

SCOPE OF WORK FOR THIRD PARTY INSPECTION, REVISION-4
SUMMARY OF CHANGES

S.N.	MAJOR CHANGES MADE IN REVISION-4
1	<ul style="list-style-type: none"> • All the TPI scope were converted in Tabular form to facilitate ease of reviewing process and reference.
2	<ul style="list-style-type: none"> • The following additional Scope of Work for Third Party Inspection of missing stationery equipment have been added: <ul style="list-style-type: none"> ➢ TPI-KNPC-14-WELD OVERLAY / CLADDED PRESSURE VESSELS - for Pressure Vessels (Separators & Other Vessels). ➢ TPI-KNPC-15-TOWER ➢ TPI-KNPC-16-COKE DRUM ➢ TPI-KNPC-17-REACTOR ➢ TPI-KNPC-23-FIRED HEATERS ➢ TPI-KNPC-24-BOILERS ➢ TPI-KNPC-11-COIL TYPE SEAL COOLERS ➢ TPI-KNPC-12-PLATE TYPE HEAT EXCHANGER ➢ TPI-KNPC-18-DESUPERHEATERS ➢ TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS ➢ TPI-KNPC-27-RUPTURE DISKS ➢ TPI-KNPC-28-METALLIC EXPANSION JOINTS ➢ TPI-KNPC-30-EJECTORS ➢ TPI-KNPC-31-SILENCERS ➢ TPI-KNPC-32-FLARE TIPS
3	<ul style="list-style-type: none"> • The requirement of Chloride content for hydrostatic testing of Austenitic stainless steel, as applicable, have been modified uniformly to "50 ppm by mass".
4	<ul style="list-style-type: none"> • TPI-KNPC-02-Pipes: Additional Scope of Work for Duplex & Nickel Alloy materials were included. In addition, detailed scope of work for cement mortar lined pipes were included as "Addendum-1".
5	<ul style="list-style-type: none"> • TPI-KNPC-03-PIPE FITTINGS: Additional Scope of Work for Duplex & Nickel Alloy materials were included. In addition, detailed scope of work for cement mortar lined fittings were included as "Addendum-2".
6	<ul style="list-style-type: none"> • TPI-KNPC-04-VALVES: Additional Scope of Work for Duplex materials were included.
7	<ul style="list-style-type: none"> • TPI-KNPC-05-TUBES: Additional Scope of Work for Duplex materials were included.
8	<ul style="list-style-type: none"> • TPI-KNPC-06-U TUBES: Additional Scope of Work for Duplex materials were included.
9	<ul style="list-style-type: none"> • TPI-KNPC-07-TUBE BUNDLES: Additional Scope of Work for Duplex materials were included.
10	<ul style="list-style-type: none"> • Existing scope of work for Refractory, Thermal (hot & cold) Insulation & Hoses were withdrawn as per comment from I&CD-MAA refinery, since they are not under the purview of Inspection & Corrosion Division.
11	<ul style="list-style-type: none"> • ANNEXURE-I, PMI: Additional Scope of Work for Duplex & Nickel Alloy materials were included.
12	<ul style="list-style-type: none"> • ANNEXURE-II, NDT: Additional Scope of Work for Duplex & Nickel Alloy materials were included.

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KUWAIT NATIONAL PETROLEUM CO. (KSC)

**SCOPE OF WORK FOR
THIRD PARTY INSPECTION**



KUWAIT NATIONAL PETROLEUM CO. (KSC)

TITLE : SCOPE OF WORK FOR THIRD PARTY INSPECTION

DOCUMENT No. : K N P C - I C T P I - 0 9 - 0 0 0 1

REVISION No. : 4

EFFECTIVE DATE : December 2021

VALID TILL : December 2024 or Until Next Revision

No. of Pages in this Document: 341

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Valid till December 2024 or Until Next Revision



KUWAIT NATIONAL PETROLEUM CO. (KSC)

SCOPE OF WORK FOR THIRD PARTY INSPECTION

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Doc. No. : KNPC-ICTPI-09-0001

Rev. : 4

Date : December 2021

Preface

Scope of Work for Third Party Inspection Agency for various stock items was developed in Nov 2009 as controlled document to ensure minimum quality of material being procured by KNPC for up keeping of static equipment & piping. This was jointly prepared by I&C Division of all the three Refineries and Commercial Department.

This is the fourth revision of the document wherein new TPI scope of work for 15 Nos. of missing stationary equipment such as Reactors, Coke Drums, Fires Heaters, Boilers, De-super heaters, Breather Valves, Rupture Discs, Silencers, Ejectors etc.) have been created and added to existing scope of work. Additionally, the existing scope of work for Refractory, Thermal (hot & cold) Insulation & Hoses were withdrawn since review of records & testing of the new materials were not under the purview of Inspection & Corrosion Division. In addition, the existing scope of work have been modified based on feedback from I&C Divisions of MAA & MAB Refinery.

The scope of work for TPI has been rewritten in Tabular format for ease of reference.

During the preparation of this document, ITPs (Inspection & test Plans) of various equipment & piping of CFP units, requirements of KNPC Eng. Standard, Shell DEP, API, ASTM & BS Standards, Material Verification Program of KNPC developed by M/s Shell Global Services and other international standards have been considered while revising the subject document.

The controlled document was developed for procurement of stationary items for the KNPC Refineries and Local Marketing. However after addition of items which are procured under direct charge, this document becomes a unified TPI scope for procurements of stock and direct charge items in KNPC by any KNPC Operating Facilities.

Although the scope of work has been prepared for TPI Agency but this document shall also be utilized whenever in-house / local fabrication of similar equipment is carried out as a part of maintenance activities.



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DOCUMENT AMENDMENT RECORD

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Date of Amendment	Memo Ref. No.	Description / Details of Amendment	Current Rev. No.
10/07/2012	SHU-ICMEMO-12-0838 (08.08.2012)	Reviewed and revised existing scope of work and added scope of work for 7 items.	1
26/01/2014	SHU-ICMEMO-14-0143 (03.03.2014)	Reviewed Colour Coding Specification and added new annexure for oxide film testing of Cu-Ni tubes along with minor modification in other TPI scopes.	2
15/05/2017	SHU-ICMEMO-17-0177 (19.07.2017)	Reviewed and revised existing scope of work and added scope of work for inspection of reformer tubes along with Heater tube and new scope of work for tower trays.	3
Dec 2021	O-QA(MAB)-I&C(I)-21-0976 (23/12/2021)	Reviewed and revised existing scope of work & Prepared new scope of work in tabular format. Additionally, scope of work for 15 Nos. of missing stationery equipment such as Reactors, Towers, High Pressure Separators with Weld Overlay / Cladding, Coke Drum & Fired heater etc. were prepared & added. Moreover, the existing scope of work for Refractory, Thermal (hot & cold) Insulation & Hoses were withdrawn, since they are not under the purview of Inspection & Corrosion Division.	4

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SCOPE OF WORK FOR THIRD PARTY INSPECTION

Symbols and Abbreviations

TPI	: Third Party Inspector or Third Party Inspector Agency as applicable.
PO	: Purchase Order
MTC	: Material Test Certificate
CS	: Carbon Steel
SS	: Stainless Steel
HAZ	: Heat Affected Zone
ITP	: Inspection & Test Plan
NDT	: Non-Destructive Testing
RT	: Radiography Testing
LPT	: Liquid Penetrant Test
MPT	: Magnetic Particle Testing
UFD	: Ultrasonic Flaw Detection
UT	: Ultrasonic Testing
PMI	: Positive Material Identification
IGC	: Intergranular Corrosion
WPS	: Welding Procedure Specification
PQR	: Procedure Qualification Records (Welding)
PWHT	: Post Weld Heat Treatment
SR	: Stress Relieving
CDTP	: Cold Differential Test Pressure
EPA	: Environment Public Authority
IMO	: International Maritime Organization
IATA	: International Air Transport Association

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PLAIN AND CLADDED PLATES

TPI No. : TPI-KNPC-01-PLATES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	<ul style="list-style-type: none"> - Material inspection chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports. - Grain size. - Hardness. - Impact test. 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. - PO. 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate. - All SS plates must be in solution annealed condition as per applicable standards.
Part B: Final Inspection						
2	Visual inspection.	No physical defect Applicable Codes & Standards.	Visual inspection report.	R	100%	-
3	Dimensional check.	Applicable Codes & Standards.	Dimensional report.	W R	5% 100%	-
4	Thickness measurement.	Applicable Codes & Standards.	Thickness report.	W R	5% 100%	-
5	Ultrasonic flaw detection report for plates thickness higher than one inch or as specified in PO.	Applicable Codes & Standards.	UFD report.	R	100%	- NDT reports must be reviewed by ASNT Level-II qualified personnel.
6	UT of clad plates to check for dis-bonding.	Applicable Codes & Standards.	UT report.	R	100%	- NDT reports must be reviewed by ASNT Level-II qualified personnel.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PLAIN AND CLADDED PLATES

TPI No. : TPI-KNPC-01-PLATES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
7	Meeting requirement of MR 0175/0103 if specified.	- As specified in PO and NACE Standards.	- Test report.	R	100%	-
8	PMI of all material except CS Plates.	- Applicable Codes & Standards.	- PMI report.	W R	One sample per heat number. 100%	- Plate must be stenciled by TPI for identification of PMI. - Review records of PMI carried out by vendor as per Annexure-I.
Part C: Marking & Packing						
9	Marking of plates with: - Manufacture's Name. - Heat No. - Applicable Standards. - Size. - Thickness.	- Physical Check & PO.	- Reports.	W	100%	- Heat # on plates shall correlate with Heat # on MTC.
10	Packing Inspection - Color code marking. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion from sea water. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings.	- PO. - Applicable Codes & Standards.	- Packing report.	W	100%	- Color coding as per Annexure – III.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR PLAIN AND CLADDED PLATES**

**TPI No. : TPI-KNPC-01-PLATES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
11	Issue of release note.	- As per PO.	- Inspection release note.	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, stamped and stamped TPI reports and after its approval KNPC will issue the release note for shipment.
12	Final Inspection Report and Manufacturers details report.	- As per PO.	- Inspection report.	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR PLAIN AND CLADDED PIPES (CARBON STEEL, ALLOY STEEL,
STAINLESS STEEL, NICKEL ALLOY, DUPLEX & NON-FERROUS)**
TPI No. : TPI-KNPC-02-PIPES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	<ul style="list-style-type: none"> - Material test certificate for chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports. - Grain size. - Hardness. - Impact test. 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PO 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate. - All SS pipes must be in solution annealed condition as per applicable standards.
1.1	IGC Test for Austenitic SS / SS Cladded / SS weld overlaid pipe & other austenitic alloys, as applicable.	- A 262 practice E.	- IGC report	R	100%	-
1.2	Mills Hydrostatic Test record for CS pipes.	- Applicable specified Standards.	- Hydro test report.	R	100%	-
1.3	Macro etch test for seamless construction.	- Latest applicable STD (ASTM E-340) and PO.	- Test report.	W	One sample from each heat number.	-
Part B: Fabrication & Inspection						
2	Welded Pipe.					-
2.1	Forming (Plate bending or rolling).	<ul style="list-style-type: none"> - Forming procedure - Applicable Codes & Standards. 	- Test report.	R	100%	-
2.2	Welding Process.	- Applicable Codes & Standards.	- WPS / PQR	R	100%	-

