



## INSPECTION REPORT

To:	xxxxxxx	Attn:	xxxxxxx
From:	Troika Inspection Service Co., Ltd	Report Date:	xxxxxxx

Project No.:	:	xxxxxxxxx
Vendor Name	:	xxxxxxxxx
Factory Name	:	xxxxxxxxx
Factory Address	:	xxxxxxxxx
Order No. / PO No.	:	xxxxxxxxx
Product description:	:	Heat Exchanger
Inspection Date:	:	xxxxxxxxx

### 1.0 Scope of Inspection:

(Brief description of details of inspections, tests etc. carried out/witnessed)

Equipment description:	Heat Exchanger	
I.T.P. line number	Inspection Activity	Results
002	Welding check of tube-to-tube sheets	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
003	Visual check of tube-to-tube sheets joints	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
004	Welding check of filler layer and cover layer of shell to tube sheet	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
005	Visual check of weld(C1&C2) of shell to tube sheet	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
006	Fitting-up check of nozzle(V1&V2) to tube sheet	<input type="checkbox"/> Accepted without deviation <input checked="" type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
007	Visual check of weld of nozzle(V1&V2) to tube sheet	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
008	Helium test for tubes and tube-to-tube sheets joints	<input checked="" type="checkbox"/> Accepted without deviation <input type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject
009	PT witness before tube expansion for weld and HAZ of tube-to-tube sheets joints	<input type="checkbox"/> Accepted without deviation <input checked="" type="checkbox"/> Accepted with deviation <input type="checkbox"/> Reject

### 2.0 Reason for visit

The purpose of this visit is to check the status of material in work shop and witness the welding and testing;

### 3.0 Documentation used

DOCUMENT NUMBER	REV. No.	TITLE	Approval Status
ZS16-E227-01~09	1	Assembly drawing	A
ITP16-E-020-2	1	Inspection Test Plan (ITP)	A



Drawing	2	Weld map	A
JIR-16034	0	Weld Procedures Specification/ Procedure Qualification Record	A
YSMUT2016042	3	Mock up test procedure	A
Procesure		Hydrostatic test procedure and helium test procedure;	A

#### 4.0 Details of inspection performed

##### 4.1 Material status

- Carbon steel plate of baffle plate and shell plates were received by mill;
- Tube sheets with drilling hole had been received by mill;
- Tubes had been received by mill;
- Flanges and nozzles of shell had been received by mill;
- Baffle plates had been received by mill;
- Tie rod and impingement rod had been received by mill;
- As information from mill, channel material of flanges had been received by them, but heads estimated receive date on Apr-8th-2017(updated time, last time is Mar-31st-2017);

##### 4.2 Fabrication status

- Shell to shell welding had been finished;
- Fitting up of nozzle to shell had been finished, internal welding had been finished;
- Nozzle (V1&V2) welding had been finished;
- Shell to tube sheets welding had been finished;
- Welding of tube-to-tube sheets had been finished;
- Helium test had been finished;
- PT before tubes expansion is still in process;

##### 4.3 Fabrication progress:

Item No.	head Forming	Welding of shell	welding of nozzles	tube bundle	welding of tube to tube sheets
Hydro-test	Painting				
E-020-2	0%	100%	80%	100%	100%
0%	0%				

##### 4.4. Inspection activity

##### 4.4.1 Welding check of tube-to-tube sheets

- TIS inspector performed welding check of tube-to-tube sheets including welding consumable(ER2209,Φ1.0, I.D. No.:HS14-114), welding parameter, welding position and welder's qualification(W20, W28 and W110 for filler layer welding, W110, W28 and W43 for cover layer welding), the results were acceptable according to drawing no.:ZS16-E227-01, Rev.4 and WPS(TTW-034, rev.0) that submitted by mill;

- TIS inspector performed welding check for 4pcs replace tubes of tube-to-tube sheets including welding consumable (ER2209, Φ1.0, I.D. No.:HS14-114), welding parameter, welding position and welder's qualification (W20 for root layer welding and filler welding, W110 for cover welding), the results were acceptable according to drawing no.:ZS16-E227-01, Rev.4, WPS (TTW-034, rev.0) that submitted by mill and repair procedure which acceptable by Dow;

#### 4.4.2 Visual check of tube-to-tube sheets joints

- TIS inspector performed visual check of tube-to-tube sheets of filler layer and cover layer, and 7pcs catch up tube ends were found at top tube sheets. After confirming with Dow SME at mill workshop, one additional layer was welding by mill for the 7pcs tubes. No defect and no burn through was found, the final results were acceptable according to drawing no.: ZS16-E227-01, Rev.4 and Dow specification G9S-3000-01(17-Feb-2016).

