

Project : SOUTH PARS GAS FIELD DEVELOPMEN TPHASES 22, 23 &24						Date: 09-Oct-2021			
ABAN Project No : 17189						Tr. No.: 17189-15			
Out Put From :		<input checked="" type="checkbox"/> Procedure	<input type="checkbox"/> Mechanical	<input type="checkbox"/> Civil	<input type="checkbox"/> Electrical				
ITEM	Title	DOC. / DWG. No.	Rev.	QTY		Purpose			
				Hard	Soft	FI	FA	FF	
1	Inspection and Test Plan For First Step Product Air Cooler (E-1708)	17-VD-204-QC-ITP-051-A4	2						
2	Surface Preparation, Painting and Coating Procedure For First Step Product Air Cooler (E-1708)	17-VD-204-QC-PCJ-047-A4	1						
3	Hydrostatic Test Procedure For First Step Product Air Cooler (E-1708)	17-VD-204-QC-PCJ-044-A4	1						
4									

Notes :
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FI=FOR INFORMATION FA=FOR APPROVAL FF=FOR FABRICATION
This transmittal Cancels all previous revisions.

Design Expert M.Khajehzadeh
Sign & Date 9-Oct-21







Notes :
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Planning Expert
Sign & Date

Result of review : (If Need any change or recommendation please note bellow and send back to Design Dep't) untill.....

Review by : Sign & Date

Eng. Consultant:	Project: Sepahan Oil Project Base Oil Unit Group II & III Project	PMC: 	Owner: 
Vendor: 	Doc. Title: Inspection and Test Plan For First Step Product Air Cooler (E-1708)		
PO No.:17-66-POR-ME-204	Doc. no. : 17-VD-204-QC-ITP-051-A4	Rev. : 02	Page : 1 of 8

Doc. Title

Inspection and Test Plan For First Step Product Air Cooler (E-1708)

HDT-Air Cooler





PURCHASER (OWNER) Name: Sepahan Oil Co (SOC)




PURCHASER Requisition No.: 17-66- POR-ME-204

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REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
02	22-Sep-2021	Issued for Approval	M. Abbaszadeh	M. Abbaszadeh	P. Karimzadeh
01	02-May-2021	Issued for Approval	M. Abbaszadeh	M. Abbaszadeh	P. Karimzadeh
00	21-Apr-2021	Issued for Approval	M. Abbaszadeh	M. Abbaszadeh	P. Karimzadeh

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Hold Point (HP)	<p>An activity designated by COMPANY, TPA and CONTRACTOR in the approved ITP which requires inspection/verification and acceptance by COMPANY, TPA and CONTRACTOR before proceeding to any further steps.</p> <p>VENDOR shall not perform any activities/items beyond a Hold Point without written approval by relevant parties when obtaining prior written permission for proceeding to further steps.</p>
Witness Point (WP)	<p>An activity designated by COMPANY, TPA and CONTRACTOR, which requires witnessing by COMPANY, TPA and CONTRACTOR as the activity will be performed after proper notification has been provided.</p> <p>VENDOR is not obliged to hold further processing, if COMPANY, TPA and CONTRACTOR are not available to witness the activity or does not provide the comments before the date related activity. Basis of acceptance shall be as per relevant technical specification.</p>
Random Inspection (RI)	<p>A designated point during or following an activity at which random inspection or random examination is required in accordance with the relative procedure and ITP.</p> <p>Work may proceed through the designated witness point if VENDOR has officially informed that inspector is not present to witness activity.</p>
Review of documents (RD)	VENDOR shall submit the certificates, inspection and test documents to the CONTRACTOR/TPI/Contractor for his review.
Review & Approval (RA)	VENDOR shall submit the required documents to the CONTRACTOR/TPI/Contractor for review and approval.
AAC	Aban Air Cooler
PMC	NDEC
ENG	Petrogas Jahan Engineering Co.
SOC	Sepahan Oil Company (Owner)
TPA	Third Party Agency

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No.	Activity	Characteristic to be Verified	Test Frequency	Acceptance Criteria	Reference Procedure	Verifying Document	Involved Parties		
							ABAN	TPI	PMC/ OWNER
A	Pre-Inspection Meeting	---	---			PIM MOM	HP	WP	HP
B	Tube Bundle inspection								
1	Storage of materials & welding consumables		100%	ASME VIII Div-1, Appendix 10,	Project Spec.,	Welding Material Certificate, Mill Certificate	HP	WP	RI
2	Review of documents								
2.1	Engineering documents (DWG, calculation & ...)	DWG, Calculation and		ASME VIII-1, ASME IX	Project Spec., Approved documents	WPS	HP	R	RA
2.2	Welding Book (WPS & PQR)	WPS & PQR Review	100%	ASME VIII-1, ASME IX	Project Spec., 17-VD-204-QC-PCJ-041-A4	WPS	HP	R	RA
2.3	Procedure & technical documents	All of procedures		ASME VIII-1, ASME IX	Project Spec., Approved procedures	WPS	HP	R	RA
2.4	Welder Performance Qualification (WPQ)	WPQ Review	100%	ASME VIII-1, ASME IX	Project Spec, 17-VD-204-QC-MTC-064-A4	WPQ	HP	WP	RA
2.5	NDT personal qualification certificates	NDT certificate review	100%	SNT-TC-1A	17-VD-204-QC-MTC-063-A4	NDT level certificate	HP	R	R
3	Material Receiving Inspection								
3.1	Verification of Material Certification or Mill Test Reports	Mill Test Certificate Review	100%	ASME SEC II	3.1 Material Certificate BS EN 10204	3.1 Material Certificates	HP	WP	WP
3.2	Visual and Dimensional Check	GA, Tube bundle detail	100%	GA, Tube bundle detail			HP	WP	WP
4	Inspection during Manufacturing								
4.1	Visual & dimensional Inspection of joint Preparation	Welding Visual Inspection	100%	DWG 17-VD-204-ME-DWG-020-A3	DWG 17-VD-204-ME-DWG-020-A3	Welding Inspection Record	HP	RI	RD
4.2	Liquid Penetrant Examination for edge bevels	PT of Edge Bevel	100%	2. ASME VIII-DIV.1	Project Spec, 17-VD-204-QC-PCJ-033-A4	PT Report	HP	RI	RD

Abbreviation:




RA: Review/Approval RI: Random Inspection WP: Witness Point HP: Hold Point RD: Review Documentation TPA: Third Party Agency

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	No.	Activity	Characteristic to be Verified	Test Frequency	Acceptance Criteria	Reference Procedure	Verifying Document	Involved Parties		
								ABAN	TPI	PMC/ OWNER
02	4.3	Marking, cutting and Fit up of header	Dimension and fit up	100%	Tube bundle detail	DWG	Visual inspection Report	HP	WP	WP
	4.4	Production test coupon and related tests							02	
	5	Welding Inspection								
02	5.1	Liquid Penetrant Examination for, Root Pass &Back gouged portion)		100%	2. ASME VIII-DIV.1	Project Spec, 17-VD-204-QC-PCJ-033-A4	PT Report	HP	W	RD
	5.2	Ultrasonic Examination for All Type Joints (if required)	UT of Attachment Welds	100%	ASME VIII-Div.1 APPENDIX 12 &Vendor NDR Procedure	Project Spec, 17-VD-204-QC-PCJ-032-A4	UT Report	HP	WP	RI
	5.3	Radiographic Examination for Butt-weld Type Joints (All Radiograph)	RT of Nozzle to Flange	100%	Article 2 of ASME V ASME VIII-Div. 1, appendix 4	Project Spec, 17-VD-204-QC-PCJ-034-A4	RT Report	HP	RD	RD
	5.4	Visual & dimensional Inspection (after completion of header boxes and before PWHT)	Welding Visual Inspection	100%	DWG 17-VD-204-ME-DWG-020-A3	DWG 17-VD-204-ME-DWG-020-A3	Welding Inspection Record	HP	W	WP
	5.5	Completeness check	DWG 17-VD-204-ME-DWG-020-A3		Approved drawing	Approved drawing	Approved drawing	HP	WP	WP
	5.6	Confirmation of Heat Treatment	Procedure Review	100%	ASME VIII-Div.1 UCS 55	Project Spec, 17-VD-204-QC-PCJ-036-A4	P.W.H.T report/chart	HP	RI	RD
	5.7	Hardness test	Hardness Check	100%	ASTM A370	ASTM A370, 17-VD-204-QC-PCJ-042-A4	Hardness Test Report	HP	WP	RD
	5.8	Magnetic particle examination	MT of header (Including Nozzle attachment welds)	100%	ASME VIII-Div.1 2. ASME V	Project Spec, 17-VD-204-QC-PCJ-031-A4	MT Report	HP	WP	RD
	5.9	Major Welding Repair	Weld Defects	100%	Project Spec.	Project Spec, 17-VD-204-QC-PCJ-030-A4	Welding Repair Report	HP	HP	W
	6	Inspection for Completed Tube Bundle								
	6.1	Finned Tube Inspection		100%				HP	RI	RI
	6.2	Visual & dimensional Inspection of side wall and other accessories after assembly		100%	DWG	DWG	Visual Report	HP	WP	WP