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FOR PLAIN AND CLADDED PIPES (CARBON STEEL, ALLOY STEEL,
STAINLESS STEEL, NICKEL ALLOY, DUPLEX & NON-FERROUS)**
TPI No. : TPI-KNPC-02-PIPES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
2.3	NDT Test prior to heat treatment	- Applicable codes & Standards and PO.	- NDT Report	R	100%	- NDT reports must be reviewed by ASNT Level-II qualified personnel.
2.4	Radiography record of welded pipes.	- Applicable Codes & Standards.	- Radiography Report.	R	100%	- Radiography films must be reviewed by ASNT Level-II qualified personnel.
2.5	Heat treatment (as applicable)	- Applicable Codes & Standards. - Heat treatment procedure.	- Heat treatment charts / report	R	100%	-
2.6	Lab test (Tensile, Bend test, Product analysis on Weld metal and base metal, Micro examination on weld, HAZ & Base metal) as applicable.	- Applicable Codes & Standards.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
2.7	Corrosion test (if applicable).	- Applicable Codes & Standards.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
2.8	Hardness test (if applicable)	- Applicable Codes & Standards.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
2.9	NDT Test after heat treatment (as applicable)	- Applicable codes & Standards and PO.	- NDT report.	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
2.10	Ferrite evaluation (WM, HAZ, BM) (If applicable).	- Applicable Codes & Standards. - Approved procedure.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR PLAIN AND CLADDED PIPES (CARBON STEEL, ALLOY STEEL,
STAINLESS STEEL, NICKEL ALLOY, DUPLEX & NON-FERROUS)**
TPI No. : TPI-KNPC-02-PIPES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
3	Cladded Pipes: Bond strength test of cladded pipes.	- Applicable Codes & Standards.	- Test report.	R	100%	-
3.1	NDT record for cladded pipes.	- Applicable Codes & Standards.	- Test report.	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
4	Visual Inspection - Straightness material finish, edges etc.	- As per specified Standards and purchase order requirements.	- Visual inspection report.	W	100%	-
5	In case of any finding during visual inspection witness - LPT.	- Applicable Codes & Standards.	- LPT report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
6	Dimensional Check: - Specified length. - Permissible variation in wall thickness. - OD. - Out of roundness etc.	- Applicable Specified Codes & Standards. - PO.	- Dimensional report.	W R	5% 100%	- Co-relate the MTCs with pipes. - Dimensional check records carried out by Vendor.
7	Thickness measurement.	- Applicable Specified Codes & Standards. - PO.	- Thickness report.	W R	5% 100%	- Thickness record carried out by vendor.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
8	UT on pipe ends for laminations and UT on pipes for dis-bonding from clad side for cladded pipes.	- Latest applicable Standards (ASTM A578) and PO.	- Test report	W	100%	-
9	UT on area of 25 mm width adjacent to the weld seam over its entire length or dis-bonding and lamination for cladded pipes.	- Latest applicable Standards (ASTM A578) and PO.	- Test report.	W	100%	-
10	Cement Lines Pipes: For Cement / Mortar Lining	- Applicable STD (KNPC ENG. STD 87C1 & PRJ-ESC-SPC-023-21-001) and PO.	- Test report	As per Addendum – 1 attached below.		-
11	PMI of pipes of all other material except CS.	- Applicable Standard.	- PMI Report.	W R	One sample per heat number. 100%	<ul style="list-style-type: none"> - Pipe must be stenciled by TPI for identification of PMI. - PMI to be carried out by Vendor as per Annexure-I.
12	Impact test of pipes used in low temperature service.	- Applicable Standard.	- Test report.	W R	One sample from each heat number. 100%	<ul style="list-style-type: none"> - - Impact Test Report carried out by vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	Thickness measurement of pipes.	<ul style="list-style-type: none"> - As per E797 pulse echo method - As per PO and Applicable STD. 	<ul style="list-style-type: none"> - Test report 	W R	10% 100%	<ul style="list-style-type: none"> - Thickness measurement shall be done by Vendor. - These pipes to be stamped / stenciled for Low Alloy, SS & Non-Ferrous by TPI. - Report of thickness measurement carried out by Vendor.
14	Hydro testing of pipes.	<ul style="list-style-type: none"> - As per applicable Standard. 	<ul style="list-style-type: none"> - Test report. 	W R	10% 100%	<ul style="list-style-type: none"> - Potable water to be used for hydro testing purpose. - Witness test for Alloy Steel, SS, Duplex, Nickel alloy & Non-Ferrous pipes and stencil the witnessed pipes. - Water used for Hydro-test of (405, 410, 430, 18/855, 18/8 SS (300 Series), Duplex SS, Alloy 20 and Alloy 400 pipes shall be free from sediments and Chlorides not more than 50 PPM by mass. - Hydrotest Report carried out by vendor.
Part C: Marking & Packing						
15	Marking on pipes with <ul style="list-style-type: none"> - Manufacture's Name. - Heat No. - Applicable Standards. - Grade. - OD. - Thickness. 	<ul style="list-style-type: none"> - PO & Physical Check. 	<ul style="list-style-type: none"> - Reports. 	W	100%	<ul style="list-style-type: none"> - Heat # shall co relate with Heat # on MTC.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Length. - For Low Temperature Services, Mark "LT" followed by temperature at which impact test is done 	-	-		-	-
16	<p>Packing Inspection:</p> <ul style="list-style-type: none"> - Properly painted (CS + Alloy Steel). - Ends protected by plugs (preferably plastic). - Color code making. - Properly packed to avoid damages during transit & handling. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	<ul style="list-style-type: none"> - PO & Physical Check. 	<ul style="list-style-type: none"> - Packing report. 	W	100%	<ul style="list-style-type: none"> - Color coding as per Annexure – III. - For cement-lined pipe, flange faces shall be protected by plywood or steel plate covers to avoid damages to cement lining. Plywood thickness shall be 12 mm minimum for flanges through 300 DN (NPS 12), and 18 mm minimum for 350 DN (NPS 14) and larger sizes. Steel plate flange protectors shall be 6 mm minimum thickness. Steel washers shall be provided under the nuts at the back side of the flanges when bolted flange covers are used. If steel covers are used for flange protectors, a soft gasket shall be provided between the steel protector and the flange. Open-end pipe shall be protected by 6 mm minimum thickness steel plate discs, cut to match the OD of the pipe, and held in place by snug fitting sheet metal caps tack welded to the pipe.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
17	Issue of release note.	- As per PO.	- Inspection release note.	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, stamped and stamped TPI reports and after its approval KNPC will issue the release note for shipment.
18	Final Inspection Report and Manufacturers details report.	- As per PO.	- Inspection report.	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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ADDENDUM-1
CEMENT MORTAR LINING OF STEEL PIPES

Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
1	Material	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
2	Cement	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
3	Sand	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
4	Water	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
5	Wire Mesh	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
6	Mortar Mix	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
7	Pipe Preparation	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
8	Mortar Application	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
9	Water Absorption	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
10	Lining Thickness	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
11	Curing	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
12	Finished Lining	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	Cracking	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
14	Spalling	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
15	Loading / Transportation	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
16	Drop Test	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	<ul style="list-style-type: none"> - Material test certificate for chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports. - Grain size. - Hardness. - Impact test. 	<ul style="list-style-type: none"> - As per specified Standards and purchase order requirements. 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate and mode of cooling.
1.1	IGC Test for Austenitic SS / SS Cladded / SS weld overlaid fittings & other Austenitic alloys, as applicable.	<ul style="list-style-type: none"> - A 262 practice E. 	<ul style="list-style-type: none"> - IGC report. 	R	100%	-
Part B: Fabrication & Inspection						
2	Seamless Pipe Fittings <ul style="list-style-type: none"> - Hot forming. - Heat treatment (Normalizing). - Macro etch test for seamless construction. 	<ul style="list-style-type: none"> - Hot forming procedure. - Applicable codes & Standards. - Latest applicable STD (ASTM E-340) and PO. 	<ul style="list-style-type: none"> - Inspection report. - Heat treatment. - Test report. 	R R W	100% 100% One sample from each heat number.	- - <ul style="list-style-type: none"> - This is applicable for tubular products also.
3	Welded Pipe Fittings:					
3.1	<ul style="list-style-type: none"> - WPS, PQR and WPS. 	<ul style="list-style-type: none"> - ASME Sec. IX. 	<ul style="list-style-type: none"> - WPS, PQR, WPQ. 	H	100%	<ul style="list-style-type: none"> - Final approval by KNPC before proceeding with welding.
3.2	<ul style="list-style-type: none"> - Welding (Longitudinal Weld). 	<ul style="list-style-type: none"> - Applicable codes & Standards. 	<ul style="list-style-type: none"> - Inspection report. 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
3.3	- Liquid Penetrant test (LPT) of weld from outside and inside.	- Latest Applicable STD.	- Test report.	W	100%	- NDT reports must be reviewed by ASNT Level-II qualified personnel.
3.4	- NDT Test prior to heat treatment.	- Applicable codes & Standards and PO.	- NDT report.	R	100%	-
3.5	- Hot Forming.	- Applicable codes & Standards. - Hot forming procedure	- Inspection report.	R	100%	-
3.6	- Heat treatment.	- Applicable codes & Standards.	- Heat treatment chart.	R	100%	- Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate.
3.7	- Hardness measurement (if applicable)	- Applicable codes & Standards.	- Hardness report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
3.8	- Lab test (Tensile, Bend test, Product analysis on Weld metal and base metal, Micro examination on weld, HAZ & Base metal) as applicable.	- Applicable codes & Standards.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
3.9	- Corrosion test (if applicable).	- Applicable Codes & Standards.	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
3.10	- NDT Test after heat treatment (as applicable)	- Applicable codes & Standards and PO.	- NDT report.	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
3.11	- Radiography record.	- Applicable codes & Standards.	- Radiography report.	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
3.12	- Ferrite evaluation (WM, HAZ, BM) (if applicable).	- Applicable codes & Standards. - Ferrite measurement procedure	- Test report.	R	100%	- Additionally, for DSS material Shell DEPs acceptance criteria shall be applicable.
3.13	In case of Weld Over Laid pipe fittings: - UFD for dis-bonding	- Latest Applicable STD and PO.	- Test Report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
3.14	- Dilution test (by PMI / wet chemical analysis)	- Latest Applicable STD and PO.	- Test Report.	W	100%	-
3.15	- Free iron check on weld overlay surface (Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSO ₄ test on other weld overlays materials).	- Latest Applicable STD and PO.	- Test Report.	W	100%	-
4	Cladded Pipe Fittings: - Bond strength test of cladded pipe fittings.	- As per applicable standard.	- Test report.	R	100%	-
4.1	- NDT record for cladded pipefittings.	- As per applicable standard.	- Test report.	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
4.2	- UT of pipe fitting for laminations. - UT for dis-bonding from clad side for cladded pipefittings.	- Latest applicable STD (A578) and PO.	- Test report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
5	Cement Lines Pipe fittings: For Cement / Mortar Lining	- Applicable STD (KNPC ENG. STD 87C1 & PRJ-ESC-SPC-023-21-001) and PO.	- Test report.	As per Addendum – 2 attached below.		-
6	Visual Inspection - Straightness, material finish, edges etc.	- As per specified STD and purchase order requirements.	- Visual inspection report.	W	100%	-
7	- In case of any finding during visual inspection witness –LPT.	- As per applicable STD.	- LPT report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
8	Dimensional Check - Specified length. - Permissible variation in wall thickness. - OD, Out of roundness etc.	- As per specified STD & PO.	- Dimensional report.	W R	5% 100%	- Co-relate the MTCs with pipefittings. - Dimensional check records carried out by Vendor.
9	- PMI of pipe fittings of all other material except CS.	- Applicable Standard.	- PMI Report.	W R	One sample per heat number. 100%	- Pipefittings must be stenciled by TPI for identification of PMI. - PMI to be carried out by Vendor as per Annexure-I.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
10	- Thickness measurement of pipefittings (Except Flanges).	- Use E797 pulse echo method - As per PO and Applicable STD.	- Test report.	W R	10% 100%	- Thickness measurement shall be done by Vendor. - These pipefittings to be stamped / stenciled for Low Alloy, SS & Non-Ferrous by TPI. - Report of thickness measurement carried out by Vendor. - In case of small fittings 1" or small, use smaller ultrasonic thickness probe on 100% quantity or radiography of 10% of quantity.
Part C: Inspection of Marking, Packing & Issuance of Release Note						
11	Marking on pipe fittings with: - Manufacture's Name. - Heat No. - Applicable Standards. - Grade. - ANSI Rating OD. - Thickness. - Length. - For Low Temperature Services, Mark LT followed by temperature at which impact test is done on pipefittings.	- PO & Physical Check.	- Reports.	W	100%	- Heat # shall co relate with Heat # on MTC.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
12	Packing Inspection: <ul style="list-style-type: none"> - Properly painted (CS + Alloy Steel). - Bevel edges are protected by plugs (preferably plastic). - Color code marking. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	<ul style="list-style-type: none"> - PO & Physical Check. 	<ul style="list-style-type: none"> - Packing report. 	W	100%	<ul style="list-style-type: none"> - Color coding as per Annexure – III.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	Issue of release note.	- As per PO	- Inspection release note.	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified and stamped TPI reports and after its approval, KNPC will issue the release note for shipment.
14	- Final Inspection Report and Manufacturers data report.	- As per PO	- Inspection report.	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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ADDENDUM-2
CEMENT MORTAR LINING OF STEEL PIPE FITTINGS

Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
1	Material	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
2	Cement	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
3	Sand	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
4	Water	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
5	Wire Mesh	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
6	Mortar Mix	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
7	Pipe Preparation	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
8	Mortar Application	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
9	Water Absorption	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
10	Lining Thickness	As per Specified STD and PO	Report	R	100%	Test report of Vendor.
11	Curing	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
12	Finished Lining	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	Cracking	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
14	Spalling	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
15	Loading / Transportation	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	
16	Drop Test	As per Specified STD and PO	Report	I	Inspect first lining operation and 5% random for subsequent operation.	

