

CASE STUDY – ACOUSTIC EMISSION TESTING



PRESSURE VESSEL

Job Overview

As per the Client's inspection/maintenance team, their major concern was to know the condition of the pressure vessel.

The Acoustic Emission Testing (AET) of in-service pressure vessel was performed in July 2020 by Arise Global Pte Ltd.

- ✚ Sensors were mounted using magnetic holders and high temperature couplant. This allowed appropriate sensitivity and reliability of installation.
- ✚ Data was collected/monitored from the pressure vessel at different pressure levels during fill and hold periods.
- ✚ AE signal detection was performed in threshold mode for corrosion/crack/stress activity detection and in continuous mode for leakage activity detection.
- ✚ AE data recorded during the examination was analysed using specially developed analysis procedure.



Fig 1: Pressure Vessel

Inspection Equipment Details:

Item No	XXX
Diameter	2 m
Thickness	14mm
Material	C22N Carbon steel
Corrosion Allowance	3mm
Circumference	6.28m
Built Year	XXX
Medium inside the vessel	LPG
Operating Pressure	6 Bar
Operating Temperature	45°C
Capacity	20 m ³
Last Cleaning/Repair Date	2018



Testing Equipment Details:



Fig 2: Vallen AE system



Fig 3: AE Sensor Model

AE Examination:

- ✚ The vessel was pressurized according to ASME Sec V; Art. 12 is as shown in Figure below.

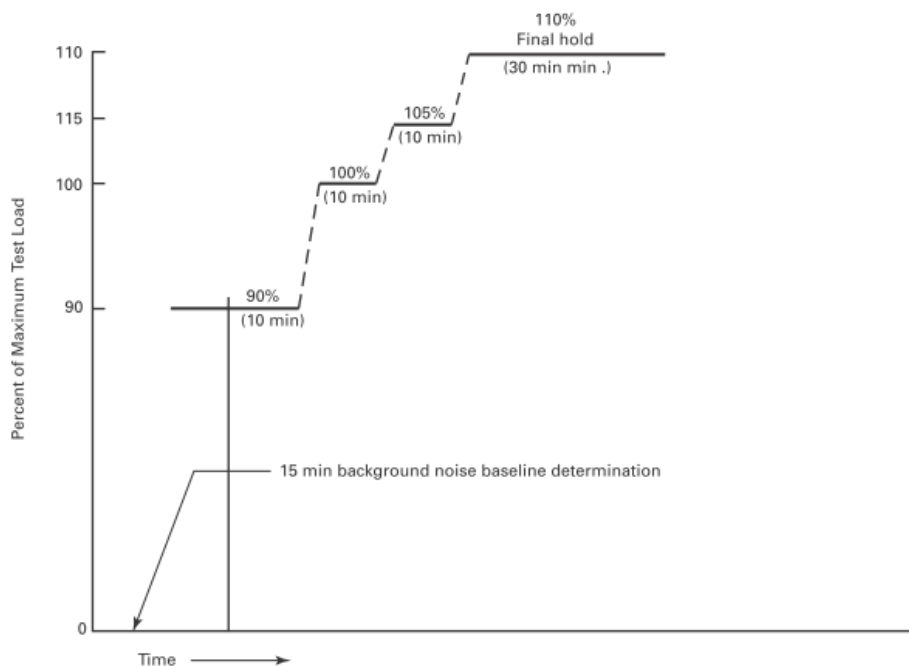


Fig 4: Pressurizing sequence for in-service pressure vessel as per ASME section V Article 12.



AE Inspection Results:

Source Localization Diagram for Pressure Vessel:

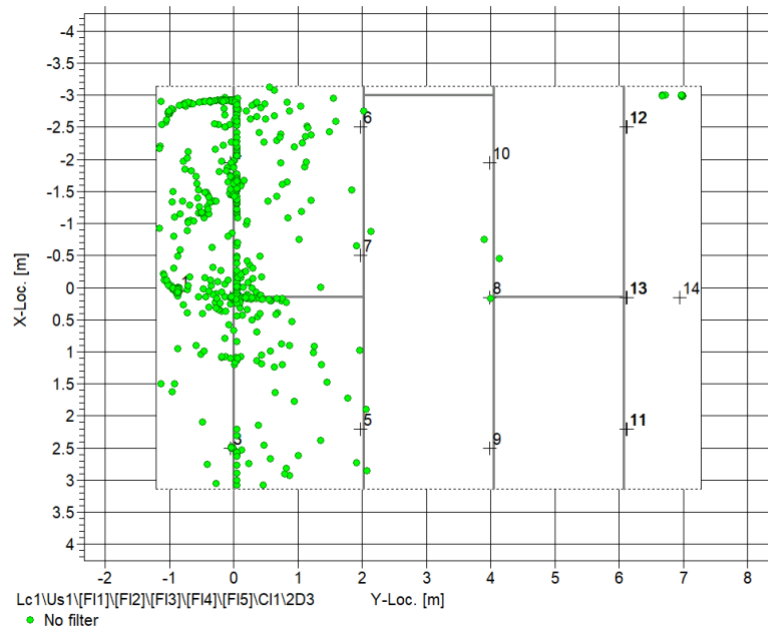


Fig 5: General Acoustic Emission activities of Pressure Vessel at maximum operating pressure

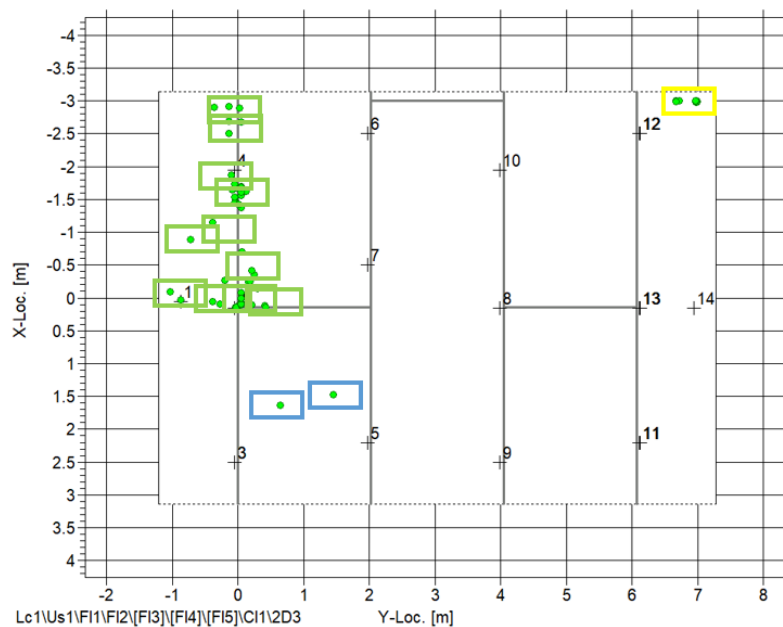


Fig 6: 2D Diagram of significant AE activity locations with severity at maximum operating pressure

No/Minor Activity Moderate Activity Minor Crack Activity



Conclusion:

Vessel Condition Grading	C
Next Inspection	Within 12 months
As per the analysis, the following are the findings around the structure of the pressure vessel: 1) Minor activities in certain areas during hold stages of different pressure levels. 2) Moderate activities near to AE sensors 1,2,3 and 4. 3) Minor crack activities near to AE sensor 11,12 and 14.	

Recommendations:

- ✚ A repeat AE inspection of this pressure vessel should be carried out within 12 months to monitor growth of significant activities observed.
- ✚ PAUT inspection is recommended to confirm any crack/minor crack activities at the clustered detected defect areas.

Validation of AET results by subsequent UT inspection:

Sl. No.	Defect Locations identified by AET	AET recommendations	PAUT Inspection Results	PAUT Defect Severity
1	Circular weld between AE sensors 2 & 4	PAUT of the weld	Blisters and pittings observed near 3 o' clock position near the T junction of CS-1 & LS-1	Minor
2	Circular weld between AE sensors 4 & 3	PAUT from location 0 - 125cm from sensor 4	Small blisters and some pittings observed all around this area	Minor
3	Dish head area between AE sensors 1,2-4	PAUT in the cluster area near to sensor 2	Major blisters observed all around the area near 9 o'clock position of the dish head near CS-1	Severe
4	Dish head area between AE sensors 1,3-4	PAUT from location 0-50cm from sensor 3, 4	Small blisters and some pittings observed all around this area	Minor
5	Axial weld between AE sensors 2 & 7	PAUT from location 0-150cm from sensor 2	Blisters observed all around the area near at T Junction of CS-1 & LS-1	Minor
6	Dish head area between AE sensors 14, 11-12*	PAUT in the cluster area near to sensor 14	Major blisters observed all around the area near 9 o'clock position of the dish head near CS-4, and Hydrogen Induced crack has been observed at this location	Severe