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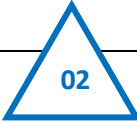
02

No.	Activity	Characteristic to be Verified	Test Frequency	Acceptance Criteria	Reference Procedure	Verifying Document	Involved Parties		
							ABAN	TPI	PMC/ OWNER
6.3	Tube sheet machining and surface roughness control	DWG		Approved drawing	Approved drawing	Approved drawing	HP	WP	RD
6.4	Confirmation of Tube Expanding	Expand Check	100%	DWG	DWG, 17-VD-204-QC-PCJ-045-A4	Expansion report	HP	WP	RI
6.5	Confirmation of tube to tube sheet welding	Welding check	100%	Approved DWG	DWG, 17-VD-204-QC-PCJ-033-A4	WPS	HP	WP	RI
6.6	Roughness checking (Flange facing)	DWG		Approved drawing	Approved drawing	Approved drawing	HP	WP	RD
6.7	Final visual & dimensional checking	Dimensional Check	100%	DWG	DWG	Inspection Report	HP	WP	RD
6.8	Hydro Test	Review Procedure & Test	100%	Project Spec, 17-VD-204-QC-PCJ-044-A4	Project Spec, 17-VD-204-QC-PCJ-044-A4	Hydro Test Report	HP	HP	W
6.9	Drain & dry & charge with N2 purging	Draining & Corrosion Inhibitor Applying	100%	Project Spec, 17-VD-204-QC-PCJ-099-A4	Project Spec, 17-VD-204-QC-PCJ-099-A4	Hydro Test Report	HP	RI	RI
6.10	Surface Preparation of header boxes + roughness	Surface Condition Check		Project Spec	Project Spec, 17-VD-204-QC-PCJ-047-A4	Painting Report	HP	WP	RI/RD
6.11	Final painting of Header Boxes	Dry Film Thickness Check		Project Spec	Project Spec, 17-VD-204-QC-PCJ-047-A4	Painting Report	H	WP	RI/RD
6.12	Galvanization VT and Thickness	Dimensional Check	100%	Project Spec	Project Spec, 17-VD-204-QC-PCJ-047-A4	Painting Report	HP	W	RD
6.13	Name plate stamping (Before attaching)	Stamp Check		DWG	DWG	Color Copy of Name Plate	HP	RD	RD
C	Air - Side Component Inspection								
1	Fan and driver assembly inspection								
1.1	Dimensional Inspection	Certificate Review	100%	Fan Manufacturer Data Sheet/Certificate	Fan Data Sheet	Inspection Report	HP	RA	RD
1.2	Visual inspection	Certificate Review	100%	Fan Manufacturer Data Sheet/Certificate	Fan Data Sheet	Inspection Report	HP	RA	RD
1.3	Balance test for pully	Certificate Review	100%	manufacturer catalogue	manufacturer catalogue	Inspection Report	RA	H	RD

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No.	Activity	Characteristic to be Verified	Test Frequency	Acceptance Criteria	Reference Procedure	Verifying Document	Involved Parties		
							ABAN	TPI	PMC/ OWNER
2	Balance test for fan blades and hubs	Blade Balance Check	100%	manufacturer catalogue	manufacturer catalogue	Blades and Hubs Balance Test Report	RA	RD	RD
2.1	Assembly of rotating parts inspection (One sample)	Certificate Review	100%	manufacturer catalogue	manufacturer catalogue	Test Certificate	RA	RD	RD
3	Electric motor inspection								
3.1	Type test	Certificate Review	100%		Data sheet, Spec. 17-VD-204-EL-DSH-012-A4	Type Test Certificate	RD	RD	RD
3.2	Routine test	Certificate Review	100%		Data sheet, Spec. 17-VD-204-EL-DSH-012-A4	Routine Test Report	RD	RD	RD
3.3	Noise level measurement load & Vibrations measurement	Certificate Review	100%		Data sheet, Spec. 17-VD-204-EL-DSH-012-A4	Test report	RD	RD	RD
D	Steel Structure Inspection								
1	Material inspection before starting	Mill Test Certificate Review	100%	ASME SEC II	3.1 Material Certificate	3.1 Material Certificates	HP	WP	RI
2	Visual & dimensional Inspection	Dimensional Check	100%	DWG	DWG	Inspection Report	HP	WP	RD
3	Surface finishing coating inspection	Surface Condition Cleaning Check	100%	Project Spec, 17-VD-204-QC-PCJ-047-A4	Project Spec, 17-VD-204-QC-PCJ-047-A4	Painting Test Report	HP	RI	RD
4	Final Painting inspection for Members	Painting Coverage, Appearance, Thickness...	100%	Project Spec, 17-VD-204-QC-PCJ-047-A4	Project Spec, 17-VD-204-QC-PCJ-047-A4	Painting Test Report	HP	WP	WP
5	Check of identification Marks	Items identification	100%	DWG	DWG	Painting Test Report	HP	RI	RI
E	Site Run Test (If Requested by Client with Cost Impact)								
1	Balance test for Pulley (If Requested by Client with Cost Impact)	Equipment Performance	100%	Vendor Inspection Procedure shall be specified	Vendor Inspection Procedure shall be specified	Running Test Report	H	R	R
2	Vibration Switch (If Requested by Client with Cost Impact)	Equipment Performance	100%	Vendor Inspection Procedure shall be specified	Vendor Inspection Procedure shall be specified	Running Test Report	H	R	R
3	Official Electrodes Certificate (If Requested by Client with Cost Impact)	Equipment Performance	100%	Vendor Inspection Procedure shall be specified	Vendor Inspection Procedure shall be specified	Running Test Report	H	R	R

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No.	Activity	Characteristic to be Verified	Test Frequency	Acceptance Criteria	Reference Procedure	Verifying Document	Involved Parties		
							ABAN	TPI	PMC/ OWNER
4	Tube Expansion Check (If Requested by Client with Cost Impact)	Equipment Performance	100%	Vendor Inspection Procedure shall be specified	Vendor Inspection Procedure shall be specified	Running Test Report	H	W	W
5	Actuator Inspection, material certificate and visual Inspection in the Factory (If Requested by Client with Cost Impact)	Equipment Performance	100%	Vendor Inspection Procedure shall be specified	Vendor Inspection Procedure shall be specified	Running Test Report	H	W	W
6	Spare Parts								
F	Auxiliary items (Spare parts, Bolt & Nut and Etc...)	Items identification	100%	DWG	DWG	MR	HP	WP	RD
1	Final Inspection and Documentation								
G	Issue Manufacturer's Certificate of Compliance (MCC)					MCC	HP	RD	RD
1	Issue of Inspection Release Note (IRN) by TPA					IRN	RD	HP	RD
2	Pre-Shipment Inspection								
H	Packing check (Packing Condition and Quantity)	Check of Packing Condition	100%	Project Spec, 17-VD-204-QC-PCJ-048-A4	Project Spec, 17-VD-204-QC-PCJ-048-A4	Packing list	HP	WP	RI
1	Preparation for shipment (Shipping Mark Check)	Shipping Mark & Quantity Check	100%	Project Spec, 17-VD-204-QC-PCJ-048-A4	Project Spec, 17-VD-204-QC-PCJ-048-A4	Shipping Mark	HP	WP	RI
2	Manufacturer's Data Books (MDR)					MDR	R	RD	RA