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR GATE, GLOBE, CHECK, BALL, PLUG, BUTTERFLY AND NEEDLE VALVES**
TPI No. : TPI-KNPC-04-VALVES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations. - Technical specifications. - Datasheet.	- PO. - Drawing, Datasheet, Technical Specifications & Calculations. - Quality & Inspection Requirements.	- Minutes of Meeting.	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Valve is new, the drawings, data sheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan.	- PO. - Approved Drawing & Data sheet. - TPI-KNPC-04-VALVES.	- Approved Inspection & Test Plan.	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC.
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT). - PMI. - Fabrication. - Pressure Testing Procedure (Hydro / Pneumatic). - Initial Thick Measurement	- PO Requirement. - Applicable Codes & Standards.	- Document Procedure.	R	100%	<u>H: for KNPC</u> - Final approval by KNPC.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Painting. - Pickling & Passivation. - Packing / shipping. - Other procedure etc. 					
4	All Raw Material Inspection (body Bonnet, trim and lining) <ul style="list-style-type: none"> - Applicable Mechanical, chemical, Impact properties. - Heat Treatment / solution annealing reports / charts. - Hardness test. - Ferrite content report, as applicable - Microstructure / Average grain size for SS as per ASTM E112 - Material Identification and Co-relation. - TAT Test (Type acceptance Test), if specified. - Casting Inspection report. - IGC test as per ASTM A262 practice E (including weld overlaid valves also), as applicable 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts. 	R	100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Fire safe test report.	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Test report. 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
6	NDT test (RT, LPT/MPI) of the raw material (Body & Bonnet): <ul style="list-style-type: none"> - Cast Valve: Test to be carried out for all type of rating. - Forged Valve: Test to be carried out for valve with rating ≥ 900 class. 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - NDT Procedure. 	<ul style="list-style-type: none"> - NDT test report. 	R	Quantity of testing shall be as per Annexure -II	<ul style="list-style-type: none"> - TPI to review all the test reports carried out by the vendor.
7	Visual & Dimensional verification of raw material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures. - Approved Drawings. 	<ul style="list-style-type: none"> - Visual & Dimensional report. 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 5% (Minimum one) 100% 	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication. - Review reports carried out by Vendor.
8	Material finish.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Visual Inspection. 	<ul style="list-style-type: none"> - Report. 	W	100%	-
9	Additional test for Duplex materials.					
9.1	- Micro structure determination.	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Micro structure report. 	R	100%	-
9.2	- PREN number.	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - PREN number report. 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
9.3	- Corrosion test.	- Applicable Codes & Standards.	- Test report.	W R	One Testing per Lot. 100%	- Review reports carried out by Vendor.
9.4	- Ferrite determination on welds.	- Applicable Codes & Standards.	- Test report.	R	100%	-
10	Check size, material, ANSI rating, trim, heat number and flow direction are marked on Valve.	- Applicable Codes & Standards. - Visual Inspection.	- Report	W	100%	-
11	- WPS, PQR & WPQ. - Weld Map.	- ASME Sec. IX.	- WPS, PQR, WPQ. - Weld map.	R	100%	-
12	NDT Personnel Qualifications (as applicable).	- Applicable Codes & Standards.	- Personnel Qualification certificates.	R	100%	-
13	Painter & Blaster Personnel Qualifications.	- Applicable Codes & Standards.	- Personnel Qualification certificates.	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	UFD of Weld Overlaid Valves to check Dis-bonding.	- Applicable Codes & Standards.	- Test report.	W	100%	-
15	Dilution test of weld overlaid Valves.	- Applicable Codes & Standards.	- Test report.	R	100%	-
16	Checking of heat number on the valve.	- Physical Check.	- Material test certificates.	W	100%	-
17	Rubber Lining Inspection: - Visual & Spark test. - Shore hardness.	- Applicable Codes & Standards.	- Inspection report.	W W R	100% 5% 100%	- Witness Spark Testing carried out by Vendor. - Review shore hardness report carried out by Vendor.
18	PMI of all material for body & bonnet except CS material.	- Applicable Codes & Standards. - PMI Procedure.	- PMI report.	W R	100% 100%	- Witnessed Valves shall be stenciled by TPI for proper identification of PMI. - Test report of Trim carried out by Vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
19	Thickness measurement of body and bonnet.	- Approved Drawing. - Approved Procedure.	- Thickness Measurement Report.	W	100%	-
20	Low temperature & Cryogenic test (if applicable).	- Applicable Codes & Standards.	- Test report.	R	100%	-
21	Hydrostatic / Pneumatic / seat Testing of the pressure containing parts (body, bonnet, cap & nozzles)	- API 598. - No leakage. - Approved Drawing. - Approved Procedure.	- Hydrostatic test / Pneumatic Test Report. - Water Test Certificates. - Gauge Calibrations.	H H R	- 100% material (for all except for CS). - 10% for CS Valves. - 100% for CS Valves	<p><u>H:</u> for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - For hydro testing of Austenitic & Duplex SS material, potable water should be used with Chloride content not more than 50PPM. - After hydrotest, the Valves shall be immediately drained, cleaned and dried out. - Testing record carried out by Vendor.
22	- Stamping of Valve.	- As per PO and Applicable Codes & Standards.	- Stamping.	W	100%	- All valves shall be stamped by TPI for identification.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part C: Inspection of Painting						
23	Surface preparation and painting inspection.	- PO. - Painting Procedure.	- Painting report.	R	100%	-
Part D: Inspection of Packing & Issuance of Release Note						
24	Packing Inspection <ul style="list-style-type: none"> - Both ends are protected with suitable plugs (preferably plastics). - Color code marking. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	- PO & Physical Check.	- Packing report.	W	100%	- Color coding as per Colour coding specification Annexure – III.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
25	Issue of release note.	- All inspection reports and certificates.	- Inspection release note.	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified stamped and signed TPI reports and after its approval, KNPC will issue the release note for shipment.
26	Final Inspection Report and Manufacturers data report.	- As per PO.	- Inspection report.	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
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FOR CARBON STEEL, ALLOY STEEL, STAINLESS STEEL, DUPLEX STAINLESS
STEEL, NICKEL ALLOY, COPPER ALLOY & TITANIUM TUBES FOR HEAT
EXCHANGERS / CONDENSERS / AIR FIN COOLERS AND TUBES FOR BOILERS**

TPI No. : TPI-KNPC-05-TUBES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	<ul style="list-style-type: none"> - Material test certificate for chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports. - Grain size. - Hardness. - Ferrite content report as applicable - Impact test. - Expansion Test. - Flattening Test. - Reverse Flattening Test. - Flaring Test. - Flange Test. - Ultrasonic Inspection of Welded Tubes. - Crush Test. 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. - PO. 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate.
1.1	IGC Test for Austenitic SS & other Austenitic alloys tubes, as applicable	<ul style="list-style-type: none"> - ASTM A262 practice E. 	<ul style="list-style-type: none"> - IGC report. 	R	100%	-
1.2	Microscopical examination result for copper – Alloy tubes.	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. - PO. 	<ul style="list-style-type: none"> - Test report. 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
1.3	Grain size measurement for Nickel Alloy tubes, all H Grade SS tubes and wherever applicable as per ASTM	- Applicable Specified Codes & Standards. - PO.	- Test report.	R	100%	-
1.4	Mercurous Nitrate Test / Ammonia Vapor Test for Copper Alloy Tubes.	- Applicable Specified Codes & Standards. - PO.	- Test report.	R	100%	-
1.5	Harmful Oxide Film Detection Test for Cupronickel Tubes.	- Applicable Specified Codes & Standards. - PO.	- Test report.	R	100%	- As per Annexure – IV.
Part B: Fabrication & Inspection						
2	Visual Inspection: - Straightness, material finish, edges, free of scale etc.	- Applicable Specified Codes & Standards. - PO.	- Visual inspection report.	W	100%	-
3	In case of any finding during visual inspection witness -LPT.	- Applicable Specified Codes & Standards.	- LPT report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
4	Dimensional Check: - Specified length. - Permissible variation in wall thickness. - OD (outside diameter). - ID (Inside diameter). - Out of roundness (Ovality).	- Applicable Specified Codes & Standards. - PO.	- Test report.	W	5%	- Co-relate the MTCs with tubes.
				R	100%	- Dimensional check record of tubes carried out by Vender.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
5	Seamless Tubes: Macro etch test for seamless construction.	- Latest applicable STD (ASTM E-340) and PO.	- Test report.	W	One sample from each heat number.	-
6	Impact Test for Tubes (To be used for Low Temperature Services).	- Applicable Specified Codes & Standards. - PO.	- Test report.	W R	- One sample from each Heat of Tubes. 100%	- Impact test records carried out by the vendor.
7	PMI of Tubes of all other materials except CS.	- Applicable Specified Codes & Standards. - PO	- PMI Report.	W R	One sample per heat number. 100%	- Tubes must be stenciled by TPI for identification of PMI. - Record of PMI of tubes carried out by Vendor as per Annexure-I.
8	Finning procedure (Including WPS/ PQR wherever applicable) for finned tubes.	- Applicable Specified Codes & Standards. - PO.	- WPS / PQR.	R	100%	-
9	Visual Inspection of Fins & Visible section of Tubes.	- Applicable Specified Codes & Standards. - PO.	- Test report.	W	100%	-
10	Check for extrusion or extrusion & serration.	- Applicable Specified Codes & Standards. - PO	- Test report.	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
11	Dimensional Inspection: - Fins OD & Pitch. - Bare both Ends. - Length.	- Applicable Specified Codes & Standards. - PO	- Test report.	W R	5% 100%	- Dimensional record of Tubes of Vendor.
12	Check Fin material before Finning.	- Applicable Specified Codes & Standards. - PO	- Test report.	W	100%	- Co-relate Fin material with MTC.
13	Pneumatic Testing (for Duplex Tubes, as applicable)	- Applicable Specified Codes & Standards. - PO	- Test Report	W R	10% 100%	- Testing shall be done after completion of all mechanical work/finning etc. - Test Record of Tubes carried out by the Vendor.
14	Hydro-test of Finned / bare Tubes.	- As per PO Specification.	- Test report.	W	10%	- Hydrostatic test shall be done after completion of all mechanical work/finning etc. - Potable water to be used for hydro testing purpose. - Water used for Hydro-test of (405, 410, 430, 18/855, 18/8 SS (300 Series), Duplex SS, Alloy 20 and Alloy 400 shall be free from sediments and Chlorides not more than 50 PPM by mass. Tubes shall be drained and dried post hydrotest.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
				R	100%	- Hydro-test record of Tubes carried out by Vendor.
Part C: Marking & Packing						
15	Marking on Tubes with - Manufacture's Name. - Heat No. - Applicable Standards / Specification. - Grade. - ANSI Rating - OD. - Thickness. - Length. - For Low Temperature Services, Mark "LT" followed by temperature at which impact test is done on pipe fittings. - Mention "Condition – Temper" for Nickel and Copper Alloy Tubes.	- PO & Physical Check.	- Reports.	W	100%	- Heat # shall co relate with Heat # on MTC.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
16	Packing Inspection <ul style="list-style-type: none"> - Tubes are properly oiled. - Plugged with plastic caps at both ends to protect from corrosion. - Properly packed to avoid damages during transit & handling. - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - Packed boxes are color coded and Metal Tag containing details of tubes. - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	<ul style="list-style-type: none"> - PO, Packing Procedure & Physical Check. 	<ul style="list-style-type: none"> - Packing reports. 	W	100%	<ul style="list-style-type: none"> - Color coding as per Annexure – III.
17	Issue of release note.	- As per PO	- Inspection release note.	H	100%	- TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
		-	-			Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified and stamped TPI reports and after its approval KNPC will issue the release note for shipment
18	Final Inspection Report and Manufacturers data report.	- As per PO	- Inspection report.	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Approval of fabrication drawing and bending procedure.	- As per PO and drawing.	- Drawing and bending procedure.	R	100%	-
Part B: Raw Material Inspection						
2	<ul style="list-style-type: none"> - Material test certificate for chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment report. - Hardness. - Impact test. - Expansion Test. - Flattening Test. - Reverse Flattening Test. - Flaring Test. - Flange Test. 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. - PO. 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate.
2.1	IGC Test for Austenitic SS & other Austenitic alloy tubes, as applicable	<ul style="list-style-type: none"> - ASTM A 262 practice E and ASTM A 213 supplementary (S4). 	<ul style="list-style-type: none"> - IGC report. 	R	100%	-
2.2	Microscopical examination result for copper – Alloy tubes.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PO. 	<ul style="list-style-type: none"> - Test report. 	R	100%	-

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2.3	Grain size measurement for Nickel Alloy tubes, all H Grade SS tubes and wherever applicable as per ASTM	- As per Specified STD ASTM-E112 and PO.	- Test report.	R	100%	-
2.4	Mercurous Nitrate Test / Ammonia Vapor Test for Copper Alloy Tubes.	- Applicable Codes & Standards. - PO.	- Test report.	R	100%	-
2.5	Harmful Oxide Film Detection Test for Cupronickel Tubes.	- Applicable Codes & Standards. - PO	- Test report.	R	100%	- As per Annexure – IV.
2.6	Impact Test for Tubes (To be used for Low Temperature Services).	- As per specified STD & PO.	- Test report.	W R	- One sample from each Heat of Tubes. 100%	- - Test record of Tubes carried out by Vendor.

Part C: Fabrication & Inspection

3	Seamless Tubes: Macro etch test for seamless construction.	- Latest applicable STD (ASTM E-340) and PO.	- Test report.	W	One sample from each heat number.	-
4	PMI of Tubes of all other materials except CS.	- Applicable Codes & Standards. - PO	- PMI Report.	W	One sample per heat number.	- Tubes must be stenciled by TPI for identification of PMI.

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				R	100%	- Record of PMI of tubes carried out by Vendor as per Annexure-I.
5	After forming of bend, check / verify the wall thinning of shortest bend.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PO Specifications / Drawing 	<ul style="list-style-type: none"> - Test report. 	W	100%	<ul style="list-style-type: none"> - Thinning of U-bend shall not exceed 17% of specified minimum wall thickness as specified in TEMA RCB-2.31.
6	Check tube flattening at middle of the tube.	<ul style="list-style-type: none"> - As per PO Specification / Drawing 	<ul style="list-style-type: none"> - Test report. 	W	100%	<ul style="list-style-type: none"> - Flattening shall not exceed 10% of OD of Tube.
7	Stress relieving / solution annealing of U-bends plus 1 foot on both side.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - As per drawing / PO Specifications. - Approved Procedure 	<ul style="list-style-type: none"> - Heat Treatment report with record chart 	R	100%	<ul style="list-style-type: none"> - Test record of U-bends carried out by Vendor. - Heat Treatment chart must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling
8	LPT of U-bends Tubes.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PO Specifications / Drawing. 	<ul style="list-style-type: none"> - Test report. 	W	All tubes of 2 nos. of inner most row tubes (shortest Bends)	
				R	100%	- LPT shall be carried out by Vendor.

