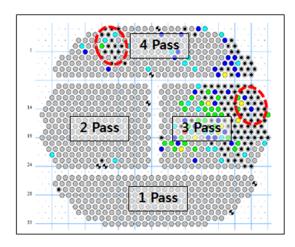
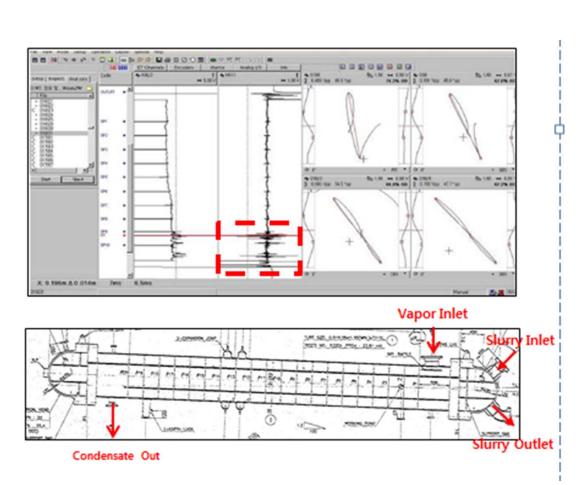
TUBE FAILURE STATUS

Since Heat Exchanger operation in 2001 year, for 15 years Tube failure occurred in drain outlet where located between Tube sheet and 2ND baffle at 3, 4 pass area particularly as much as 8~10 tube leakage yearly.

Currently total Tube Plugged q'ty is 127 of 932 tubes.

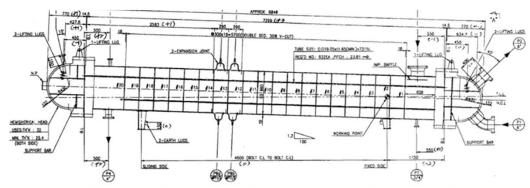






Description	Unit	Design Condition		
		Design	Actual	
Tube <u>Q'ty</u>	EA	932	901	
ID	mm	860	860	
Tube Thickness	mm	1.65	1.65	
Tube Pitch	mm	23.8	23.8	
Tube Length	m	7,315	7,315	
Tube In/Out Velocity	m/s	1.7	1.9	
Tube In / Out	℃	125 → 183°C	123 → 176°C	
Shell In / Out	℃	187 → 187°C	196 → 171℃	
Surface area	m²	408	380.9	
Heat Duty	MMkcal	13.8	13.4	

1) Shell Side Flash Vapor: 0.3% of <u>Terephthalic</u> Acid contained Water, Condensate water pH 3.8



	Shell Side	Tube Side		Shell Side	Tube Side
Fluid	Process Steam	Reactor Feed	Design Press' (K/G)	14.5	120
재질	SUS304L	SUS316L	Operating Press' (K/G)	9.0	100
No. of Pass	1	4	Design Temp' (°C)	199	200
No. of Tube	-	932	Operating Temp' (°C) (In/Out)	178	128 / 162
Surface Area (m²)	408		Heat Duty (MMkcal)	13.	79

3) Tube Plugging Status for 3 months Operation



<1 Pass>

Tube: 232ea

Metal Plugged Tube: 1ea

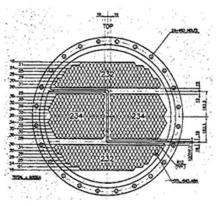
T.A Plugging: 148 ea

<2 Pass>

Tube: 234ea

Metal Plugged Tube: 1 ea

T.A Plugging: 132 ea



<3 Pass>

Tube: 234ea

Metal Plugged Tube: 91ea

T.A Plugging: 46 ea

<4 Pass>

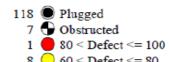
Tube: 232ea

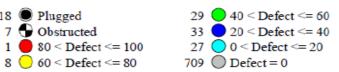
Metal Plugged Tube: 36 ea

T.A Plugging: 0 ea

X Tube Plugged Increased for Operation

2005.10	2007.09	2009.01	
		00000000000000000000000000000000000000	
2012.05	2014.05	2016.05	