#### 4.4.3 Welding check of filler layer and cover layer of shell to tube sheet;

- TIS inspector performed welding check of filler layer and cover layer of shell to tube sheets including welding consumable(E309L-16, I.D.: HT17-030), welding parameter, welding position and welder's qualification(W32), the results were acceptable according to WPS no.:YA-562, rev.0, drawing no.: ZS16-E227-03, rev.03 and Dow specification G8S-6500-01(25-Jan-2016).

#### 4.4.4 Visual check of weld (C1&C2) of shell to tube sheet

- TIS inspector performed visual check of weld (C1&C2) of shell to tube sheet including weld seam appearance, fillet weld size, the results were acceptable according to drawing no.:ZS16-E227-03, rev.03, ASME VIII.1-2015 and Dow specification G8S-6500-01(25-Jan-2016).

#### 4.4.5 Fitting-up check of nozzle (V1&V2) to tube sheet

- TIS inspector performed fitting-up check of nozzle (V1&V2) to tube sheets including nozzle orientation check, gap check, projection length from center line check, and found nozzle orientation according to drawing cannot get enough fillet weld size because nozzle O.D. is almost flush with the edge of tube sheets' bolt area. After confirming with XXX at mill workshop, the orientation of V1 and V2 had been adjusted(center of thickness of tube sheet's bolt area) in order to get enough fillet weld size.

#### 4.4.6 Visual check of weld of nozzle (V1&V2) to tube sheet

- TIS inspector performed visual check of weld of nozzle (V1&V2) to tube sheet including weld visual quality, fillet weld size, the results were acceptable according to drawing no.: ZS-ES227-01, rev. 4& ZS-E227-03, rev.3 and Dow specification G8S-6500-01(25-JAN-2016).



#### 4.4.7 Helium test for tubes and tube-to-tube sheets joints

- XXX and TIS inspector performed helium test for tubes and tube-to-tube sheets joints including calibrate equipment by standard leak detector, test pressure (3.2bar), helium volume percentage (30%), soaking time, and no leak rate is out of acceptable criteria, the results were acceptable with note according to Dow specification G8S-5031-03(28-Jan-2011) and helium procedure submitted by mill.

Note: No helium equipment calibration certification was submitted by mill for reference till end of the visit. The standard leak detector and pressure gauges were calibrated.

#### 4.4.8 PT witness before tube expansion for weld and HAZ of tube-to-tube sheets joints

- XXX and TIS inspector witnessed PT before tube expansion for weld and HAZ of tube-to-tube sheets joints including test panel, and 215pcs tubes' end of inside surface showed linear indications on bottom tube-to-tube sheets and 185pcs tubes' end of inside surface showed linear indications on top tube-to-tube sheets. The results were pending.

#### 5.0. Result of Inspection

☐ Accepted without deviation ☒ Accepted with deviation ☐ Reject

#### 6.0. Quality Records reviewed and attached:

- Raw Material certificate
- Dimension and visual inspection report
- NDE operator certificate
- Welder certificate

#### 7.0 Progress Status

Befroe to next step, the mill should confirm it with client for the above findings.

#### 8.0 Next Forecasted Inspection Date:

TBA;

#### 9.0 Attendees

- Mr. XXX project manager
- Mr. XXX Inspector
- Mr. XXX TIS inspector on behalf of XXX

Any deviation & PUNCH attached : Yes <input checked="" type="checkbox"/> No, <input type="checkbox"/>	Punch No.: XXX
IRN attached : Yes <input type="checkbox"/> No, <input checked="" type="checkbox"/>	IRN No.: NA