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9	Hardness Test after Stress Relieving (CS & Low Alloy Steel Material).	- Applicable Codes & Standards. - PO Specifications / Drawing.	- Test report.	W	On 2 Nos. inner row tubes (shortest bends).	- Hardness measurement shall be carried out by Vendor.
10	Visual Inspection - Straightness, material finish, edges, free of scale etc.	- Applicable Codes & Standards. - PO Specifications / Drawing.	- Visual inspection report.	W	100%	-
11	In case of any finding during visual inspection witness -LPT.	- Applicable Codes & Standards. - PO Specifications / Drawing	- LPT report.	W	100%	-
12	Dimensional Check: - Specified length. - Bend radii. - Permissible variation in wall thickness. - OD (Outside Diameter). - ID (Inside diameter). - Out of roundness (Ovality).	- As per specified STD. - PO and drawing.	- Test report.	W R	5% 100%	- Co-relate the MTCs with tubes. - Dimensional check record of tubes carried out by Vender.
13	Pneumatic Testing (for Duplex Tubes, as applicable).	- Applicable Specified Codes & Standards. PO.	- Test report.	W R	10% 100%	- Testing shall be done after completion of all mechanical work/finning etc. - Test Record of Tubes carried out by the Vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	Hydro-test of U-bend Tubes.	- As per PO Specification.	- Test report.	W R	10% 100%	<ul style="list-style-type: none"> - Hydrostatic test shall be done subsequent to Bending. - Potable water to be used for hydro testing purpose. - Water used for Hydro-test of (405, 410, 430, 18/855, 18/8 SS (300 Series), Duplex SS, Alloy 20 and Alloy 400 shall be free from sediments and Chlorides content not more than 50 PPM by mass. Tubes shall be drained and dried post hydrotest. - Hydro-test record of Tubes carried out by Vendor.
Part D: Marking & Packing						
15	Marking on Tubes with <ul style="list-style-type: none"> - Manufacture's Name. - Heat No. - Length. - Applicable Standards / Specification. - Grade. - OD (Outside Diameter) - Minimum wall thickness. - For Low Temperature Services, Mark LT followed 	- PO & Physical Check.	- Reports.	W	100%	<ul style="list-style-type: none"> - Heat # on tubes shall co relate with Heat # on MTC.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<p>by temperature at which impact test is done on tubes.</p> <ul style="list-style-type: none"> - Mention "Condition – Temper" for Nickel and Copper Alloy Tubes. 					
16	<p>Packing Inspection:</p> <ul style="list-style-type: none"> - U-Tubes are properly oiled. - Plugged with plastic caps at both ends to protect from corrosion. - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - U-Tube boxes are color-coded and Metal Tag containing details of tubes. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion resulting from seawater 	<ul style="list-style-type: none"> - PO & Physical Check. 	<ul style="list-style-type: none"> - Packing reports. 	W	100%	<ul style="list-style-type: none"> - Color coding as per Annexure – III.

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	<ul style="list-style-type: none"> - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings 	-	-		-	
17	Issue of release note.	<ul style="list-style-type: none"> - As per PO. 	<ul style="list-style-type: none"> - Inspection release note. 	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, signed and stamped TPI reports and after its approval, KNPC will issue the release note for shipment.
18	Final Inspection Report and Manufacturers data report.	<ul style="list-style-type: none"> - As per PO. 	<ul style="list-style-type: none"> - Inspection report. 	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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Part A: Pre Inspection						
1	- Vendor's drawings and calculations. - Datasheet.	- PO. - Drawing, Datasheet & Calculations. - Quality & Inspection Requirements.	- Approved Drawing, Datasheet & Calculations.	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the tube bundle is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan (ITP).	- PO. - Approved Drawing. - TPI-KNPC-07-Tube Bundle.	- Approved Inspection & Test Plan.	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC.
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/RT) - PMI - Fabrication - Hydrostatic Test - Painting	- PO Requirement - Applicable Codes & Standards.	- Document Procedure.	R	100%	<u>H:</u> for KNPC - Final approval by KNPC.

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	<ul style="list-style-type: none"> - Hydrostatic Test - Painting - Packing / shipping - Other procedure etc. 					
4	All Raw Material Inspection: <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties. - Heat Treatment reports / charts. - Bond strength test (Cladded Material). - Hardness test. - Microstructure / Average grain size. - Material Identification and Correlation. 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts. 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	IGC Test for Austenitic SS & other Austenitic alloys tube sheets and SS weld overlay / cladding, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report. 	R	100%	-
6	PMI of all material except CS material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PMI Procedure. 	<ul style="list-style-type: none"> - PMI Report. 	W W R	100% One sample per heat number. 100%	<ul style="list-style-type: none"> - Tube sheet, baffles, tie-rods, spacers etc. - For Tubes / U-Tubes PMI requirement refer to TPI-KNPC-05-TUBES / TPI-KNPC-06-U TUBES. - PMI carried out by Vendor reports as per Annexure – I.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
7	Visual & Dimensional verification of raw material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures. - Approved Drawings. 	<ul style="list-style-type: none"> - Visual & Dimensional report. 	R	100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication.
8	NDT Personnel Qualifications.	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates. 	R	100%	-
Part C: Welding Document						
9	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map. 	<ul style="list-style-type: none"> - ASME Sec IX. 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map. 	H	100%	<u>H: for KNPC</u> - Final approval by KNPC.
10	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material). 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C. 	<ul style="list-style-type: none"> - Test report - PMI Report. 	R	100%	-
11	Tubes.	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	Tubes to comply to requirement of <ul style="list-style-type: none"> - TPI-KNPS-05-TUBES or - TPI-KNPC-06-U TUBES - As applicable.
12	Forging and Plates.	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	<ul style="list-style-type: none"> - See Remarks. 	Forging and plates to comply to requirement of TPI-KNPC-03-PIPE FITTINGS & TPI-KNPC-01-PLATES.
13	Visual and dimensional Inspection of tube sheets prior to drilling.	<ul style="list-style-type: none"> - As per specified standard / code and drawing. 	<ul style="list-style-type: none"> - Visual & Dimensional report. 	W	100%	-

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14	Ultrasonic examination (UFD) on tube sheets prior to drilling.	- As per specified standard / code and drawing.	- UFD Report.	W	100%	- Cladding, weld overlay & PWHT if applicable shall be carried out prior to hole drilling.
15	Inspection of weld overlay of tube sheets. - Visual inspection - LPT - Dilution test (by PMI / wet chemical analysis) - Free iron check on weld overlay surface (Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSO ₄ test on other weld overlays materials). - Ferrite check of weld overlay (for DSS & Austenitic Material) - Thickness checking of overlay to check minimum overlay thickness - UT check for dis-bonding	- As per specified code / standard and drawing.	- Test reports.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
16	Inspection prior to assembly of tube bundle.					
16.1	Dimensional inspection of tube sheet including Go/No Go gauge check of tube holes.	- As per RCB 7.21 of TEMA latest edition.	- Dimension report.	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
16.2	Tube hole ligaments.	- As per RCB 7.22 of TEMA latest edition.	- Dimension report.	W	100%	-
16.3	Visual and Dimensional verification of Baffles.	- As per specification and drawing.	- Dimension report.	W	100%	-
16.4	Check tubes for finish, permissible variation in wall thickness, diameter specified length & straight length of tubes.	- As per specification and drawing.	- Dimension report.	W	100%	-
16.5	Radiography report if any.	- Applicable codes / standard RT procedure.	- Radiography report.	R	100%	- Radiograph interpreted by ASNT Level – II qualified Personnel.
16.6	Mock-up Test for Tube to Tube Sheet Joint (as applicable)	- As per applicable code / standard / PO / Approved Drawing.	- Test report.	R	100%	-
17	After tube bundle assembly and welding / expansion of tube to tube sheet carry out the following:					
17.1	Visual & Dimensional Inspection.	- As per Approved Drawing.	- Dimension report.	W	100%	-
17.2	Check length and contour of expansion of tubes with tube sheets.	- As per TEMA class RB 7.3111 7.3.312	- Dimension report	W	100%	-
17.3	Tube expansion.	- As per PO and specified standard and approved drawing.	- Dimension report.	W	100%	-

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17.4	Tube projections beyond the face of the tube sheets.	- As per approved drawing and TEMA RCB 7.313.	- Dimension report.	W	100%	-
18	Inspect welded tube to tube sheet joints as follows:					
18.1	LPT of tube to tube sheet welds.	- As per applicable code / standard and NDT procedure.	- LPT report.	W	100%	- If stress relieving is applicable then LPT to be done after SR.
18.2	Hardness test (if specified)	- As per applicable code / standard, PO, drawing and NDT procedure.	- Hardness report.	W R	5% 100%	- Hardness report carried out by Vendor.
18.3	PMI or Wet Chemical analysis (for all tube to tube sheet weld joints except CS).	- As per applicable code / standard, PO and PMI procedure.	- PMI report.	W	2%	-
19	Hydro test of shell side and tube side of tube bundle.	- As per applicable code / standard and approved drawing. - Hydro-test procedure.	- Hydro-test report (no leak) - Water test certificate. - Gauge calibration.	H	100%	- Potable Water shall be used for Hydrotesting - Water used for Tube Bundle made from Martensitic and ferrite grade steels, stainless steels, duplex grade, alloy 400, nickel alloy material shall not contain trace of any type of sediment and chlorides not more than 50 ppm. - Tube bundle shall be drained and dried after hydrotest.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
20	Final Visual Inspection for Anti rust coatings (if specified).	- Applicable codes & approved procedure.	- Rust coating report.	W	100%	-
Part D: Packing & Issue of Release Note						
21	Packing Inspection <ul style="list-style-type: none"> - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion resulting from sea water. - Properly preserved to avoid any corrosion - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing. - Shipping markings. 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - It should be supported with load bearing wooden section / member at baffle plates. - The tube sheet face should be sealed preventing any damage to tube bores and protecting the joint face.
22	Issue of Release Note	- As PO required inspection satisfactorily completed.	- Inspection release note	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.

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						- KNPC will review the final duly certified signed & stamped TPI reports MTCs and other test reports and after its approval KNPC will issue the release note for shipment.
23	Final Inspection report and Manufacturer data reports.	- PO.	- Inspection report.	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

KUWAIT NATIONAL PETROLEUM COMPANY



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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR SHELL & TUBE TYPE HEAT EXCHANGER**
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Heat exchanger is new, the drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-08-HEAT EXCHANGER	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT/VT) - Ferrite Measurement - PMI - Heat Treatment	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Hardness Measurement - Production test coupon - Fabrication Procedure (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	All Raw Material Inspection & Reports (Plates, Pipes, forgings, Tubes, Fasteners, Gasket etc.) <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - For plates refer to TPI-KNPC-01-PLATES. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - NDE for raw material - Shear strength and bond quality test for clad plates. - Mill hydrotest (as applicable) 					<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS. - For tubes refer to TPI-KNPC-05-TUBES / TPI-KNPC-06-U TUBES. - In case the exchanger components are fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling/Forming reports. <p>MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.</p>
5	IGC Test for Austenitic SS & other Austenitic alloy material, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report 	R	100%	<ul style="list-style-type: none"> - This clause is applicable for weld overlaid items as well.
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - PMI Report 	W (all items except tubes) W(Tubes)	100% One sample per heat Number R 100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs. - For Tubes / U-Tubes PMI requirement refer to TPI-KNPC-05-TUBES / TPI-KNPC-06-U TUBES. - TPI to review the Test reports carried out by the vendor.