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PO No.:17-66-POR-ME-204	Doc. no. : 17-VD-204-QC-PCJ-047-A4	Rev. : 01	Page : 1 of 24

Doc. Title

Surface Preparation, Painting and Coating Procedure For First Step Product Air Cooler (E-1708)

HDT-Air Cooler



PURCHASER (OWNER) Name: [Sepahan Oil Co \(SOC\)](#)

PURCHASER Requisition No.: 17-66- POR-ME-204

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01	25-May-2021	Issued for Approval	M. Khajehzadeh	M. Abbaszadeh	P. Karimzadeh
00	15-May-2021	Issued for Approval	M. Khajehzadeh	M. Abbaszadeh	P. Karimzadeh
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

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1. Scope

The following procedure covers the minimum requirements for surface preparation and paint application procedure that is based on **17-66-ESS-PI-013-02** (Specification for Painting) and will be applied to “**Sepahan Oil Project/Base Oil Unit Group II & III Project**”, with the following content.

2. Definition of Terms

PROJECT: Base Oil Unit (Group II & III) Project- Isfahan

OWNER: Sepahan Oil Company (SOC)

PMC: Project Managing Contractor, NDEC


VENDOR: Aban Air Cooler

3. Reference & Applicable Codes & Standards

Title	No.
Engineering STD for Paints	IPS-E-TP-100
Construction STD for Surface Preparation	IPS-C-TP-101
Construction STD for Painting	IPS-C-TP-102
Coal tar epoxy polyamide paint	IPS-M-TP-190
Epoxy polyamide primer	IPS-M-TP-215
Epoxy polyamide as intermediate paint	IPS-M-TP-220
Epoxy polyamide as top coat	IPS-M-TP-225
Two pack aliphatic polyurethane paint as top coat	IPS-M-TP-235
Zinc silicate paint as primer and top coat	IPS-M-TP-210
Control of Corrosion Under Thermal Insulation and Fire Proofing Materials	NACE SP0198
US specifications of steel structures painting council, SSPC	
Good painting practice	Vol I
System and specifications	Vol II

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Title	No.
Shop, Field & Maintenance Painting	PA1
Measurement of dry paint thickness with magnetic gauges	PA2
Visual standard for abrasive blast cleaned steel	VIS1
Solvent cleaning	SP 1
Hand tool cleaning	SP 2
Power tool cleaning	SP 3
Flame cleaning (New Steel)	SP 4
White metal blast cleaning	SP 5
Commercial blast cleaning	SP 6
Brush-off blast cleaning	SP 7
Pickling	SP 8
Near white metal blast cleaning	SP 10
Power tool cleaning to bare metal	SP 11
Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness.	ISO 8501-1:2001
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates.	ISO 8503-1:1997
Surface preparation standards for Painting steel surfaces	Swedish Standard SIS 055900
VIS 673 and VIS 806	Swedish Standard No.
Color for Identification, coding and special purposes	BS 381C 1996
Schedule of paint colors for building purposes	BS 4800
Specification for identification of pipelines and services	BS 1710: 1984
Hot dip galvanized coatings on iron and steel articles	BS EN ISO 1461:1999

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Title	No.
Surface finish of blast cleaned steel for painting. Part O. A1 & supplement	BS 7079: 1990
Methods of test for paints. Part A, B, C, E & F	BS 3900: 1989
Surface finish of Blast-Cleaned steel for painting	BS 4232
Specification for metallic Zinc – Rich priming coating (organic media)	BS 4652 1995
Code of protective for coating of Iron and steel structures against corrosion	BS 5493
Specification for identification of contents of industrial gas containers	BS 349
Standards Test Methods for Measuring Adhesion by Tape Test	ASTM D 3359
Standards Test Methods for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub	ASTM D 4752
Standards Test Methods for Conductimetric Analysis of Water-Soluble Ionic Contamination of Blasting Abrasives	ASTM D 4940
Quality Systems	ISO 9000 2000
Identification of pipeline according to the fluid conveyed	DIN 2403
Corrosion practice for protection of steel structure by the application of organic or metallic coating	DIN 55928
Specification for Protection of Underground Piping-Coating & Wrapping	17-66-ESS-PI-014
Process Design Basis	17-66-ESS-PR-001

4. General Notes

- All surfaces shall receive an appropriate paint system as specified in this specification with the following exceptions:
- Any equipment furnished completely painted by the Supplier unless it is specially required to match a color scheme or to repair damage to the paint film;
- Hot-dip galvanized steel, stainless steel and non-ferrous metals, monel, brass, copper, aluminum jacketing, unless it is specially required;

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- Nonmetallic surface;
- Nameplates, code stampings and push-buttons;
- Note: All steel structures and plates shall be provided with primer to prevent corrosion during the transportation, storage, construction and joining stages.
- Steel structures shall receive 2 coats to 100 µm. (each coat) of zinc free epoxy paint material (200µm. total dry film thickness).
- Machined surfaces;
- Rubber, hoses, belts, flexible braided connectors, stainless steel tubing and fittings and gages;
- And any surface particularly indicated as not to be painted.
- Paint shall not be applied under the following conditions:
 - When the temperature of the surface is less than 3°C above the dew point of the surrounding air, and/or the relative humidity is higher than 80%;
 - When the temperature is below 4°C;
 - When the surface temperature is higher than 35°C; as recommended by Supplier.
 - When there is the likelihood of an unfavorable change in weather conditions within two hours after coating;
 - When there is a deposition of moisture in the form of rain, condensation, frost, etc., on the surface.
- Outside daylight hours on exterior location,
- Painting In exterior locations may be suspended due to wind speed exceeds 7 m/s.
- Work shall be performed by an experienced contractor and all tools, equipment, coating, solvents, etc. required to complete the work shall be furnished by him.
- The Contractor shall comply with all the local and national laws, regulations and ordinances of Iran pertaining to his work and coating materials.
- Blast cleaning is applicable method of surface preparation for this project. Silica sand shall not be used. For surface preparation of Stainless Steel, Al₂O₃ or Garnet shall be used.
- Blast abrasive media shall be free of corrosion producing contaminants and oil and with medium size of 0.425 to 0.85 mm. Abrasive media when tested in accordance with ASTM D4940 shall have a conductivity not exceeding 1000 microsiemens. The threshold limit of chlorides on abrasive media is 200 microsiemen.
- Only the latest approved data sheets issued by the paint Supplier for application and system combinations of coatings shall be followed. Superimposed primers and coatings shall be compatible. In the event of conflict, differences shall be brought to PMC specialist for resolution.

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- For Shop primed equipment the Field coating contractor shall touch up prime coat and apply additional coats in accordance to the painting schedule. It is the contractor's responsibility to ensure compatibility between shop and field applied paint systems.
- Adequate precautions shall be taken to protect other surfaces from abrasive blasting, coating and spatter. Damage to other surfaces or equipment shall be repaired by the field coating sub-contractor at his expense.
- The field coating contractor shall submit surface preparation and application procedures for review and acceptance by the PMC representative.
- Carbon and Alloy Steel Material under insulation shall only be painted in accordance with Appendix A.

Pipes, Fittings and Flanges shall be prime painting at site (surface preparation and anticorrosive primer). Valves and Fabricated Equipment shall be prime painting with zinc ethyl silicate at Supplier's shop (surface preparation and anticorrosive primer).

After erection and before the application of the insulation at site the surfaces shall be treated as follows:

Wash-ups: The surfaces shall be washed with fresh water if the substrate has been contaminated with chloride, powder, etc during its transportation, storage and erection. The surfaces shall be washed with chloride-free solvent, where strictly necessary, to remove traces of grease, oil, etc.