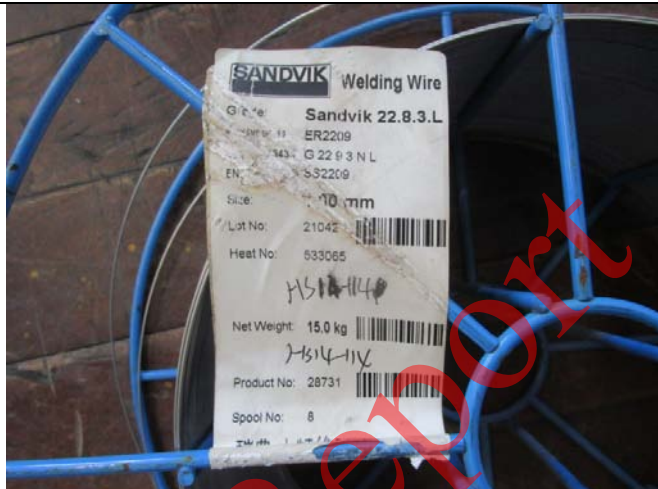
#### 10. Photo Report



**Photo 1. Visual check of tube-to-tube sheet during welding**



**Photo 2. Welding consumable check**



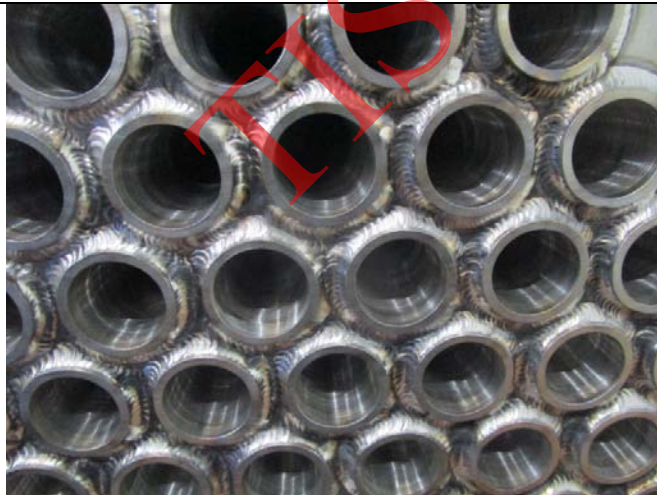
**Photo 3. Welding parameter check**



**Photo 4. Process of welding**



**Photo 5. Visual check of tube-to-tube sheet**



**Photo 6. Visual check**





Photo 7. Catch up tube end



Photo 8. Additional layer for catch up tubes



Photo 9. Fitting-up check of nozzle V1&V2



Photo 10. Fitting-up check: tack weld's filler metal

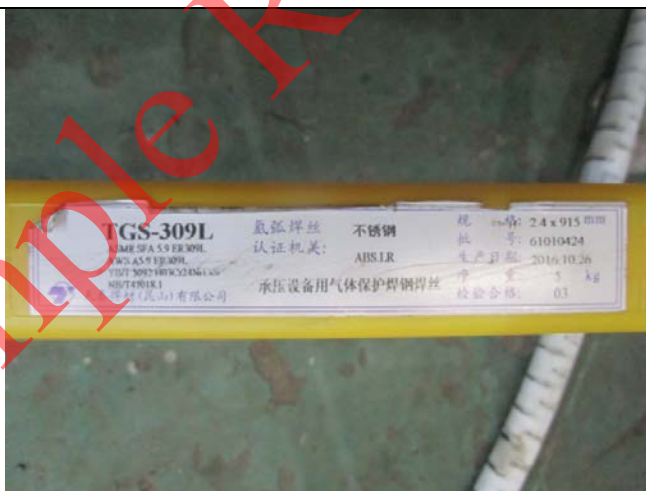
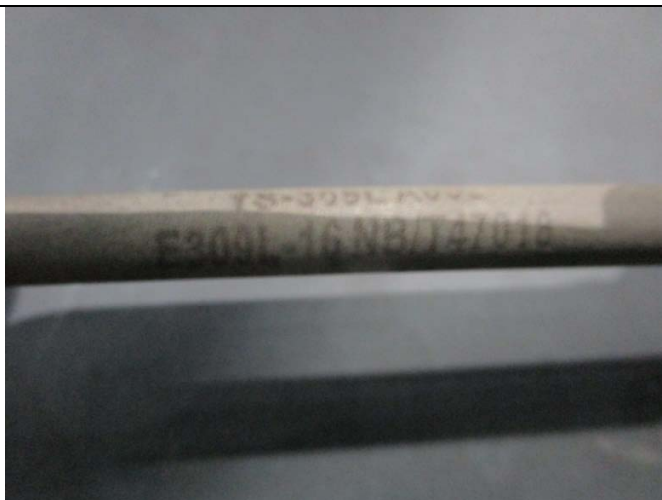


