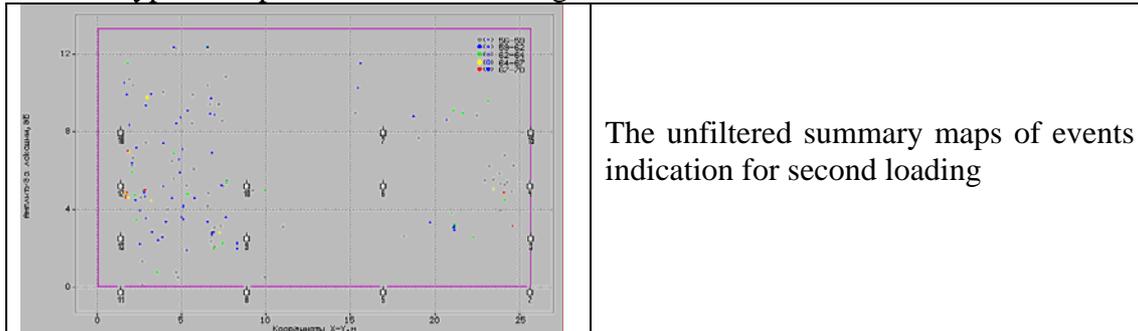


Filtered map of AE sources locations with active emission sources.

This place were showed to customer to repeat the examination using other NDT technologies.

### AE examinations in Italy and Canada

Also our last experience includes acoustic emission examination of several objects in Italy and Canada. There was eight big chemical reactors (diameter near 4 meters, length 20 - 26 meters, test pressure 160 - 250 Bars). This vessels were tested before they go into service. Examination procedure was the similar like described above. Typical map of events is on this figure.



In all this cases acoustic emission tests have been satisfactory. All revealed AE sources belongs to admissible. There is no inadmissible dangerous defects in the vessels. The evaluation of acoustic emission maps has not indicated areas requiring additional NDT test or AE retest.

### Latest AE examinations in Russia

During 2003-2004 years our company provides examination of more than 480 km of different pipelines and several vessels in Russia. We also install three devices (totally 56 AE channels) to provide a continuous AE monitoring of six chemical reactors in Kazan. In this case AE monitoring allows the prolongation of vessel's lifetime, because some of this have growing cracks.