Touch-ups: The primed surfaces having mechanical damages or rusting (inclusive of weld seam), shall be prepared and treated by a powerful wire brushing to the degree St3 per Standard ISO 8501-1:1988. The touch-ups shall then be done, using specified paint system for each line. On surfaces primed with Zinc Ethyl Silicate, the surface shall be blasted to Sa3 before application of the paint. Additionally, Zinc Ethyl Silicate primer shall be applied with airless. For touch up of damaged surface, below paint shall be considered as a primer:

1- Temperature ≤ 120 °C: Zinc Rich Epoxy

2- 120 °C < Temperature < 200 °C: Zinc Ethyl Silicate

3- Temperature > 200 °C: Zinc Silicone

- Stainless Steels (austenitic or duplex) and galvanized material under insulation shall not be painted. This material shall be covered by means of a 0.08 mm thk aluminum foil to avoid chloride corrosion in the event of perspiration under insulation that may contain chloride ion.
- The Contractor shall operate a Quality System in accordance with ISO 9000.
- Carbon steel bolting shall be hot spun galvanized.
- For piping bolts and nuts, the specification requested by piping material specification shall be considered as the first priority.
- Profile measurements for abrasive blast cleaned surface shall be made with a Keane Tator Profile Comparator, Clemtec Anchor Profile Chips, Testex Press O-Film or other contractor accepted method suitable for the abrasive being used.
- The standard of cleanliness for blasted surface could be described as per follow:
- Sa1 (Light blast cleaning): when viewed without magnification, the surface shall be free from visible oil. Grease and dirt and from poorly adhering mill scale rust, paint and foreign material
- Sa2 (Through blast cleaning): when viewed without magnification, the surface shall be free from visible oil, grease and dirt and from most of mill scale, rust, paint and foreign material. Any residual contamination shall be firmly adhering.

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- Sa2 ½ (Very through blast cleaning): when viewed without magnification, the surface shall be free from visible oil and grease and dirt and mill scale, rust and paint.
- Sa3 (While blast-cleaning): blast cleaning to visually clean steel when viewed without magnification, the surface shall be free from visible, oil grease, and dirt and shall be free from mill scale, rust, paint and foreign material.
- St2 (Through hand and power tool cleaning): When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from poorly adhering mill scale, rust, paint and foreign material. This will be used for spot cleaning.
- St3 (Very through hand and power tool cleaning): As for St2 but the surface shall be treated much more thoroughly to give a metallic sheen arising from the metallic substrate. This will be used for a spot cleaning.
- Method of cleanness measurement is visual evaluation by comparing with:
- Swedish Standard SIS 055900.Surface preparation standards for Painting steel surfaces
- Swedish Standard No VIS 673 and VIS 806
- The level of cleanliness for prepared steel surface shall be Sa3 for zinc silicate and zinc rich epoxy primers and Sa2 ½ for other primers, organic coating and metal coating.
- Measuring of salt contamination as per random check could be applied for blast cleaned surfaces before applying any coating as per BS 5493 Section 3 item 16.2.1.1
- Internal surface of above ground equipment such as Steel tanks and Vessels shall be painted in accordance with IPS-E-TP-100(1) Appendix C. Type and necessity of internal coating shall be specified in related equipment data sheets.
- Pressure equipment shall not be painted till completion of all heat treatment and hydrostatic or pneumatic tests.
- References to operating temperature in this specification shall be taken to mean the maximum temperature in normal operation.
- Machined and threaded surfaces shall be protected with temporary rust preventative paint.

5. Surface Preparation

5.1. Preparation before blast cleaning

- All rough-edged cuts and welds, weld spatters, indentations, all surfaces and protrusions must be ground to smooth out the contour before the surface is prepared for painting. Any grinding performed after blast cleaning, must be re-blasted to required roughness.
- All bolt holes shall be drilled and blunted before blasting.
- Prior to surface preparation, the surface shall be inspected for spotting oil and grease deposits or pollution on the surface. If any, the deposits of oil or grease shall be removed from the surface by solvent cleaning (SSPC-SP1) prior to further surface preparation.

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- Prior to blast cleaning the substrate shall be dry and at least 3°C above the dew point temperature.
- Visual inspection shall be carried out to detect any sharp edges, weld spatter or visible laminations. Where these are discovered they shall be ground smooth prior to water washing.
- Inspection of the blast equipment i.e. blast nozzles, helmet and lines, deadman handles, air reservoirs etc., will be carried out by the operators supervisor to ensure sound working conditions with no danger to life.
- The steel to be blast-cleaned by dry methods shall be dry and the operating conditions shall be such that condensation does not occur on it during the work. When compressed air is used, this shall be dry and free from oil.
- Weld defects such as pin holes and discontinuities shall be rectified.
- Weld undercutting shall be filled or dressed.
- Excessive weld spatter shall be dressed off (Only light spatter will be adequately removed by blast cleaning).
- Welding slag shall be cleaned off.
- Laminations, laps and shelling shall be dressed off completely.
- Sharp edges shall be smoothed off.
- Burrs shall be removed.
- Friction surfaces of assemblies using friction shall be protected by suitable means against corrosion.

5.2. Required Cleanliness

All surfaces prepared for painting shall satisfy the requirement mentioned in Appendix A for each painting system.

5.3. Required Roughness

The surface roughness of Carbon and Low alloy steels work shall be in the range of 30 to 50 micron for painting and coating.

The surface roughness of Stainless Steel work shall be 25 micron for painting and coating.

5.4. Blasting

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Only dry blast cleaning procedures shall be allowed. The compressed air used for blast cleaning shall be free of detrimental amount of water and oil. Blast cleaning shall be scheduled to allow priming on the same day.

The blast cleaning procedure to be submitted to PMC shall include:

Abrasive composition to obtain a surface roughness according to para. 5.3.

Dust level (level 2 maximum of ISO 8502-3).

5.4.1 Precautions

- Surface preparation by dry blasting techniques shall not be performed if:
- The surface is likely to be humid after surface preparation and before painting,
- The surface temperature is less than 3°C above the surrounding air's dew point,
- The air's relative humidity is greater than 85 %.
- If the air's relative humidity exceeds 80 %, the Contractor must obtain permission from the PMC to proceed with or continue with surface preparation. The Contractor must provide a hygrometer to measure the air's relative humidity.
- Surface preparation operations shall be terminated early enough during the day to permit application of the adopted primer on the prepared surface before the sun sets and rust sets in.

If, exceptionally, surface preparation is authorized at night, the prepared surfaces shall be wiped the next morning. They shall be freshened with light sand blasting before the primer is applied.

- A 50 mm wide strip along the perimeter of the sand blasted surface shall be left unprimed unless adjacent surfaces have already been coated or if it is the last part of the surface to be prepared. Surface preparation shall be extended at least 25 mm to the interior of coated adjacent surfaces.
- During surface preparation, care shall be taken not to damage or alter identification plates, machined surfaces and parts coated in the factory. These parts shall be properly protected. Blasting shall not be performed in the same area where coating or curing of coated surfaces is in progress.
- Any oil, grease, dust or foreign body present on the surface after surface preparation operations shall be removed before painting. If rust reappears on the surface, the surface shall be re blasted.
- Nozzle blast operators exposed to blast dust shall wear a suitable helmet.
- Filter type air respirators shall be worn by all others who are exposed to blast dust environment. Adequate protection for personnel from flying particles shall also be provided in any blasting operation.
- Safety goggles shall be worn by all persons near any blasting operation.

Blast nozzle shall be properly grounded through use of hose with anti-static lining. Blasting pot will be equipped with ground wire.

- Blasting operations shall never be allowed in the vicinity of painting work or near to a wet paint surface or anywhere that blast abrasive, grit or fall-out shall impinge on a freshly painted surface, or on any uncovered primed surface.

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- Where rectification has been necessary on blast-cleaned surface, the particular area shall be re-blasted to remove all rust and slag, and to provide adequate paint adhesion.

5.4.2 Repair of Damaged Coated Surface

Primed surfaces shall be inspected prior to over coating. Touch-up and repair of damaged primer (scratched, rusted, peeled, blistered, etc.) shall be repaired by the contractor. Surface preparation and DFT of the primer shall be in accordance with the requirements for the specified coating system.