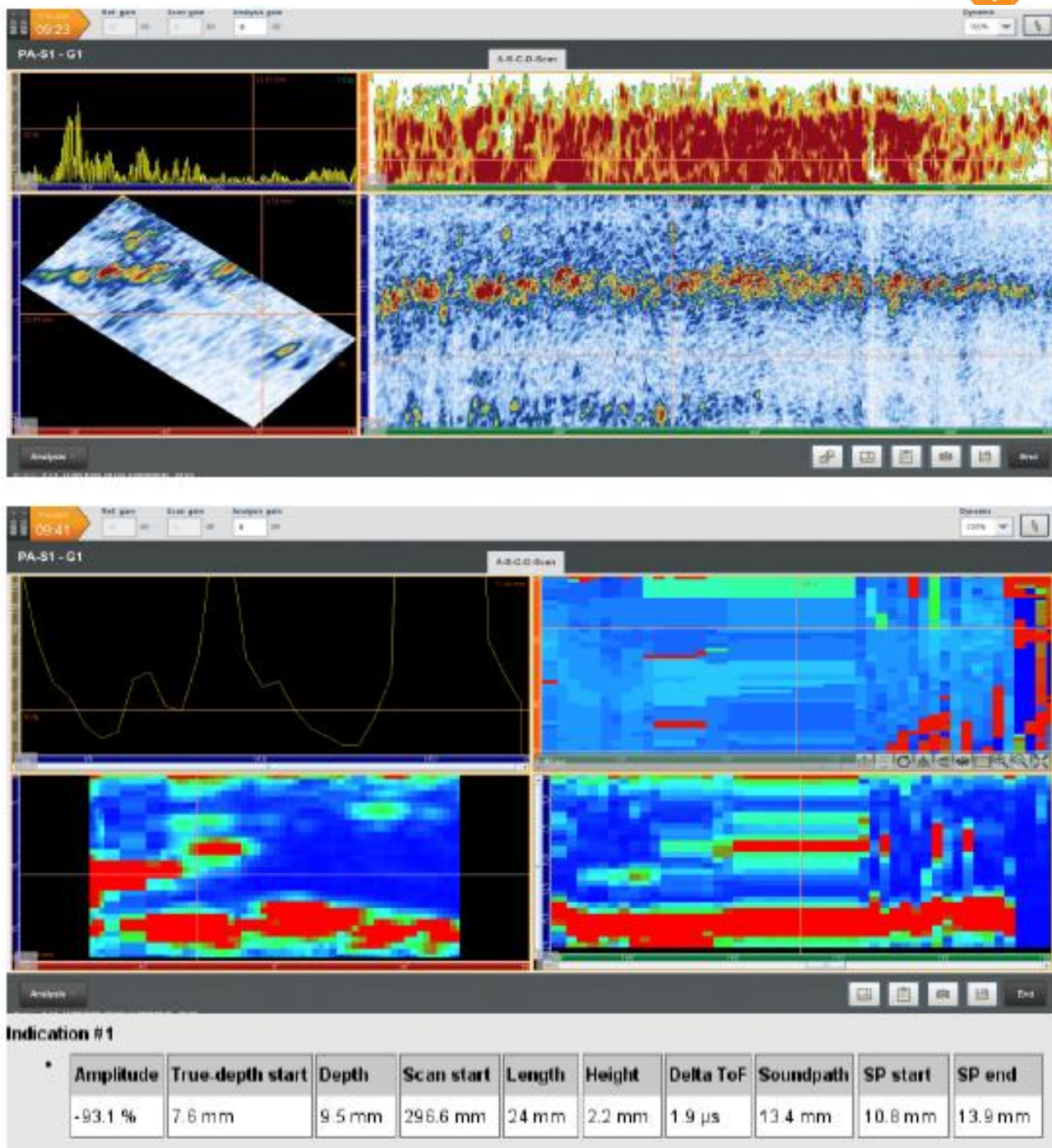


Fig 6: Screenshot of crack detected by PAUT on dish head between blisters (After CS4, 9 O' clock position)