

APR INSPECTION ON U-TUBE

- Mr. Jeff Lew

DATE OF INSPECTION	11 Sept 2019	TOTAL NO. OF TUBES INSPECTED	4
LOCATION	Italy	CONFIGURATION	U-tube
		TUBE OUTER DIAMETER	25.4mm
		TUBE THICKNESS	2.77mm
		TUBE LENGTH	12.6m

THE CHALLENGE

The client would like to verify the capability of acoustic pulse reflectometry inspection system (APRIS) for U-bend tube.

THE SOLUTION

Acoustic Pulse Reflectometry technology (APR) can identify holes and blockages in a tube of regardless of tube configuration and material. It is quick as it takes only 10 seconds per tube for measurement and can give the location and size of the defects.

After measurement had been taken by APRIS, Tube #4 had been identified with 38.1 % wall loss as shown in Table 1.

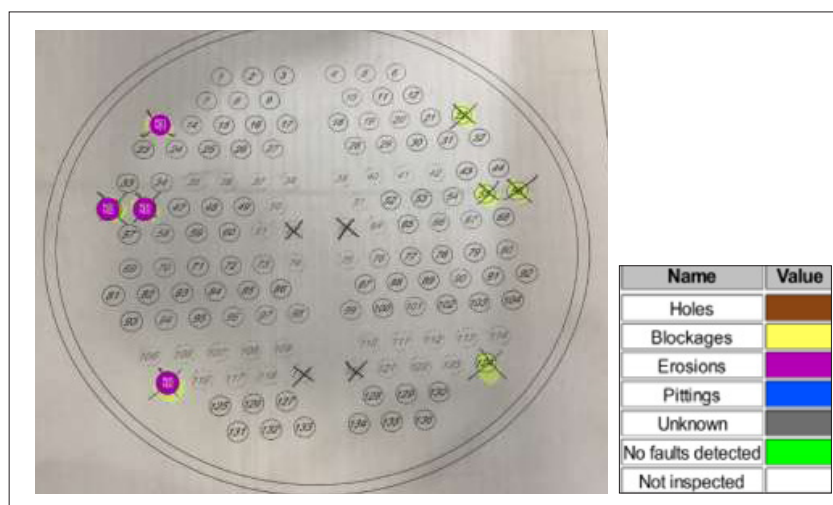


Figure 1: Defects

Wall loss

Fault ID	Tube ID	Pos[m]	Wall Reduction[%]	Wall Reduction[mm]	Comments	Graph
1	R[1]	2.46	24.6	0.68		Link
3	R[1]	3.6	30.4	0.84		Link
5	R[1]	4.73	28.9	0.8		Link
7	R[1]	6.21	27.3	0.76	Wall loss at U bend	Link
9	R[1]	8.32	32.6	0.9		Link
11	R[1]	6.63	27.3	0.76		Link
13	R[2]	12.49	21.3	0.59		Link
15	R[2]	5.33	31.4	0.87		Link
17	R[2]	6.9	25.8	0.71		Link
19	R[2]	4.5	28.7	0.79		Link
21	R[3]	0.12	27.3	0.76		Link
23	R[3]	3.52	31.7	0.88		Link
25	R[3]	6.92	30.4	0.84	Wall loss at U bend area	Link
27	R[3]	7.99	26.1	0.72		Link
29	R[4]	0.32	25.2	0.7		Link
31	R[4]	5.04	38.1	1.06	General wall loss including bend area	Link
33	R[4]	9.3	29.8	0.83		Link
35	R[3]	5.9	24.7	0.68		Link

Table 1: Wall loss defect table.

VERIFICATION

After viewing the defect table, the client decided to cut open tube R[4] to verify the wall loss. The wall loss was proven to be at the exact location as indicated in the defect table.



Figure 2: Cut U-tube with wall loss.

CONCLUSION

The advantages of APR were demonstrated in the following aspects:

- Speed of measurement : APR was able to quickly assess the condition of the U-tube in a fraction of the time as compared to other technologies.
- U-bend defect detection : APR was able to detect defects located in the U-bend area.
- Sizing and Location indicated APR indicated the size and location of the defects.

APR technology is recommended for applications such as condenser, reboiler and heat exchanger, which have defects originating from the inner diameter of the tubes and located in the U-bend. **APR was proven to be useful in quickly detecting inner diameter surface defects.**