Repairs of intermediate or topcoats, which expose the steel surface, shall require prior consent of the PMC. Steel surfaces shall be prepared by spot blast cleaning and coated in accordance with the original coating system.

All repair coatings shall be applied in accordance with the Supplier's instructions.

Repair of damaged coating shall be applied in accordance with painting system by means of brushing. Roller shall not be used.

5.5. Surface Not Blast Cleaned

Surfaces to be painted which cannot be blast cleaned due to inaccessibility or impracticality (e.g. oil or instrument air tubing) may be cleaned either mechanically or chemically upon the approval of the PMC's representative.

5.6. After Blast Cleaning

- Residual shot, grit and dust shall be completely removed after blasting, preferably by vacuum cleaning, but otherwise by oil and water free air blast or fiber brush.
- Care shall be taken not to contaminate blast cleaned surfaces prior to painting.
- The prepared blast cleaned surface shall be completely primed the same day as blasted, and before any visible rusting or deterioration of the surface occurs. No blasted surface shall stand overnight before coating. All prepared surfaces shall be primed before visible re-rusting occurs, or within four hours of preparation taking place, whichever is soonest.

Coated steel or components shall be rested on wooden supports during shop storage or shipment and shall at no time be placed directly on other steel or directly on the ground.

6. Storage, Mixing and Thinning of Products

6.1. Storage Condition

- Paint shall be stored in a well-ventilated room, free from excessive heat or direct rays of the sun and maintained at a temperature between 4 °C to 27 °C.
- Open air storage shall be avoided particularly of heavy paints such as primers and undercoats.
- All paint and thinner containers shall be kept closed before use and stored under shelter.
- Any paint which has gelled or settled during storage shall not be used.

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- Any paint for which the shelf life is expired shall not be used.
- Thinners, solvents, etc. shall be stored in a suitably ventilated fireproofed building, separate from other painting consumable.
- The products shall be delivered in their original sealed packaging and stored in such conditions as to avoid their degradation (controlled temperature, etc). The packaging shall be clearly marked with the product description, the batch number, the fabrication date and the expiry date.

6.2. Mixing

- All the ingredients in each container shall be thoroughly mixed and homogenized. Mechanical mixing shall be such that all pigments or other agents are held in solution during application. Manual mixers are not authorized.
- Paint mixed in the original container shall not be transferred until all settled particles have been remixed with the medium. This does not imply temporary removal of part of the medium to facilitate mixing. Paint shall be mixed with mechanical mixers to keep the pigment in suspension.
- Paint shall not be mixed or held in solution with air bubbles.
- If a skin has formed in the container, it shall be cut and removed. If the skin is thicker than 1 mm, the paint shall not be used.
- All pigmented products shall be strained after mixing unless Contractor equipment is provided with adequate strainers.

Strainers must allow all pigments to pass through, but not any skin.

- Products with unlimited pot life or which do not alter on standing may be mixed at any time; however, if they have set, they must be mixed immediately before use. Paint shall not be kept in the spray equipment pots overnight, but shall be put back into a closed container and remixed before re-use. Containers must be marked with the involved paint's pot-life.
- Hand mixing of paints shall be permitted only for containers up to 5 liters. All larger containers shall be mixed by mechanical agitators and brought to a uniform consistency. Where pigment separation readily occurs, such as heavy or metallic pigments, prevention shall be made for continuous mixing during application.
- Two-pack paints shall be mixed in strict accordance with Supplier's instruction. The pot life of such paints shall be noted specifically and any mixed paint which has exceeded its pot life shall be discarded irrespective of its apparent condition. For starting chemical reaction between components, time should be spent (20-30 minutes) between mixing and applying of paint.

6.3. Thinning

- No thinners are to be added unless necessary for proper application. Thinning must never exceed Supplier recommendations.

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- Thinners used must be those suggested by the Supplier.
- When use of thinner is authorized by the Supplier, it shall be added during mixing. Contractors shall not add thinner after the paint has been thinned to the proper consistency. Thinners must be added under the guidance of a specialist who is thoroughly familiar with the quantity and type of the added thinner.

7. Application of Paint

7.1. Paint systems

- Type, number of coats and thickness must be in accordance with Attachment A.
- The primer to finishing coat paint shall be from the same Supplier for each system to ensure compatibility.
- Supplier recommendations and safety instructions form part of this specification. In case of conflict, the Supplier's recommendations take precedence.

7.2. Application

Paint shall not be applied to surfaces:

- During rain, snow, fog or when dust is in suspension in the air, when wind velocity exceeds 7 m/s.
- In areas where harmful particles are in suspension,
- When surface temperature is less than 3°C above the surrounding air's dew point,
- When relative humidity is greater than 80 %,
- When temperature is below 4°C.
- Blast cleaned surfaces shall be primed as quickly as possible and at the latest during the day they shall be blast cleaned. The primer coat shall end 5 cm from a surface to be prepared on the same panel.
- As far as possible, each coat of paint shall be applied in a continuous, even coat free of holiday. Any area which has not been properly coated or missed shall be repainted.
- Each coat must cure or dry properly before application of the next coat. The Contractor shall follow Supplier's instructions.
- When several coats of the same type of paint have been specified, alternate coats of paint shall be tinted as much as possible to make sure that the surface is completely covered. If a colorant is added, it shall be compatible with the paint and not alter its service life.

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- Silicon base paints require a minimum temperature of 200°C for full curing. Additional care is required in handling painted equipment to minimize mechanical damages.
- To ensure that the minimum thickness is achieved on all angles, corners, bulkheads, crevices, blind areas of all rivets and bolts and all other inaccessible parts, such areas shall be stripe coated separately before applying the main system.
- Brush Application
 - When paint is applied with a brush, the following shall be satisfied:
 - Brush type and quality shall enable proper application of paint. Round or oval brushes are best suited for rivets, bolts, irregular or rough surfaces or pitted steel. Flat and wide brushes are suitable for large flat surfaces, but must not exceed 125 mm. Long handle brushes shall not be authorized.
 - Brush applied coats shall be as smooth and uniform as possible.
 - Paint shall penetrate angles.
 - Protruding parts shall be pre-coated.
 - All paint drips shall be removed with the brush.
 - A minimum of brush strokes shall be visible.
 - Surfaces that are not accessible to brush shall be sprayed or painted with a sheep skin.
- Application by Pneumatic Spray Gun
 - Application by pneumatic spray gun must satisfy the following conditions:
 - Equipment used shall be capable of spraying the paint properly. It shall be fitted with pressure indicators and regulators adapted to service. Nozzles and needles shall be those recommended by the equipment Supplier for the paint being used. Equipment shall be maintained in good working order.
- Traps or separators shall be installed to trap oil or water condensed in the air.
- Traps or separators shall be of adequate capacity and drained regularly. Air from the spray gun impinging against the surface shall not deposit any oil or condensed water.
- Continuous mechanical agitation shall keep paint mixture in spray pots or containers at proper consistency.
- Pressure on the product in the spray pot and air in the gun shall be adjusted to obtain optimum atomization. Pressure on the product in the pot shall be set, if necessary, to accommodate gun height with respect to the can height. Air pressure in the gun shall be high enough to atomize paint without forming excessive mist or causing excessive evaporation of solvent.