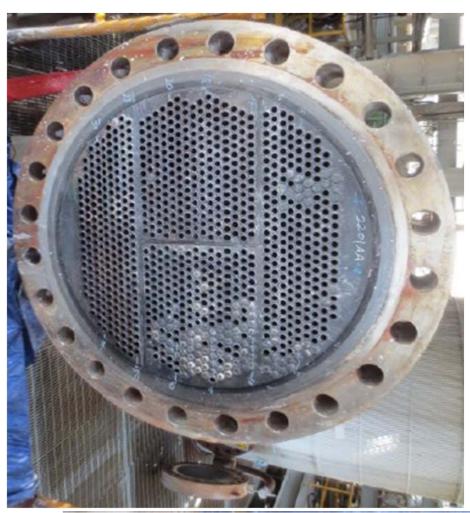


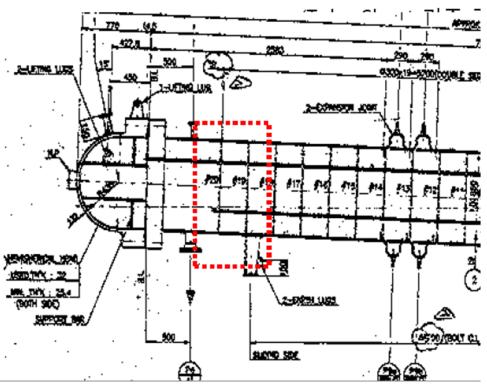


0 O Default

TUBE DAMAGE LOCATION AND STATUS

Location : Drain Nozzle (2ND Baffle from Tube Sheet) At 3 Pass and 4Pass Area

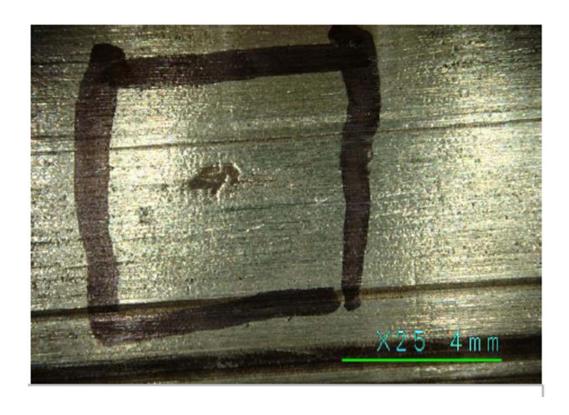




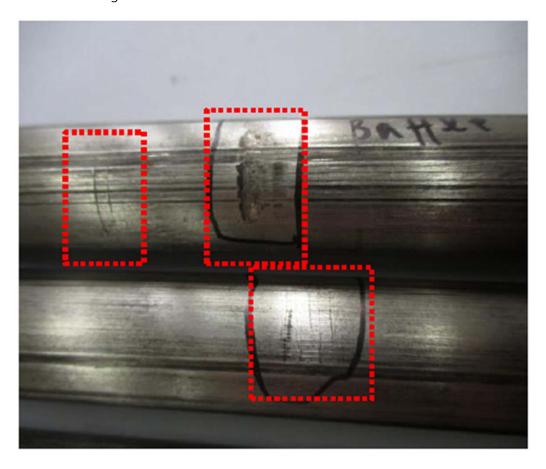
1. Tube Surface Pitting



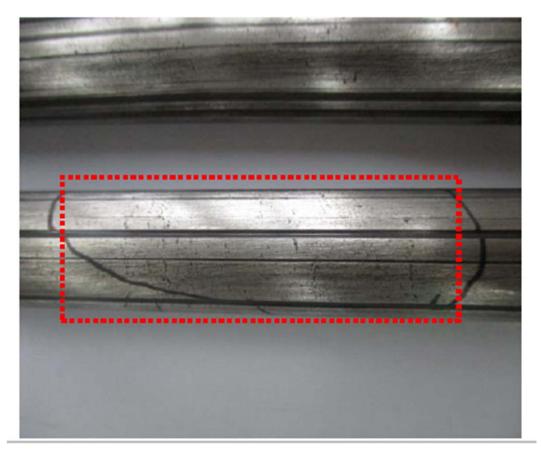


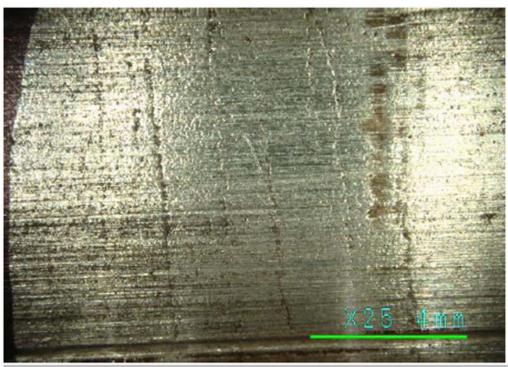


2. Friction Damage at Baffle

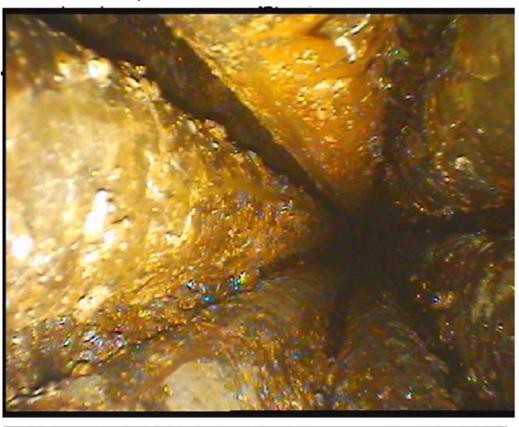


3. Tube Surface Pitting and Micro Crack





4. Tube Surface near by Tube Sheet







5. Micro Crack (Max. 1.1mm)