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7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W (Visual) W (Dimension check) R 	<ul style="list-style-type: none"> 100% 5% 100% 	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part - C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
12	Production test coupon (Production Test Plate) - As applicable	- Applicable Codes & Standards. - Approved Production Test Coupon Procedure	- Heat Treatment and Mechanical / other testing reports	R (Heat treatment charts and other test reports) W (Mechanical testing)	100%	<u>H:</u> for KNPC - Final approval by KNPC
Part D: Fabrication Inspection (Shell/Channel & Components, Floating Head Cover & Nozzles)						
13	Marking, cutting/rolling of plates for shell, nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Ultrasonic Thickness check - Dimension & cutting allowance etc.	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
14	Head forming inspection (as applicable): - Template guide - Visual & Dimensional inspection - Ultrasonic Thickness check - Heat treatment (as applicable)	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	- Heat Treatment charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling. - LPT: for Austenitic and Non-ferrous materials.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	- LPT/MPT on Internal & External surfaces of Knuckle region after forming (before & after Heat treatment)					- MPT: for Ferromagnetic material
15	CuSO ₄ test after clad removal for welding (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure 	<ul style="list-style-type: none"> - Inspection report 	W R	10% 100%	<ul style="list-style-type: none"> - Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor
16	UT of clad plates after forming/rolling (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT report 	W	100%	<ul style="list-style-type: none"> - Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
17	Visual Inspection of edges to be welded & any openings (check cracks & laminations)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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18	LPT / MPT (as applicable) of edges to be welded & any openings to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
19	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
20	Intermediate stress relief / Dehydrogenation treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedures 	<ul style="list-style-type: none"> - Heat Treatment report 	R	100%	<ul style="list-style-type: none"> - ISR/Dehydrogenation treatment charts mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
21	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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22	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
23	PMI of completed welds except CS welds (from inside and outside)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
24	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
25	Ferrite Testing of pressure retaining welds (for Duplex and Austenitic Stainless steel material)	<ul style="list-style-type: none"> - Latest API 660 - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - The quantity of welds to be tested by vendor shall be governed by shell DEPs.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
26	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO & Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
27	UT of the completed Nozzles Neck attachment welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures 	<ul style="list-style-type: none"> - UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
28	Pneumatic testing of RF pads / Lined nozzles (as applicable)	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-

Part E: Inspection of Weld Overlay / Cladding Restoration

29	Visual Inspection after weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
30	Dilution test (by PMI / wet chemical analysis)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO & Procedure 	<ul style="list-style-type: none"> - Test report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI to review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
31	Free iron check on weld overlay surface: • Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSo ₄ test on other weld overlays materials	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Test report	R	100%	- TPI shall review test reports carried out by vendor
32	Ferrite check of weld overlay (for DSS & Austenitic Material)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure	- Ferrite test reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
33	Thickness checking of overlay to check minimum overlay thickness	- Applicable Codes & Standards. - Approved drawing/PO - Approved Procedure	- Inspection Report	R	100%	-
34	LPT of weld overlay	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT reports	W R	10% 100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
35	UT of weld overlay (to check for dis-bonding)	- Applicable Codes & Standards. - Approved UT Procedure	- UT reports	R	100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part F: Inspection of External attachment (such as lifting lugs, support bracket, earthing connection etc.)						
36	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-
37	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - Test reports carried by vendor.
38	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual Inspection Reports 	R	100%	-
39	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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40	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-
41	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
42	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part G: Final Inspection Prior to PWHT						
43	Final Visual, dimensional & alignment check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-

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44	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
Part H: PWHT & Inspection after PWHT of Shell/Channel & Components (As applicable)						
45	PWHT of the Heat Exchanger Components (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
46	Hardness test of pressure retaining welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
47	LPT/MPT of all pressure retaining welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 10% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
				R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
48	RT or UT (as applicable) for Pressure retaining Butt welds joints after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
49	LPT of weld overlay surface after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - Test reports carried out by vendor
50	UT of weld overlay after PWHT (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
51	Final Visual & dimensional check - Release shell for tube bundle insertion	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
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FOR SHELL & TUBE TYPE HEAT EXCHANGER**

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52	Initial Thickness measurement of all components	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
Part I: Tube Bundle Fabrication & Inspection						
53	Tube Bundle Fabrication	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - For the TPI scope of Tube bundle fabrication & inspection, refer to TPI-KNPC-07-TUBE BUNDLE
Part J: Pressure Testing of the Heat Exchanger Assembly						
54	Visual & Dimensional Inspection of Test Ring	<ul style="list-style-type: none"> - Approved Drawing / PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	R	100%	<ul style="list-style-type: none"> - TPI shall review the test report carried out by vendor & verify the identification markings on the test rings.
55	Pneumatic Test to check the integrity of tube to tubesheet weld joints of the Tube Bundle (as applicable)	<ul style="list-style-type: none"> - No leakage - Approved Drawing / PO - Approved Pneumatic Testing Procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
56	Hydrostatic Test <ul style="list-style-type: none"> - Shell Side - Tube Side - Final shell side 	<ul style="list-style-type: none"> - No leakage - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates 	H	100%	<ul style="list-style-type: none"> - <u>H: for KNPC</u> - Final approval by KNPC - Potable water to be used for hydro testing purpose.

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		<ul style="list-style-type: none"> - Approved Hydrotest Procedure - Approved Drawing 	<ul style="list-style-type: none"> - Gauge Calibrations 			<ul style="list-style-type: none"> - For Austenitic SS material (300 series austenitic) & duplex material (e.g. Alloy 2205, Alloy 2507) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - After hydoteest, the heat exchanger shall be immediately drained, cleaned and dried out.
57	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part K: Inspection of Painting						
58	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part L: Inspection of Packing & Issuance of Release Note						
59	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - The Exchanger shall be properly supported with load bearing sections/members.
60	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.

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61	Issue of Release Note	- As per PO	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
62	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR BREECH LOCK HEAT EXCHANGER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the BLC exchanger is new, the drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-09-BLC EXCHANGER	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT/VT) - PAUT & TOFD - Ferrite Measurement - PMI - Heat Treatment	- PO Requirement - Applicable Specified Codes & Stds.	- Document Procedure	R	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - Final approval by KNPC

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping Other procedure etc. 	-	-		-	
4	All Raw Material Inspection & Reports (Plates, Pipes, Forgings, Tubes, Fasteners, Gasket etc.) <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties including J factor confirmation, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO 	<ul style="list-style-type: none"> - Applicable Specified Codes & Stds. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - For plates refer to TPI-KNPC-01-Plates. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

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	<ul style="list-style-type: none"> - Heat Treatment reports - NDE for raw material - Shear strength and bond quality test for clad plates. - Mill hydrotest (as applicable) 					<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipefittings refer to TPI-KNPC-03-PIPE FITTINGS. - For U-Tubes, refer to TPI-KNPC-06-U TUBES. - In case the exchanger components are fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling/Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2
5	IGC Test for Austenitic SS & other Austenitic alloy material, as applicable	- ASTM A262-E	- Test Report	R	100%	<ul style="list-style-type: none"> - This clause is applicable for weld overlaid items as well.
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W (all items except tubes) W(Tubes) R 	<ul style="list-style-type: none"> 100% One sample per heat Number 100% 	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs. - For U-Tubes PMI requirement refer to TPI-KNPC-06-U TUBES. - TPI to review the Test reports carried out by the vendor.
7	Visual & Dimensional verification of raw material	- Applicable Codes & Standards.	- Visual & Dimensional report	W (Visual)	100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel.

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		- Approved Drawing/PO Approved Procedure		W (Dimension check) R	5% 100%	- TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
12	Production test coupon (Production Test Plate)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Production Test Coupon Procedure 	<ul style="list-style-type: none"> - Heat Treatment and Mechanical / other testing reports 	R (Heat treatment charts and other test reports) W (Mechanical testing)	100%	H: for KNPC - Final approval by KNPC

Part D: Fabrication Inspection (Shell, Dished, Channel & Nozzles)

13	Marking, cutting/rolling of plates for shell, nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Ultrasonic Thickness check - Dimensions & cutting allowance etc.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication procedure 	<ul style="list-style-type: none"> - Fabrication report 	R	100%	-
14	Head forming inspection (as applicable): - Template guide - Visual & Dimensional inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication procedure 	<ul style="list-style-type: none"> - Fabrication report 	R	100%	- Heat Treatment charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling. - LPT: for Austenitic and Non-ferrous materials.

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	<ul style="list-style-type: none"> - Heat treatment (as applicable) - Ultrasonic Thickness check - LPT/MPT on Internal & External surfaces after forming (before & after Heat treatment) 	-	-			<ul style="list-style-type: none"> - MPT: for Ferromagnetic material
15	CuSO ₄ test after clad removal for welding (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure 	<ul style="list-style-type: none"> - Inspection report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor
16	UT of clad plates after forming/rolling to check for dis-bonding (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT report 	W	100%	<ul style="list-style-type: none"> - Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
17	<ul style="list-style-type: none"> Buttering on Nozzle Lip (as applicable) - Visual & Dimensional Inspection - LPT of buttering on Nozzle Lip - UT of buttering on Nozzle Lip 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedures 	<ul style="list-style-type: none"> - Inspection Test Reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	- RT of buttering on Nozzle Lip					
18	PMI of buttering on Nozzle Lip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Test Report 	<ul style="list-style-type: none"> W 	100%	-
19	Visual Inspection of edges to be welded & any openings (check cracks & laminations)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
20	LPT / MPT (as applicable) of edges to be welded & any openings to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
21	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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22	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none">- Applicable Codes & Standards.- Approved LPT / MPT Procedures	<ul style="list-style-type: none">- NDT Reports	<ul style="list-style-type: none">WR	<ul style="list-style-type: none">10%100%	<ul style="list-style-type: none">- LPT : for Austenitic and Non-ferrous materials- MPT: for Ferromagnetic material- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.- TPI shall review test reports carried out by vendor
23	Visual inspection of completed welds	<ul style="list-style-type: none">- Applicable Codes & Standards.- Approved Visual Inspection Procedures	<ul style="list-style-type: none">- Visual inspection reports	<ul style="list-style-type: none">WR	<ul style="list-style-type: none">10%100%	<ul style="list-style-type: none">- TPI shall review test reports carried out by vendor
24	Intermediate stress relief / Dehydrogenation treatment (as applicable)	<ul style="list-style-type: none">- Applicable Codes & Standards.- Approved Drawing- Approved Heat Treatment Procedures	<ul style="list-style-type: none">- Heat Treatment report	<ul style="list-style-type: none">R	<ul style="list-style-type: none">100%	<ul style="list-style-type: none">- ISR/Dehydrogenation treatment charts mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
25	PMI of completed welds except CS welds (from inside and outside)	<ul style="list-style-type: none">- Applicable Codes & Standards.- Approved PMI Procedures	<ul style="list-style-type: none">- PMI Report	<ul style="list-style-type: none">WR	<ul style="list-style-type: none">10%100%	<ul style="list-style-type: none">- TPI shall review test reports carried out by vendor
26	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none">- Applicable Codes & Standards.- Approved LPT / MPT Procedures	<ul style="list-style-type: none">- NDT reports	<ul style="list-style-type: none">W	<ul style="list-style-type: none">10%	<ul style="list-style-type: none">- LPT : for Austenitic and Non-ferrous materials- MPT: for Ferromagnetic material.

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		- Approved LPT / MPT Procedures	-	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
27	RT or UT (as applicable) for completed Butt welds joints.	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- RT Reports / UT Reports	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
28	UT of the completed Nozzles Neck attachment welds	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures	- UT Reports	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
Part E: Inspection of Weld Overlay / Cladding Restoration						
29	Visual Inspection after weld overlay	- Applicable Codes & Standards. - Visual Inspection Procedures	- Visual inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
30	Dilution test (by PMI / wet chemical analysis)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor

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31	Free iron check on weld overlay surface: - Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSo ₄ test on other weld overlays materials	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Test report	R	100%	- TPI shall review test reports carried out by vendor
32	Ferrite check of weld overlay (for DSS & Austenitic Material)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure	- Ferrite test reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
33	LPT of weld overlay	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT reports	W R	10% 100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
34	UT of weld overlay (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel.
Part F: Inspection of External attachment (such as lifting lugs, support bracket, earthing connection etc.)						
35	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-
36	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
37	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual Inspection Reports 	R	100%	-
38	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W	10%	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
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FOR BREECH LOCK HEAT EXCHANGER**

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				R	100%	Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
39	PMI of the attachment welds except carbon steel material	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI Report	W	One spot on each completed welds	-
40	UT of full penetration completed welds (to check weld discontinuity)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- UT reports	R	100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
41	Pneumatic testing of RF pads	- Approved drawing - Approved Pneumatic Test procedure	- Pneumatic Test Report	W	100%	-
Part G: Final Inspection Prior to PWHT						
42	Final Visual, dimensional & alignment check	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensional Inspection Reports	W	100%	-
43	LPT/MPT of the temporary attachment removal areas	- Applicable Codes & Standards.	- NDT Reports	W	10%	- LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material.