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- Spray equipment shall be kept clean so that dust, dry paint or other foreign matter are not deposited in the coat of paint.
- Any solvent left in the spray equipment shall be completely removed before applying the paint to the surface.
- Paint shall be applied in uniform coats with total spray pattern coverage.
- Spray patterns shall be such that paint is evenly applied.
- Drips or excess thickness shall be removed with a brush or the surface cleaned and repainted.
- Surfaces inaccessible by spray gun shall be brush painted. If they are inaccessible by brush, a sheep skin shall be used. Brushes shall be used to work paint into cracks, crevices or other areas not properly coated by spraying.
- Special precautions shall be taken when inorganic zinc is applied. These are given in the Supplier's instructions.
- Application by "Airless" Gun
- The same conditions as for air guns apply except for air pressure adjustment.
- The equipment Supplier's recommendation shall be followed for choosing the nozzle and pressure ratio.
- All identification plates, machined surfaces, instrument glass, bearing surfaces of flange, control valve shafts and other similar material shall be masked. If paint gets on these surfaces they shall be cleaned and returned to their original condition.
- Structural steel section edges and irregular surfaces shall be coated first and an additional coat shall be applied at a later stage.
- All equipment and component contact surfaces (skid bases, equipment bottoms, etc...) shall be painted.
- Fresh paint shall be protected against dust and other foreign matter.
- In order to minimize Contamination between successive coats of paints, over coating of the preceding coat shall be done within a period of time recommended by the Supplier and any delay beyond the specified period is not acceptable. When delays are unavoidable, the painted surface shall be thoroughly cleaned and dried to the satisfaction of the PMC before over coating may take place.
- Primed steelwork, especially if it has been exposed for a lengthy period, shall be examined carefully before further coats of paints are applied. If the primer has been deteriorated, e.g. is perished, eroded or poorly adhering or has been damaged, so allowing corrosion to develop, the

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affected areas shall be re-prepared and primed. If there is any evidence of widespread corrosion beneath the primer, it shall be removed and the surface shall be prepared and primed again.

- Removal of salt deposits by washing from surfaces primed with zinc-rich primers is especially important as the corrosion products formed by reaction between the salts and the zinc can affect the performance of subsequent coats.
- The Construction Contractor shall avoid contamination any adjacent items of plant and equipment by paint over spray, drips or spillage providing appropriate protection, where necessary. Stainless Steel and high Nickel-Chromium alloy surfaces shall be protected against over spray or paint drips, particularly those containing metallic pigments. If any such contamination does occur, the paint shall be immediately and thoroughly removed by Construction Contractor.
- Coatings containing heavy or metallic pigments that have a tendency to settle shall be kept in suspension by a mechanical agitator or stirrer.

7.3. Drying Painted Surface

- An additional coat of paint shall not be applied until the previous coat is dry and may be painted. Read Supplier's instructions for drying times with respect to ambient temperature and humidity.
- Paint shall not be dried under conditions that may cause wrinkling, blistering, pore formation or other injurious defects.
- No drier shall be added to paint.
- Paint shall be protected from rain, condensation, snow or freezing until it is completely dry (refer to Supplier's technical data sheet).

7.4. Repair of Damaged Paint Area

When factory painted or painted surfaces have been marked in handling, the damaged paint and non-adherent paint shall be removed and the surface thoroughly cleaned. The edges of the damaged area shall be smoothed. Surface preparation shall extend approximately 5 cm into the sound coat.

The primer and finishing coats shall be applied in accordance with paragraph 7.

NOTE: if sand blasting is not applicable for any reason to be agreed upon by PMC or inspector, zinc silicate primer shall not be used for touch up repairs.

Zinc rich 2 components epoxy primer or an approved epoxy primer formulated for application on hand or mechanically brushed surfaces should be used instead.

The touch up primer shall be compatible with the paint system.

8. Inspection

Painting works achieved in accordance with this specification, shall be inspected by a PMC's representative.

The Construction Contractor shall inform the inspector before commencing paint application.

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Each coat shall be inspected prior to application for the next coat. Areas found to contain runs, overspray, roughness, cracks or other signs of improper application shall be repaired or recoated in accordance with the inspector's advice.

Each paint coat shall be free from defects and damage. Finished paint shall have the correct shade, degree of gloss and even and be free from tackiness after drying / curing and from cracks, holidays, runs, sags, wrinkles, patchiness, brush or roller marks, or defects that may be deleterious to the quality of the coating.

The maximum degree of rust shall be Ri2 according to ISO 4628.

The maximum degree of cracking, blistering or flaking shall be 3S3 according to ISO 4628.

8.1. Free Access to Products and Work Site

The Inspector or the PMC's representative shall be allowed free access to the products and the work site. The Contractor shall make an office and all means required for proper inspection available to the Inspector, including scaffolding, access gangways, etc...

8.2. Previous Approval

PMC approval shall be obtained for each stage, indicated below, before going on to the next stage.

- Location of the painting work, products and painted equipment storage conditions.
- Equipment
- Surface preparation
- Primer or prime coat
- After each coat of paint

8.3. Contractor's Commitment

The Contractor shall repair any or all work that does not satisfy this specification's requirements.

8.4. Humidity Check

The air's relative humidity shall be measured with a psychrometer. Surface preparation and/or paint application operations shall not commence until relative humidity is less than the limits set in this specification. Relative humidity shall be measured and recorded a minimum of six (6) times a day whence two (2) times before commencement of work. Moisture on the surface being prepared or painted shall be measured every day with a surface moisture indicator before beginning surface preparation operations or applying a coat of paint.

8.5. Roughness Check

Total angular roughness Rt of the surface shall be measured after preparation and recorded or an impression made with:

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- Rugotest LCA-CEA N° 3-Ba 11 degree or equivalent,
- Tested "Press-O-Film" pads or equivalent,
- Electronic roughness tester (Perthometer type or equivalent).

A minimum of one measurement or impression shall be made per square meter of prepared surface.

8.6. Thickness Check

Dry paint thickness shall be measured with a magnetic probe, such as Micro test or Elcometer or equivalent. It is imperative that the magnetic probe be calibrated for each thickness of coating steel support with a non-magnetic block whose thickness is as close as possible to the coating being checked. Each coat's thickness and total thickness shall be checked. Make five (5) separate spot measurements spaced evenly over each section of the structure 10 square meters in area (divide the entire surface in 10 square meter areas).

On each spot, make 3 readings by moving the probe a short distance for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average of the three (3) gage readings as the spot measurement.

For each successive coat, the minimal allowable thickness shall be at least 80 % of the specified thickness; the maximum thickness shall not exceed 120 % of the specified thickness.

For the total system, the minimal allowable thickness shall be at least 80 % of the specified thickness. The maximum thickness shall not exceed 120 % of the specified thickness unless the paint remains soft or shows mud crack or orange skin or wrinkling which cause rejection of the paint.

Surfaces with coat thicknesses out of tolerance shall:

- be sand blasted if too thick and repainted,
- Receive an additional paint coat to obtain specified thickness.

In order to achieve the specified dry film thickness, frequent checks of wet film thickness shall be carried out during the paint application with film thickness gauges such as the elcometer wheel or comb type. In the vent of the film thickness not meeting the specified requirements, additional coat(s) of the paint concerned shall be applied in compliance with the specified requirements.

The degree of curing of epoxy resin based paint systems shall be checked by the determination of the resistance of the coating to methyl ethyl ketone (MEK). After rubbing the coating for one minute with a rag soaked in MEK, the coating shall not be softened and shall resist scraping with a fingernail.

8.7. Adhesion Check

Paint adherence shall be checked as per ASTM method D 3359. Method A (X cut) shall be used for paint film thicker than 125 microns, Method B (lattice pattern) shall be used for paint films up to 125 microns.

Test Method A: An X-cut is made in the film to the substrate, pressure-sensitive tape is applied over the cut and then removed. Acceptable rating are 5A (No peeling or removal) or 4A (Trace peeling or removal along incisions or at their intersections).

Test Method B: A lattice pattern with either six or eleven cuts in each direction (cross cut) is made in the film to the substrate, pressure-sensitive tape is applied over the lattice and then removed, and adhesion is evaluated by comparison with descriptions and illustrations. Spacing between the cut lines shall be 1 mm for film thicknesses up to 50 microns and 2 mm for film thicknesses from 50 to 125 microns. Acceptable results are rate 5B (The edges of the cuts are completely smooth; none of the

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squares of the lattice is detached) or 4B (Small flakes of the coating are detached at intersections; less than 5% of the area is affected)

If the test is unsatisfactory, the entire surface shall be blast cleaned and repainted.

Recoating after this destructive test is at the Contractor's expense.

ASTM D3359 is not applicable for Inorganic Zinc Silicate primer. For determination of degree of hardening and adhesion test, aid of solvent (e.g.methylethyl- ketone) is necessary. When a piece of cloth saturated with solvent is rubbed over the coating, the coating shall not soften and discolor. (As defined in ASTM D4752).