Photo 11. Fitting up check of V1&V2: tack welding parameter



Photo 12. Welding check of C1&C2: filler metal check







<b>Photo 13. Welding check of C1&amp;C2: filler metal check</b>	<b>Photo 14. Welding check of C1&amp;C2: welding parameter check</b>
	
<b>Photo 15. Welding check of C1&amp;C2: Cleaning check</b>	<b>Photo 16. Welding check of C1&amp;C2: witness process of welding</b>
	
<b>Photo 17. Visual check of C1&amp;C2: Weld size check</b>	<b>Photo 18. Visual check of C1&amp;C2: Weld size check</b>
	



Photo 19. Visual check of V1&V2: Weld size check



Photo 20. Helium test: Gas check



Photo 21. Helium test: Pressure gauge with calibration label



Photo 22. Helium test: He pressure



Photo 23. Helium test: Cleaning check before helium test



Photo 24. Helium test: prepared before helium test





Photo 25. Helium test: Calibration equipment



Photo 26. Helium test: Witness helium test



Photo 27. Helium test: Max. helium leak rate

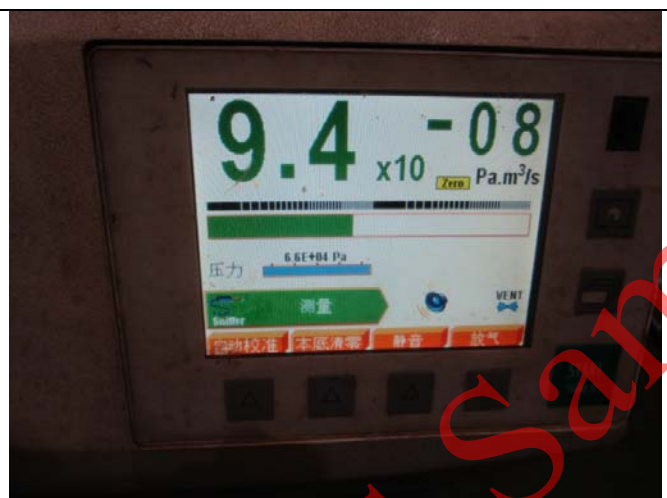


Photo 28. Helium leak rate without background gas affect



Photo 29: PT witness

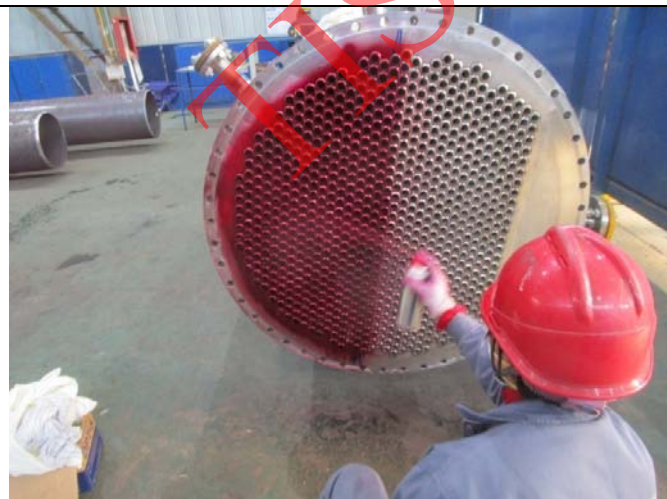


Photo 30: PT check for weld of bottom tube-to-tube sheets

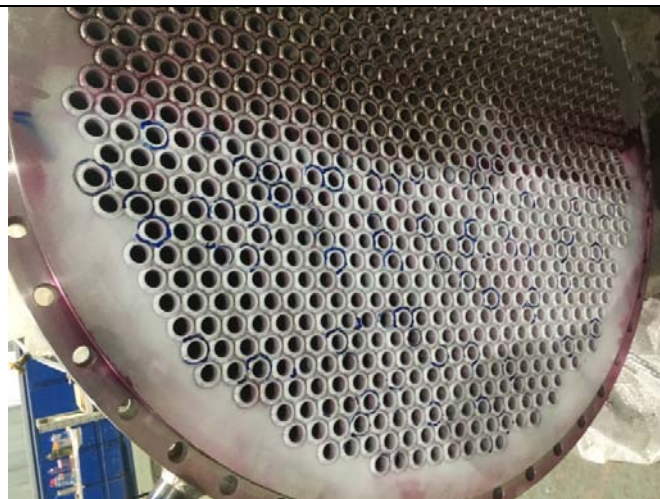

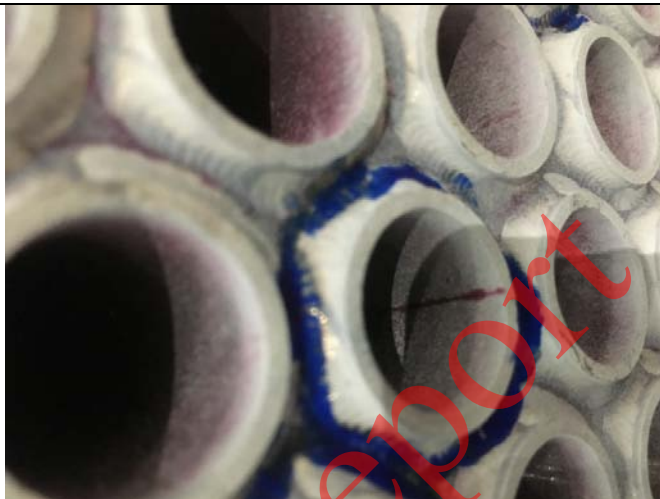
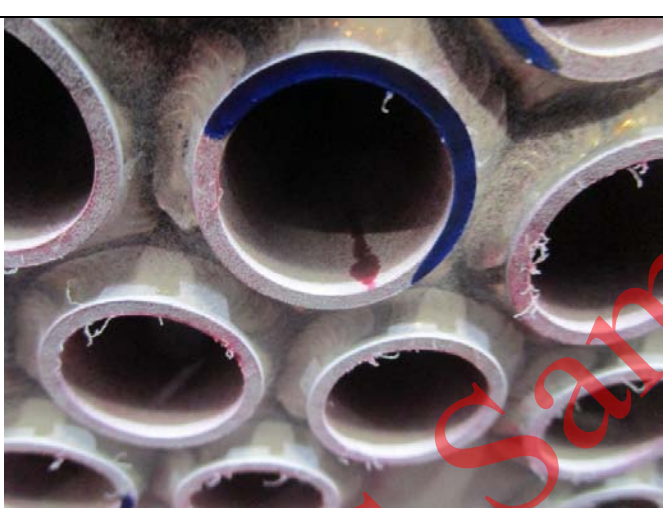


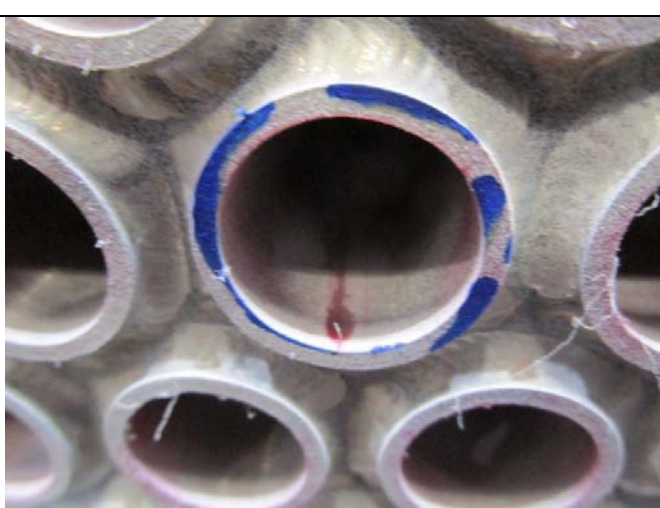




Photo 31: Test Panel	Photo 32: Linear indications were found
	
Photo 33: Linear indications were found	Photo 34: Linear indications were found
	
Photo 35: Linear indications were found	Photo 36: Linear indications were found
	





**Troika Inspection Service**

**Your Quality Solution Partner**

Report No.:xxxxx

<b>Prepared by :</b> xxxxx  <b>Signed:</b> xxxxxx  <b>Date:</b> xxxxx	<b>Reviewed by :</b> xxxxxxxx
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TIS Sample Report