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		- Approved LPT / MPT Procedures	-	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
Part H: PWHT & Inspection after PWHT of Shell / Channel Assembly						
44	PWHT of the Heat Exchanger Components (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
45	Hardness test of pressure retaining welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
46	LPT/MPT of all pressure retaining welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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47	RT or UT (as applicable) for Pressure retaining welds joints after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
48	Visual inspection of the final overlay on the gasket grooves of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedure - Approved Drawing/PO 	<ul style="list-style-type: none"> - Visual Inspection Reports 	R	100%	<ul style="list-style-type: none"> -
49	Dilution test (by PMI / wet chemical analysis) on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
50	Ferrite check of weld overlay on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
51	LPT of weld overlay surface after PWHT	- Applicable Codes & Standards. - LPT Procedure	- LPT reports	W R	10% 100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
52	UT of weld overlay after PWHT (to check for dis-bonding)	- Applicable Codes & Standards. - Approved UT Procedure	- UT reports	W R	10% 100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
53	Final Visual & dimensional check	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensions report	W R	10% 100%	- Ensure roundness (by dummy pass) of shell. - TPI shall review test reports carried out by vendor
54	Initial Thickness measurement of all components	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Thickness Measurement Report	W	100%	-

Part I: Inspection of Channel Internals

55	Visual & Dimensional inspection of channel female thread after machining: - Surface finish check - Angle of thread - Dimesons Check	- Applicable Codes & Standards. - Approved Drawing / PO - Approved Procedure	- Visual & Dimensions report	W R	10% 100%	- TPI shall review test reports carried out by vendor.
56	Visual & Dimensional inspection of Threaded Lock	- Applicable Codes & Standards.	- Visual & Dimensions report	W	100%	- TPI shall review test reports carried out by vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	Ring: - Surface finish check - Angle of thread Dimesons Check	- Approved Drawing / PO - Approved Procedure				
57	Visual & Dimensional Inspection including flatness of Diaphragm	- Applicable Codes & Standards. - Approved Drawing / PO - Approved Procedure	- Visual & Dimensions report	W	100%	-
58	LPT on both surface of the Diaphragm	- Applicable Codes & Standards. - Approved Drawing / PO - Approved LPT Procedure	- LPT reports	W	100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel.
59	Visual & Dimensional Inspection of other internals (such as channel cover, compression ring, support ring, split ring etc.)	- Applicable Codes & Standards. - Approved Drawing / PO - Approved Procedure	- Visual & Dimensions report	W R	10% 100%	- TPI shall review test reports carried out by vendor.
Part J: Tube Bundle Fabrication & Inspection						
60	Tube Bundle Fabrication	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For the TPI scope of Tube bundle fabrication & inspection, refer to TPI-KNPC-07-TUBE BUNDLE

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part K: Pressure Testing of the Heat Exchanger Assembly						
61	Pneumatic Test to check the integrity of tube to tubesheet weld joints of the Tube Bundle (as applicable)	<ul style="list-style-type: none"> - No leakage - Approved Drawing / PO - Approved Pneumatic Testing Procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
62	Inspection of Breech Lock Channel Closure Operation	<ul style="list-style-type: none"> - Approved Drawing / PO - Approved Assembly Procedure 	<ul style="list-style-type: none"> - Inspection Checklist / Report 	W	100%	-
63	Torqueing tightening of bolts	<ul style="list-style-type: none"> - Approved Drawing / PO - Approved Assembly Procedure 	<ul style="list-style-type: none"> - Inspection Checklist / Report 	R	100%	- TPI to review the records of torque applied for tightening the bolts by the vendor
64	Hydrostatic Test <ul style="list-style-type: none"> - Shell Side - Tube Side - Tube and Shell side simultaneous Hydrostatic test (combined test) 	<ul style="list-style-type: none"> - No leakage - Applicable Codes & Standards. - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) & duplex material (eg. Alloy 2205, Alloy 2507) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
						- After hydostest, the BLC exchanger shall be immediately drained, cleaned and dried out.
65	LPT/MPT after hydrotest of shell assembly Circ. Seam, long seam, Nozzle welds & attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
Part L: Inspection of Painting						
66	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part M: Inspection of Packing & Issuance of Release Note						
67	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Antirust coating for protection during transit 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - The Exchanger shall be properly supported with load bearing sections/members.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 					
68	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
69	Issue of Release Note	<ul style="list-style-type: none"> - All required Inspection Satisfactorily Completed 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
70	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR AIR COOLED HEAT EXCHANGER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	- Vendor's drawings and calculations. - Datasheet.	- PO - Drawing, Datasheet & Calculations. - Quality & Inspection Requirements.	- Approved Drawing, Datasheet & Calculations.	H	100%	<u>H: for KNPC</u> - In case of fabrication, drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Air Cooled Heat Exchanger is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan (ITP).	- PO - Approved Drawing - TPI-KNPC-10-Air Cooled Heat Exchanger.	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC.
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/RT) - PMI - Ferrite measurement - Tube bending	- PO Requirement - Applicable Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Tube finning - Heat treatment (SR PWHT & Solution Annealing) - Hardness measurement - Production test coupon - Initial thickness measurement - Fabrication - Hydrostatic Test - Painting - Packing / shipping - Other procedure etc. 					
4	All Raw Material Inspection and material test certificate review (whichever is applicable) <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Bond strength test (Cladded Material) - Hardness test 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - MTC shall comply with ISO 10474

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	<ul style="list-style-type: none"> - Microstructure / Average grain size. - Material Identification and Co-relation. - Ultrasonic testing - Mill hydro-test record of tubes. 					<p>type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2. Tubes to comply to requirement of</p> <ul style="list-style-type: none"> - TPI-KNPS-05-TUBES or - TPI-KNPC-06-U TUBES <p>As applicable except witnessing hydrotest of tubes instead only reviewed record of hydrotest as per MTC. Forging and plates to comply to requirement of TPI-KNPC-03-PIPE FITTINGS & TPI-KNPC-01-PLATES.</p>
5	Intergranular Corrosion (IGC) test for Austenitic SS & other Austenitic alloys tube sheets and SS weld overlay / cladding, as applicable	- ASTM A262-E	- Test Report.	R	100%	-
6	PMI of all material except CS material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PMI Procedure. 	- PMI Report.	W	100%	<ul style="list-style-type: none"> - Plates, nozzles and other parts. - Tubes / U-Tubes as mentioned in TPI scope of tubes TPI-KNPC-05-TUBES / TPI-KNPC-06-U TUBES
7	Visual & Dimensional verification of raw material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures - Approved Drawings 	- Visual & Dimensional report	W R	10% 100%	<ul style="list-style-type: none"> - Random dimensional & Visual Inspection. - TPI shall co-relate MTCs with items used for fabrication

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8	Hardness check of raw material.	- Applicable Codes & Standards and PO.	- Hardness report.	W R	10% 100%	- Hardness of solid metal gaskets of plugs. - Hardness shall not exceed HRB68 for CS and HRB-82 for SS as applicable materials. - Hardness record from MTC.
9	NDT Personnel Qualifications.	- Applicable Codes & Standards.	- Qualification certificates.	R	100%	-
10	Painter & Blaster Personnel Qualification.	- Applicable Codes & Standards.	- Qualification certificates.	R	100%	-
Part C: Welding Document						
11	- WPS,PQR & WPQ - Weld Map.	- ASME Sec IX.	- WPS,PQR,WPQ - Weld map.	H	100%	<u>H: for KNPC</u> - Final approval by KNPC.
12	Welding Consumables - Batch Testing - PMI Check (Except CS material).	- PO - ASME Sec II Part C.	- Test report - PMI Report.	R	100%	-
13	Production test coupon (Production Test Plate) - As applicable	- Applicable Codes & Standards. - Approved Production Test Coupon Procedure	- Heat Treatment and Mechanical / other testing reports	R (Heat treatment charts and other test reports) W (Mechanical testing)	100%	<u>H: for KNPC</u> - Final approval by KNPC

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Part D: Fabrication Inspection						
14	Visual and dimensional Inspection of tube sheets prior to drilling.	- As per specified Standard / code and drawing.	- Visual & Dimensional report.	W	100%	-
15	Inspection prior to assembly of tube bank.					
15.1	Dimensional inspection of tube sheet including Go/No Go gauge check of tube holes.	- As per specified code / standard or API 661.	- Dimension report.	W	100%	-
15.2	Tube hole finish and grooving.	- As per specification drawing and API 661	- Dimension report.	W	100%	-
15.3	Check tubes for finish, permissible variation in wall thickness, diameter specified length & straight length of tubes.	- As per specification and drawing.	- Dimension report.	W	100%	-
15.4	Check plugholes on header plug sheet.	- As per specification, drawing and API 661.	- Dimension report	W	100%	-
15.5	Mock-up Test for Tube to Tube Sheet Joint.	- As per applicable code / standard.	- Test report.	W	100%	-

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16	Welding / fabrication of header.					
16.1	LPT / MPT (as applicable) of edges to be welded & any openings to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
16.2	Fit-up, edge preparation and welding.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - Report carried out by Vendor.
16.3	LPT / MPT (after back chip, completed welds, as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
16.4	Radiography	<ul style="list-style-type: none"> - Applicable codes & Standards and approved drawings. 	<ul style="list-style-type: none"> - RT reports 	R	100%	<ul style="list-style-type: none"> - Radiography film interpreted by ASNT Level-II qualified Personnel.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR AIR COOLED HEAT EXCHANGER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
16.5	UT flaw detection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - UT report. 	R	100%	<ul style="list-style-type: none"> - UT carried out reported by ASNT Level-II qualified personnel.
16.6	PMI of welds of header except for CS material.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI report. 	W R	One spot on each completed welds. 100%	<ul style="list-style-type: none"> - PMI report carried out by Vendor.
16.7	Ferrite test of welds for austenitic SS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test report. 	W R	10% 100%	<ul style="list-style-type: none"> - Ferrite test record carried out by Vendor.
16.8	Final Visual, dimensional & alignment check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-
16.9	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT: for Austenitic and Non-ferrous materials. - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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16.10	PWHT (As applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT reports and charts. 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature soaking time, heating / cooling rate and mode of cooling.
16.11	Hardness test of welds.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness test report. 	W R	10% 100%	<ul style="list-style-type: none"> - Hardness record carried out by Vendor.
16.12	RT after PWHT.	<ul style="list-style-type: none"> - Applicable Codes / standards and approved drawing. 	<ul style="list-style-type: none"> - RT report. 	R	100%	<ul style="list-style-type: none"> - Radiography films interpreted by ASNT Level-II qualified personnel.
16.13	UT flaw detection after PWHT.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - UT report. 	R	100%	<ul style="list-style-type: none"> - UT carried out reported by ASNT Level-II qualified personnel.
17	After Tube Assembly:					
17.1	Visual & Dimensional Inspection.	<ul style="list-style-type: none"> - As per Approved Drawing. 	<ul style="list-style-type: none"> - Dimension report. 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
17.2	Check length and contour of expansion of tubes with tube sheets.	- As per TEMA, class RB 7.3.111 7 7.3.312 / API 661.	- Dimension report	W	100%	-
17.3	Tube expansion.	- As per PO and specified standards and approved drawing.	- Dimension report.	W	100%	-
17.4	Tube projections beyond the face of the tube sheets.	- As per approved drawing and TEMA RCB 7.313 / API 661.	- Dimension report.	W	100%	-
17.5	2 Part Plugs Hardness Verification and Treatment against Galling (as applicable)	- Applicable Codes & Standards. - Approved Drawing / PO - Approved Procedure	- Inspection Report	R	100%	-
17.6	Plug Bolt Torque Check	- Approved Drawing / PO - Approved Procedure	- Inspection Checklist / Report	R	100%	- TPI to review the records of torque applied for tightening the bolts by the vendor
18	Inspection of Tube to Tube Sheet Weld Joints:					
18.1	LPT of tube to tube sheet welds.	- Applicable Codes & Standards. - Approved Drawing & LPT Procedure	- LPT report.	W	100%	- If stress relieving is applicable then LPT to be done after SR. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
18.2	Hardness test (if specified)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness report. 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 5% 100% 	<ul style="list-style-type: none"> - Hardness report carried out by Vendor.
18.3	PMI or Wet Chemical analysis (for all tube to tube sheet weld joints except CS).	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - Test report. 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 2% 	-
18.4	Air leak test prior to final expansion.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures 	<ul style="list-style-type: none"> - Air leak test report. 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	-
18.5	Stage wise inspection of tube to tubesheet expansion joint (before & after welding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedures 	<ul style="list-style-type: none"> - Tube expansion report. 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	-
18.6	LPT after expansion	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT report. 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR AIR COOLED HEAT EXCHANGER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Pressure Testing & Final Inspection						
19	LPT / MPT of lifting lugs.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
20	Hydro test of completed Air Cooled Heat Exchanger.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Hydrotest Procedure - Approved Drawing 	<ul style="list-style-type: none"> - Hydro-test report (no leak) - Water test certificate. - Gauge calibration. 	H	100%	<p><u>H:</u> for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For 12 and 17 Cr stainless steels (ANSI Types 405, 410, and 430), 18-8 stainless steels (300 series austenitic), duplex grades (Alloy 2205, Alloy 2507, and Alloy 20), or Alloy 400 (Monel) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - Header & Tubes shall be drained and dried after hydro-test. - Ensure shoulder plugs are properly fixed with gaskets and lubricated properly.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
21	Air leak test of plug joints and all gasketed joint after hydrotest	- Latest API 661 - Approved Procedures	- Leak Test Report	W	100%	-
22	LPT/MPT after hydrotest of pressure retaining accessible welds (without disassembly)	- Latest API 661 Standard - Approved Drawing / PO - Approved LPT / MPT Procedures	- NDT Reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - Review test reports of vendor
23	Pickling & Passivation of Austenitic SS Welds	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Inspection Report	R	100%	-
24	Inspect retarders, louvers / steam coils (as applicable).	- As per specified codes / Standards PO.	- Inspection Report	R	100%	- Reports of fabrication, testing and installation.
25	Function test of louvers.	- As per specified codes / Standards PO	- Inspection Report	W	100%	-
26	Final visual: Dimensional and thickness verification.	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual and dimensional report. - Thickness report.	W	100%	-
Part F: Inspection of Painting						
27	Surface preparation and painting inspection or anti rust coatings.	- Approved Drawing & Painting Procedure - Applicable Codes & Standards.	- Painting report / anti rust coating report.	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part G: Inspection of Packing & Issuance of Release Note						
28	Packing Inspection: - Internal Cleaning - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - Properly packed to avoid damages during transit & handling. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing. - Packing suitable for protection against corrosion resulting from seawater. - Shipping markings.	- PO - Applicable Codes & Standards. - Approved Packing Procedure	- Packing report.	W	100%	- It should be supported with load bearing wooden sections / members. - Yellow tag with clear message for removal of the shipping bolts after installation and before commissioning of air cooler. - PO and physical check.
29	Issue of Release Note	- As per PO. Required inspection satisfactorily completed.	- Inspection release note	H	100%	<u>H: for KNPC</u> TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.