8.8. Extended Inspection

Any extension of inspection time due to the above cited reasons and repairs shall not be billed as additional costs.

8.9. Inspection Result

All quality control results shall be written up into reports. All reports shall be submitted to the PMC during provisional acceptance of the paint.

9. Guarantee

The Contractor shall guarantee the paint systems durability.

The Contractor shall commit himself to retouching any or all paint-work if it does not satisfy the aforementioned requirements at any time during the guarantee period.

By retouching, is meant surface preparation, procurement and application of the paint, as per this specification, at the work site and at the expense of the Contractor.

The PMC should not be billed for any service, procurement or labour appertaining to retouching/repainting.

10.Painting Report

Refer to attachment in the last page.

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Paint System Determination

<i>Equipment</i>	<i>Item No.</i>	<i>Material</i>	<i>Insulation</i>	<i>Fireproofed</i>	<i>Operating Temperature (°C)</i>	<i>Paint System</i>
Header box	E-1708	CS	No	No	188.7	3
Steam Coil	E-1708	CS	No	No	210	4
Side frame	E-1708	CS	No	No	Ambient	HDG
Steel Structures (fireproofed)	E-1708	CS	No	Yes	Ambient	2
Steel Structures (non-fireproofed)	E-1708	CS	No	No	Ambient	2
Plenum, Fan ring, fan guard and Louver	E-1708	CS	No	No	Ambient	HDG
Grating	E-1708	CS	No	No	Ambient	1

Paint system 1:

Item: Grating		Operating Temperature: <u>Up to 120°C</u>	
Minimum surface preparation			Sa 3
Paint and DFT (microns)	Primer	-	-
	Intermediate	-	-
	Finishing	Hot Dip Galvanize	85
Total DFT (microns)			85
Finishing RAL			-

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Paint system 2:

Item: Steel Structural, Support Equipment, Ladder, Plat Form, Hand Rail, Stairways, Walkways			Operating Temperature: <u>Up to 120°C</u>
Minimum surface preparation			Sa 2 1/2
Paint and DFT (microns)	Primer	Zinc Rich Epoxy, (IPS-M-TP-205)	75
	Intermediate	Epoxy Polyamide, (IPS-M-TP-220)	80
	Finishing	Aliphatic Acrylic Polyurethane, (IPS-M-TP-235)	50
Total DFT (microns)			205
Finishing RAL	Main steel structures and pipe racks Equipment, structures and supports		Fawn, RAL 8007
	Upper ladders, tee boards, horizontal poles, top rails		Black, RAL 9005
	Platform lower edges and toe boards, mid, rails, safety platform, safety cages poles, top rails		Light Orange, RAL 2000

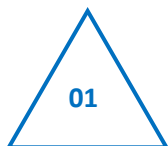
Paint system 3:

Item: Header box (E-1708)			Operating Temperature: <u>121°C to 200°C</u>
Minimum surface preparation			Sa 3
Paint and DFT (microns)	Primer	Zinc Silicate, (IPS-M-TP-210)	75
	Intermediate	Acrylic Silicon, (IPS-M-TP-168)	25
	Finishing	Acrylic Silicon, (IPS-M-TP-168)	25
Total DFT (microns)			125
Finishing RAL			Aluminum, RAL 9006


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Paint system 4:

Item: Steam coil (E-1708)			Operating Temperature: <u>201 °C to 400 °C</u>
Minimum surface preparation			Sa 3
Paint and DFT (microns)	Primer	Zinc Silicate, (IPS-M-TP-210)	75
	Intermediate	Silicon Aluminum	25
	Finishing	Silicon Aluminum	25
Total DFT (microns)			125
Finishing RAL			Aluminum, RAL 9006



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	Quality Control		Report No.:			
	Painting Report		Date Of Exam. :			
PROCEDURE No. : DOCUMENT NO. : SAND BLAST : PRIMER : THK : INTERMEDIATE : THK : FINISHING : THK : FINISH COLOR : Temperature : Humidity : Dew point temp :						
ITEM NO:						
SR. No.	Description	THK(mic)	Result	Date	TIME	Curing & adhesion
1	Sand Blast					
2	Primer					
3	Intermediate					
4	Finish					
Note:						
Inspector	A.A.C Inspector	CLIENT		NARGAN		
NAME & SIGNATURE						
Qualification						
DATE						

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Doc. Title

Hydrostatic Test Procedure For First Step Product Air Cooler (E-1708)

HDT-Air Cooler



PURCHASER (OWNER) Name: [Sepahan Oil Co \(SOC\)](#)

PURCHASER Requisition No.: 17-66- POR-ME-204

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01	15.May.2021	Issued for Approval	M. Khajehzadeh	M. Abbaszadeh	P. Karimzadeh
00	24.Apr.2021	Issued for Approval	M. Khajehzadeh	M. Abbaszadeh	P. Karimzadeh
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED







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1. Purpose

The hydrostatic test is carried out to verify tightness and from stability of Air cooler. A hydrostatic test shall be conducted on air cooler after all fabrication has been completed, and all examinations have been performed. Approved and signed release note for hydro test shall be prepared before.

2. Scope

This procedure is applicable for testing of air-cooled heat exchanger for “**Sepahan Oil Project/Base Oil Unit Group II & III Project**”.

3. Reference

ASME CODE SEC VIII, UG (99), (102)

API 661

4. Description

4.1. Test Equipment




The test equipment comprises a manually or motor operated test pump, a water tank & two calibrated pressure gauge. For the respective measuring range and suitable connection material (flanges, blind flanges, vent and drain connections, covers, bolts, gaskets) to comply with the test requirements shall be supplied.

All gauges shall be calibrated not more than 6 months before hydro test. The calibration / test certificate form for relevant pressure gauges shall be attached to test report.

4.2. Test fluid

Water used for testing vessels lined with Carbon steel shall be potable and salt free. Vessels shall be thoroughly dried after draining to prevent evaporation and concentration of chlorides during storage and shipping.

It is recommended that the metal temperature during hydrostatic test be maintained at least 17 °C above the minimum design metal temperature, but need not exceed 48 °C, to minimize the risk of brittle fracture.

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When carbon and low alloy steel materials are exposed to test water, chloride content in the water shall be less than 50 ppm. Corrosion inhibitor such as 500 ppm NaNO₂ shall be dosed to the test water. When austenitic stainless-steel materials are exposed to test water, chloride content of water shall be less than 30 ppm.

4.3. Safety instruction

All flange connections shall be closed and relevant bolts to be tight before pressurizing. Repairs and rework are not allowed on pressurized heat exchangers. If repairs are required the test must be stopped and start again after repair work is completed.

4.4. Preparation for pressure test

Prior to starting the pressure test, the inner and outer surface has to be cleaned from dust, rolling residues, dirt, oils and other foreign material. The pressure gauge must be installed the way that the operator can inspect it during pressurizing.

Each exchanger shall accompany with min. 2 Nos. pressure gauges (i.e. one on the top nozzle and another on the bottom nozzle.)

All gauges shall be calibrated & certificate shall be kept as a part of quality record. Dial indicating pressure gages used in testing shall be graduated over a range of about double the intended maximum test pressure, but in no case shall the range be less than 1 1/2 nor more than 4 times of that pressure.

Digital reading pressure gages having a wider range of pressure may be used provided the readings give the same or greater degree of accuracy as obtained with dial pressure gages.




All gages shall be calibrated against a standard deadweight tester or a calibrated master gage. Gages shall be recalibrated at any time that there is reason to believe that they are in error.

4.5. Venting

During filling and depressurizing, the air cooler has to be properly vented at the highest point.

4.6. Testing process

- 4.6.1. The air cooler is pressurized slowly and gradually to the half of the design pressure. The holding time for a visual check at this stage is 15 minutes.

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- 4.6.2. The pressure shall be increased to design pressure and a visual check in 15 minutes holding time shall be done. The pressure shall be increased to test pressure (1.3 design pressures) and a complete visual check for all connections and weld joints shall be done for determining leakages or deformation. The holding time for this stage is min.1 hour.