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KUWAIT NATIONAL PETROLEUM COMPANY



SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR AIR COOLED HEAT EXCHANGER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
						- KNPC will review the final duly certified signed & stamped TPI reports MTCs and other test reports and after its approval KNPC will issue the release note for shipment.
30	Final Inspection report and Manufacturer data reports.	- As per PO.	- Inspection report.	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR COIL TYPE SEAL FLUSING COOLERS

TPI No. : TPI-KNPC-11-COIL TYPE SEAL COOLERS
(Sheet 1 of 6)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	- Vendor's drawings and calculations - Datasheet	- PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements	- Approved Drawing, Datasheet & Calculations	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the seal cooler is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-11-COIL TYPE SEAL COOLERS	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/RT) - PMI - Fabrication - Hydrostatic Test - Pickling & Passivation - Painting - Packing/shipping	- PO Requirement - Applicable Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR COIL TYPE SEAL FLUSING COOLERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
4	All Raw Material Inspection - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size. - Material Identification and Co-relation	- Applicable Codes & Standards.	- Material Inspection reports / charts	R	100%	- Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of all material except CS material	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI Report	W	100%	-
7	Visual & Dimensional verification of raw material	- Applicable Codes & Standards. - Approved Procedures / Drawings	- Visual & Dimensional report	R	100%	- TPI shall co-relate MTCs with items used for fabrication
8	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel certificates	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
Part D: Fabrication & Assembly						
12	Forming of the coil & Heat Treatment (as applicable)	- Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure	- PWHT Report with record chart & hardness report	R	100%	- Heat treatment chart must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
13	RT (check of films & reports) of butt weld joints	- Applicable Codes & Standards. - Approved RT Procedure	- RT Reports	R	100%	- Radiograph to be interpreted by ASNT Level-II Qualified Personnel
14	LPT of fillet weld joints	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT Reports	W R	10% 100%	- LPT to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
15	Ferrite check of weld overlay (for DSS & Austenitic Material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
16	Hardness Test of weld joint	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Hardness Test Procedures 	<ul style="list-style-type: none"> - Hardness Test Report 	R	100%	-
17	Final Visual & dimensional check of the assembly	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection report 	W	100%	-
18	Baseline Thickness measurement before surface preparation & painting	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
19	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Drawing - Approved Hydrotesting Procedure 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) & duplex material (e.g. Alloy 2205, Alloy 2507) potable water shall not contain traces of any type of sediment or

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR COIL TYPE SEAL FLUSING COOLERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
						- more than 50 ppm chloride by mass. After hydostest, the Coil type seal coolers shall be immediately drained, cleaned and dried out.
20	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Pickling Procedure 	- Inspection Report	R	100%	-
Part E: Inspection of Painting						
21	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	- Painting report	W	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
22	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for 	<ul style="list-style-type: none"> - PO - Applicable Standard - Approved Packing Procedure 	- Packing report	W	100%	-

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR COIL TYPE SEAL FLUSING COOLERS

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	<ul style="list-style-type: none"> - protection against corrosion resulting from sea water - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping mark 					
23	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.
24	Issue of Release Note	<ul style="list-style-type: none"> - All required Inspection satisfactorily completed 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<ul style="list-style-type: none"> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
25	Final Inspection Report & Manufacturer's Data Report	<ul style="list-style-type: none"> - As per PO 	<ul style="list-style-type: none"> - Inspection Report 	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value
(For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PLATE TYPE HEAT EXCHANGER

TPI No. : TPI-KNPC-12-PLATE TYPE HEAT EXCHANGER
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings, Technical Specifications and Calculations - Datasheet	- PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case Plate type Heat exchanger is new, drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-12-PLATE TYPE HEAT EXCHANGER	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/MPT/RT) - PMI - Fabrication - Pneumatic Test	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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	<ul style="list-style-type: none"> - Hydrostatic Test - Helium Leak Test - Painting - Pickling & Passivation - Packing / shipping - Installation and Site Maintenance - Other procedure etc. 					
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Ultrasonic testing for thick plates higher than one inch or as specified in PO. - Microstructure / Average grain size. - Material Identification and Co-relation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report 	R	100%	-

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6	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs.
7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Approved Procedures - Approved Drawings 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standard. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standard. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<ul style="list-style-type: none"> <u>H: for KNPC</u> - Final approval by KNPC
11	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-
Part D: Fabrication & Assembly (Header & Core)						
12	Visual & Dimensional check of the core & Port Passages	<ul style="list-style-type: none"> - Approved Drawing 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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13	RT (check of films & reports) of butt weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Approved RT Procedure 	- RT Reports	R	100%	<ul style="list-style-type: none"> - Radiograph interpreted by ASNT Level-II Qualified Personnel
14	LPT/MPT of fillet weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Approved NDT Procedure 	<ul style="list-style-type: none"> - NDT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - NDT to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
15	PMI of completed weld joints (for all material other than CS material)	<ul style="list-style-type: none"> - Applicable Codes & Standard. - PMI Procedures 	- PMI report of weld joints	W	One spot on each completed weld joints	-
16	Ferrite Testing of Austenitic Stainless Steel weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Ferrite Testing Procedures 	- Ferrite Test Report	R	100%	-
17	Pneumatic testing of Pads (such as lifting lug pads, support pads etc.)	<ul style="list-style-type: none"> - Approved drawing - No leak - Pneumatic Test Procedure 	- Pneumatic Test Report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Additional requirement for Inspection of Bimetallic Transition Joints (As applicable)						
18	Thermal Cyclic Testing	- Approved Drawing / PO - Latest API 668 Std.	- Test Report	R	100%	-
19	NDE Testing (as applicable): - UT shear wave testing - LPT	- Approved Drawing / PO - Latest API 668 Std.	- NDE Test Report	R	100%	- NDT to be interpreted by ASNT Level-II Qualified Personnel.
20	Helium Leak Testing	- Approved Drawing / PO - Latest API 668 Std.	- Leak Test Report	R	100%	
Part F: Final Inspection						
21	Final Visual & dimensional check of the assembly	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensional Inspection report	W R	10% 100%	- TPI shall review test reports carried out by vendor
22	Initial Thickness measurement before surface preparation & painting	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Thickness Measurement Report	W	100%	-
23	Low Pressure Pneumatic Leak Test (as applicable)	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Leak test report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
24	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Drawing - Approved Hydrotesting Procedure 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) & duplex material (eg. Alloy 2205, Alloy 2507) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - After hydostest, the equipment shall be immediately drained, cleaned and dried out.
25	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part G: Inspection of Painting						
26	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-

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Part H: Inspection of Packing & Issuance of Release Note						
27	Packing Inspection: <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - Applicable Standard - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	-
28	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
29	Issue of Release Note	- All required Inspection satisfactorily completed	- Inspection release note	H	100%	<u>H:</u> for KNPC - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
30	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

(I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.

(II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value
(For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PRESSURE VESSELS WITHOUT WELD OVERLAY / CLADDING

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case Pressure Vessel is new, drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-13-PLAIN PRESSURE VESSELS	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PAUT & TOFD - Ferrite Measurement - PMI - Heat Treatment	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H:</u> for KNPC - Final approval by KNPC

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports - NDE for raw material - Mill hydrotest (as applicable) 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the plates are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS

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						<ul style="list-style-type: none"> - For plates refer to TPI-KNPC-01-PLATES - For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS. - In case the Vessel is fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling / Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.
7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W (Visual) W (Dimension check) R 	<ul style="list-style-type: none"> 100% 5% 100% 	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
8	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
12	Production test coupon (Production Test Plate), as applicable	- Applicable Codes & Standards. - Approved Production Test Coupon Procedure	- Heat Treatment and Mechanical / other testing reports	R (Heat treatment charts and other test reports) W (Mechanical testing)	100%	<u>H: for KNPC</u> - Final approval by KNPC
Part D: Fabrication Inspection (Shell, Head, Cone Section, Skirt, Nozzles)						
13	Marking, cutting/rolling of plates for shell/skirt/nozzles (as applicable)	- Applicable Codes & Standards.	- Fabrication report	R	100%	-

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	<ul style="list-style-type: none"> - Template guide - Transfer of heat number & Identification of item. - Thickness check - Dimensions & cutting allowance etc. 	<ul style="list-style-type: none"> - Approved Fabrication procedure 				
14	Head/crown petal forming inspection: <ul style="list-style-type: none"> - Template guide - Visual & Dimensional inspection - Thickness check - Heat treatment (as applicable) - LPT/MPT (as applicable) 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication procedure 	<ul style="list-style-type: none"> - Fabrication report 	R	100%	-
15	Visual of edges to be welded (check cracks & laminations)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	W R	10% 100%	- TPI shall review test reports carried out by vendor
16	LPT / MPT (as applicable) of edges to be welded to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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17	UT of the edges to be welded (check cracks & laminations), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI to review 100% of the UT inspection report. - UT results to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
18	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
19	Intermediate stress relief / Dehydrogenation treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedures 	<ul style="list-style-type: none"> - Heat Treatment report 	R	100%	<ul style="list-style-type: none"> - ISR/Dehydrogenation treatment charts mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling. - This is applicable as per API 934A.
20	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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21	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
22	PMI of completed welds except CS welds from inside and outside (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
23	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
24	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
25	UT of the completed Nozzles Neck attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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25	UT of the completed Nozzles Neck attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures 	<ul style="list-style-type: none"> - UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
26	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part E: Inspection of External attachment (such as lifting lugs, earthing connection etc.) & Internal attachments (such as TSRs, Supporting bars etc.)						
27	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-
28	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
29	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-

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30	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
31	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-
32	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
33	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part F: Final Inspection Prior to PWHT						
34	Final Visual, dimensional & alignment check of the equipment along with its fixed internals (integral with vessel)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-
35	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
36	Trial assembly of the internals (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Trial Assembly Procedure 	<ul style="list-style-type: none"> - Assembly report 	W	100%	-
Part G: PWHT & Inspection after PWHT						
37	PWHT of the Pressure vessel	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
38	Hardness test of all the pressure retaining welds & Skirt to shell welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
39	LPT/MPT of all welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
40	RT or UT of the pressure retaining welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
41	Final Visual & dimensional check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> -

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
42	Initial Thickness measurement of all components	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
Part H: Pressure Testing of the Pressure Vessel						
43	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment or more than 50 ppm chloride by mass. - After hydostest, the pressure vessel shall be immediately drained, cleaned and dried out.
44	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-

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Part I: Inspection of Internals (as applicable)						
45	Trays	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For trays refer to TPI-KNPC-19-TOWER TRAYS
46	Pipes & Pipe fittings	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS
47	Internal rubber lining & other non-metallic lining: - Quality Of rubber/lining material - Quality of Bond Material - Shore Hardness - Spark Testing	- Applicable Codes & Standards. - Approved Drawing PO	- Material test certificates - Inspection Report	R W (Shore hardness & spar testing)	100% 10%	- TPI shall review test reports carried out by vendor
48	Grid / Demister / Coalescer / Packing / Filter Elements	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS
Part J: Inspection of Painting						
49	Surface preparation and painting inspection	- Approved Procedure, Drawing/PO - Applicable Codes & Standards.	- Painting report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part K: Inspection of Packing & Issuance of Release Note						
50	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - It should be supported with load bearing sections/members - Ensure flanges of flanged head equipment are tightened in line with company-approved procedure for bolt Torqueing / Tensioning.
51	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
52	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H:</u> for KNPC - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
53	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. In case pressure vessel is new, drawing and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-14-WELD OVERLAY / CLADDED PRESSURE VESSELS	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> ITP shall be in line with scope of inspection mentioned here. Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PAUT & TOFD - Ferrite Measurement	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> Final approval by KNPC

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	<ul style="list-style-type: none"> - PMI - Heat Treatment - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 	-	-			-
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports - NDE for raw material - Mill hydrotest (as applicable) 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the plates are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

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		-	-			<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS - For plates refer to TPI-KNPC-01-PLATES - For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS. - In case the Vessel is fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling / Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.