After that the pressure shall be decrease to design pressure & hold 15 minutes for this stage for final inspection.

- 4.6.3. The vent valve shall be gradually opened. After ensuring this valve is fully opened, the drain valve shall be slowly opened. At this stage care must be taken to avoid any vacuum in air cooler due to waters draining. After the hydro test all pressure gauges shall be checked to show zero value.

- 4.6.4. Gaskets shall be the same as for the service type, dry or coated with graphite. Use of compounds, glue, lead, is not permitted.

Metallic O-rings gaskets shall be replaced after testing if damaged. All other gaskets shall be replaced with new ones after testing.

Service bolting shall be used for pressure testing. Bolt and nuts shall be thoroughly inspected after testing and replaced whenever damaged. This inspection shall be witnessed by the inspection agency.

- 4.6.5. For protection and preservation of system after hydro test, air cooled heat exchanger must be fully and immediately drained & dry by blowing hot air.




❖ After hydro test, all exchangers should be thoroughly dried and tilled with Nitrogen.

- 4.6.6. Nitrogen filling

Internal surface shall be dry with blowing hot air. The absolute absence of water pockets must be ensured by using hygrometer.

All flanges shall be completely blind with BLANK & GASKET.

The purge gas flow rate shall be controlled by the use of a pressure regulator and flow meter or combination thereof.

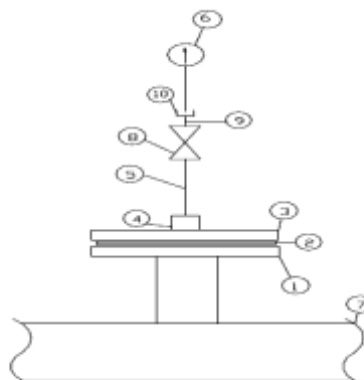
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In order to ensure that all ambient air has been removed from the air-cooled heat exchanger, an oxygen analyzer or other practices shall be used to verify the effectiveness of the purge. The oxygen analyzer shall read below 1 percent oxygen concentration.

Open nitrogen cylinder valve and allow dry nitrogen to flow through the system until air is removed from the system.

As follows components shall be used & assembled as shown in following figure:

1. FLANGE
2. GASKET
3. BLANK
4. COUPLING 1/2"
5. NIPPLE 1/2 "
6. GAGE,0-2 bar
7. AIR COOLED HEAT EXCHANGER
8. VALVE 1/2"
9. NIPPLE 1/2 "
10. CAP 1/2"



Valve, compound gauge, protective cover & warning tag shall be installed on the nozzle on the air-cooled heat exchanger.

Pressurizing method shall be applied to sweep air out of air-cooled heat exchanger.

Pressurize to 0.7 kg/cm².g (10 psig) with nitrogen




Release to 0.0 kg/cm².g (0.0 psig)

Pressurize to 0.7 kg/cm².g (10 psig) with nitrogen

Reduce the pressure to 0.5 kg/cm².g (7 psig) minimum, 0.7 kg/cm².g (10 psig) maximum.

The tube bundle shall be completely purged & blocked in, test all flanged, gasket & plugged opening for leakage with soap solution confirm zero leakage.

The pressure of nitrogen gas shall be kept at 0.5 kg/cm².g (0.483 bar) minimum, 0.7 kg/cm².g (0.689 bar) maximum pressure. Minimum pressure shall be verified, after the unit is loaded onto the ship.

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For N2 detection in outlet a flame shall be used to ensure that N2 filled completely inside the air-cooled heat exchanger.

Warning tag attached to pressure valve: the following minimum information shall appear on the warning tags attached to the pressure nozzle.

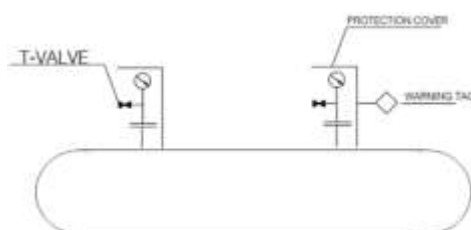
WARNING

The equipment is under low pressure nitrogen blanket. Do not open equipment until pressure has been reduced to atmospheric & verified.

Note: The valve & pressure gauge for nitrogen purging shall be as below.

Valve: 1/2" (oil free type) NPT with cap

Pressure gauge: 1/2" x75 with the range of 0~2 kg/cm2.G (Oil free type)



4.6.7. Pressure test diagram

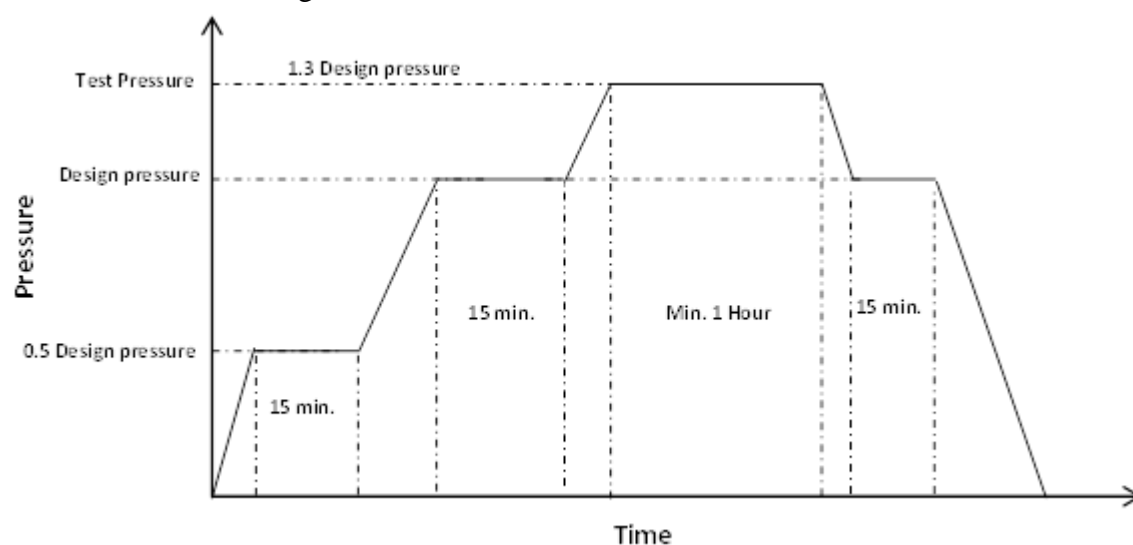


Figure 1: Pressure Test Diagram




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Table 1: Design and test pressure for air cooler

<i>Item No.</i>	<i>Design Press. (barg)</i>	<i>Test Press. (barg)</i>
E-1708	14.6	18.98

4.7. Acceptance Criteria




During the holding time, the test pressure shall not fall below the required value. A deformation of the pressure retaining parts (permanent & transient deformation) is not allowed. If leakages are found at the weld joints, repairs shall be performed only according to an approved repair procedure. If any pressure drops detected, it must be depressurized & leakage shall be found & rectified under client witness.

5. Documentation


After satisfactory performance of pressure test the hydrostatic test report shall be issued and signed by AAC, TPI.

6. Attachments

Refer to next page for Hydrostatic Test Report.

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Attachment 1
Hydrostatic Test Report

	Quality Control		Code No : QF-QC-11
			Date & Rev :0-1386/2/10
	HYDROSTATIC TEST REPORT		Report No:
		Date :	
PO. NO.:			
ITEM NO.		DWG. No.:	
TEST PRESSURE			
DESIGN PRESSURE			
PROCEDURE APPLIED			
TEST FLUID			
HOLDING TIME :	1/2 D.P :	D.P :	T.P :
FLUID TEMP (C)		EXTERNAL TEMP:	
GAUGES EMPLOYED			
DRYING METHOD:			
TEST RESULT: ACCEPTED <input type="checkbox"/> NOT ACCEPTED <input type="checkbox"/>			
REMARK :			
<div>At: to:</div> <div>At: to:</div> <div>At: to:</div>			
	A.A.C	TPI	Client
INSPECTOR			
SIGNATURE			
DATE			