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7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W (Visual) W (Dimension check) R	100% 5% 100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-
12	Production test coupon (Production Test Plate), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Production Test Coupon Procedure 	<ul style="list-style-type: none"> - Heat Treatment and Mechanical / other testing reports 	R (Heat treatment charts and other reports) W (Mechanical testing)	100%	<u>H: for KNPC</u> - Final approval by KNPC

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Part D: Fabrication Inspection (Shell, Head, Cone Section, Skirt, Nozzles)						
13	Marking, cutting/rolling of plates for shell/skirt/nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Thickness check - Dimensions & cutting allowance etc.	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
14	Head/crown petal forming inspection: - Template guide - Visual & Dimensional inspection - Thickness check - Heat treatment (as applicable) - LPT/MPT (as applicable)	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
15	CuSO ₄ test after clad removal for welding (as applicable)	- Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure	- Inspection report	W R	10% 100%	- Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor

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16	UT of clad plates after forming/rolling to check for dis-bonding (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT report 	<ul style="list-style-type: none"> W 	100%	<ul style="list-style-type: none"> - Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
17	Visual of edges to be welded (check cracks & laminations)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
18	LPT / MPT (as applicable) of edges to be welded to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
19	UT of the edges to be welded (check cracks & laminations), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI to review 100% of the UT inspection report. - UT results to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR PRESSURE VESSELS (SEPARATORS & OTHER VESSELS) WITH WELD
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20	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
21	Intermediate stress relief / Dehydrogenation treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedures 	<ul style="list-style-type: none"> - Heat Treatment report 	R	100%	<ul style="list-style-type: none"> - ISR/Dehydrogenation treatment charts mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
22	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
23	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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24	PMI of completed welds except CS welds from inside and outside (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
25	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
26	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
27	UT of the completed Nozzles Neck attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures 	<ul style="list-style-type: none"> - UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
28	Pneumatic testing of RF pads / Lined nozzles (as applicable)	<ul style="list-style-type: none"> - Approved drawing - Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> -

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Inspection of Weld Overlay / Cladding Restoration						
29	Visual Inspection after weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
30	Dilution test (by PMI / wet chemical analysis)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
31	Free iron check on weld overlay surface: <ul style="list-style-type: none"> • Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSO₄ test on other weld overlays materials 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
32	Ferrite check of weld overlay (for DSS & Austenitic Material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
33	Thickness checking of overlay to check minimum overlay thickness	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
34	LPT of weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
35	UT of weld overlay (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel.
Part F: Inspection of External attachment (such as lifting lugs, earthing connection etc.) & Internal attachments						
36	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
37	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
38	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	R	100%	-
39	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
40	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
41	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
42	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part G: Final Inspection Prior to PWHT						
43	Final Visual, dimensional & alignment check of the equipment along with its fixed internals (integral with vessel)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
44	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
45	Trial assembly of the internals (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO - Approved Trial Assembly Procedure 	<ul style="list-style-type: none"> - Assembly report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	-
Part H: PWHT & Inspection after PWHT						
46	PWHT of the Pressure vessel	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
47	Hardness test of all the pressure retaining welds & Skirt to shell welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
48	LPT/MPT of all welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
49	RT or UT of the pressure retaining welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
50	Visual inspection of the final overlay on the gasket grooves of the vessel nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedure - Approved Drawing/PO 	<ul style="list-style-type: none"> - Visual Inspection Reports 	R	100%	-
51	Dilution test (by PMI / wet chemical analysis) on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
52	Ferrite check of weld overlay on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
53	LPT of weld overlay surface after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
54	UT of weld overlay after PWHT (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
55	Final Visual & dimensional check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	W	100%	-
56	Initial Thickness measurement of all components	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part I: Pressure Testing of the Pressure Vessel						
57	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment or more than 50 ppm chloride by mass. - After hydrotest, the pressure vessel shall be immediately drained, cleaned and dried out.
58	Pickling & Passivation of Austenitic SS Welds (after completion of hydrotest)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part J: Inspection of Internals (as applicable)						
59	Pipes & Pipe fittings	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS

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60	Grid / Demister / Coalescer / Packing / Filter Elements	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS
Part K: Inspection of Painting						
61	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure	- Painting report	W	100%	-
Part L: Inspection of Packing & Issuance of Release Note						
62	Packing Inspection - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been	- PO - Applicable Codes & Standards. - Approved Packing Procedure	- Packing report	W	100%	- Ensure flanges of flanged head equipment are tightened in line with company-approved procedure for bolt Torqueing / Tensioning.

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	inspected and content tally with packing list - Shipping Markings					
63	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
64	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
65	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case Tower is new, drawing and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-15-TOWER	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PAUT & TOFD - Ferrite Measurement	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

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	<ul style="list-style-type: none"> - PMI - Heat Treatment - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 	-	-			-
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports - NDE for raw material - Mill hydrotest (as applicable) 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the plates are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

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		-	-			<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS - For plates refer to TPI-KNPC-01-PLATES - For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS. - In case the Tower is fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling / Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.

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7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W (Visual) W (Dimension check) R	100% 5% 100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-
12	Production test coupon (Production Test Plate), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Production Test Coupon Procedure 	<ul style="list-style-type: none"> - Heat Treatment and Mechanical / other testing reports 	R (Heat treatment charts and other reports) W (Mechanical testing)	100%	<u>H: for KNPC</u> - Final approval by KNPC

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part D: Fabrication Inspection (Shell, Head, Cone Section, Skirt, Nozzles)						
13	Marking, cutting/rolling of plates for shell/skirt/nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Thickness check - Dimensions & cutting allowance etc.	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
14	Head/crown petal forming inspection: - Template guide - Visual & Dimensional inspection - Thickness check - Heat treatment (as applicable) - LPT/MPT (as applicable)	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
15	CuSO ₄ test after clad removal for welding (as applicable)	- Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure	- Inspection report	W R	10% 100%	- Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
16	UT of clad plates after forming/rolling to check for dis-bonding (as applicable)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- UT report	W	100%	- Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
17	Visual of edges to be welded (check cracks & laminations)	- Applicable Codes & Standards. - Visual Inspection Procedures	- Visual inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
18	LPT / MPT (as applicable) of edges to be welded to check cracks and laminations	- Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO	- NDT reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
19	UT of the edges to be welded (check cracks & laminations), as applicable	- Applicable Codes & Standards. - Approved UT Procedures - Approved Drawing/PO	- UT reports	W R	10% 100%	- TPI to review 100% of the UT inspection report. - UT results to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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20	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
21	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
22	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
23	PMI of completed welds except CS welds from inside and outside (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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24	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
25	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
26	UT of the completed Nozzles Neck attachment welds, skirt to shell welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures 	<ul style="list-style-type: none"> - UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
27	Pneumatic testing of RF pads / Lined nozzles (as applicable)	<ul style="list-style-type: none"> - Approved drawing - Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Inspection of Weld Overlay / Cladding Restoration (as applicable)						
28	Visual Inspection after weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
29	Dilution test (by PMI / wet chemical analysis)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
30	Free iron check on weld overlay surface: <ul style="list-style-type: none"> • Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSO₄ test on other weld overlays materials 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
31	Ferrite check of weld overlay (for DSS & Austenitic Material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
32	LPT of weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
33	UT of weld overlay (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel.
Part F: Inspection of External attachment (such as lifting lugs, earthing connection etc.) & Internal attachments (such as TSRs, Supporting bars etc.)						
34	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-
35	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
36	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	R	100%	-
37	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
38	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-
39	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor

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40	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part G: Final Inspection Prior to PWHT						
41	Final Visual, dimensional & alignment check of the equipment along with its fixed internals (integral with vessel)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-
42	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
42	Trial assembly of the internals (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO - Approved Trial Assembly Procedure 	<ul style="list-style-type: none"> - Assembly report 	W	100%	-
Part H: PWHT & Inspection after PWHT						
44	PWHT of the Pressure vessel	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
45	Hardness test of all the pressure retaining welds & Skirt to shell welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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46	LPT/MPT of all welds after PWHT	- Applicable Codes & Standards. - Approved LPT / MPT Procedures	- NDT Reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
47	RT or UT of the pressure retaining welds (as applicable)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- RT Reports / UT Reports	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
48	LPT of weld overlay surface after PWHT	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT reports	W R	10% 100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
49	UT of weld overlay after PWHT (to check for dis-bonding)	- Applicable Codes & Standards. - Approved UT Procedure	- UT reports	W R	10% 100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor

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50	Final Visual & dimensional check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	W	100%	-
51	Initial Thickness measurement of all components	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
Part I: Pressure Testing of the Pressure Vessel						
52	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment or more than 50 ppm chloride by mass. - After hydostest, the tower shall be immediately drained, cleaned and dried out.

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53	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part J: Inspection of Internals (as applicable)						
54	Trays	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For trays refer to TPI-KNPC-19-TOWER TRAYS
55	Pipes & Pipe fittings	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS
56	Grid / Demister / Coalescer / Packing / Filter Elements	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR TOWER

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part K: Inspection of Painting						
57	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part L: Inspection of Packing & Issuance of Release Note						
58	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
59	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
60	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
61	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR COKE DRUM

**TPI No. : TPI-KNPC-16-COKE DRUM
(Sheet 1 of 15)**

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case Coke Drum is new, drawing and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-16-COKE DRUM	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PAUT & TOFD - PMI	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Heat Treatment - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 	-	-			-
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports - NDE for raw material - Mill hydrotest (as applicable) 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the plates are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
		-	-			<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS - In case the Coke Drum is fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling / Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs.
6	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W (Visual) W (Dimension check) R 	<ul style="list-style-type: none"> 100% 5% 100% 	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
7	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
8	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part C: Welding Document						
9	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H:</u> for KNPC - Final approval by KNPC
10	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
11	Production test coupon (Production Test Plate), as applicable	- Applicable Codes & Standards. - Approved Production Test Coupon Procedure	- Heat Treatment and Mechanical / other testing reports	R (Heat treatment charts and other reports) W (Mechanical testing)	100%	<u>H:</u> for KNPC - Final approval by KNPC
Part D: Fabrication Inspection (Shell, Head, Cone Section, Skirt, Nozzles)						
12	Marking, cutting/rolling of plates for shell/skirt/nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Thickness check - Dimensions & cutting allowance etc.	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	Head/crown petal forming inspection: - Template guide - Visual & Dimensional inspection - Thickness check - Heat treatment (as applicable) - LPT/MPT (as applicable)	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
14	CuSO ₄ test after clad removal for welding (as applicable)	- Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure	- Inspection report	W R	10% 100%	- Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor
15	UT of clad plates after forming/rolling to check for dis-bonding (as applicable)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- UT report	W	100%	- Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
16	Visual of edges to be welded (check cracks & laminations)	- Applicable Codes & Standards. - Visual Inspection Procedures	- Visual inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
17	LPT / MPT (as applicable) of edges to be welded to check cracks and laminations	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
18	UT of the edges to be welded (check cracks & laminations), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI to review 100% of the UT inspection report. - UT results to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
19	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
20	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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21	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
22	PMI of completed welds except CS welds from inside and outside (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
23	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
24	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
25	UT of the completed Nozzles Neck attachment welds, skirt to shell welds (as applicable)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures	- UT Reports	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
26	Pneumatic testing of RF pads / Lined nozzles (as applicable)	- Approved drawing - Pneumatic Test procedure	- Pneumatic Test Report	W	100%	-
Part E: Inspection of Weld Overlay / Cladding Restoration						
27	Visual Inspection after weld overlay	- Applicable Codes & Standards. - Approved Visual Inspection Procedures	- Visual inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
28	Dilution test (by PMI / wet chemical analysis)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor
29	Free iron check on weld overlay surface: • CuSO ₄ test on weld overlays surface	- Applicable Codes & Standards. - Approved Drawing/PO	- Test report	R	100%	- TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
30	LPT of weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
31	UT of weld overlay (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel.
Part F: Inspection of External & Internal attachments						
32	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-
33	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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34	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	R	100%	-
35	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
36	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-
37	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor

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38	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part G: Final Inspection Prior to PWHT						
39	Final Visual, dimensional & alignment check of the equipment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-
40	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W	10%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
41	Trial assembly check (Internal & external attachment pre-assembly, including trial fit up of ladder, platform, if any)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO 	<ul style="list-style-type: none"> - Assembly report 	W	100%	-

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Part H: PWHT & Inspection after PWHT						
42	PWHT of the Pressure vessel	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
43	Hardness test of welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
44	LPT/MPT of all welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
45	RT or UT of the pressure retaining welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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46	LPT of weld overlay surface after PWHT	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT reports	W R	10% 100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
47	UT of weld overlay after PWHT (to check for dis-bonding)	- Applicable Codes & Standards. - Approved UT Procedure	- UT reports	W R	10% 100%	- UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
48	Final Visual & dimensional check	- Applicable Codes & Standards. - Approved Drawing & Procedure	- Visual & Dimensions report	W	100%	-
49	Initial Thickness measurement of all components	- Applicable Codes & Standards. - Approved Drawing / Procedure	- Thickness Measurement Report	W	100%	-
Part I: Pressure Testing of the Pressure Vessel						
50	Hydrostatic Test	- No leakage - Approved Hydrotest Procedure - Approved Drawing / PO	- Hydrotest Report - Water Test Certificates - Gauge Calibrations	H	100%	<u>H: for KNPC</u> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - After hydostest, the coke drum shall be immediately drained, cleaned and dried out.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part J: Inspection of Painting						
51	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part K: Inspection of Packing & Issuance of Release Note						
52	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
53	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
54	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
55	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case reactor is new, drawing and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-17-REACTOR	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PAUT & TOFD - Ferrite Measurement	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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	<ul style="list-style-type: none"> - PMI - Heat Treatment - Hardness Measurement - Production test coupon - Fabrication (Bending/Forming, edge preparation etc.). - Repair - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 	-	-			-
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties, grain size hardness etc. - Ultrasonic testing for thick plates higher than one inch or as specified in PO - Heat Treatment reports - NDE for raw material - Mill hydrotest (as applicable) 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the plates are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - Integrally clad plates shall be checked by Ultrasonic testing from the clad side prior to fabrication.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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		-	-			<ul style="list-style-type: none"> - For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS - For plates refer to TPI-KNPC-01-PLATES - For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS. - In case the Vessel is fabricated from Pre-rolled / Pre-formed plates, the TPI shall 100% review the Rolling / Forming reports. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of raw materials excluding CS materials	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.

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7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W (Visual) W (Dimension check) R	100% 5% 100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-
12	Production test coupon (Production Test Plate), as applicable	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Production Test Coupon Procedure 	<ul style="list-style-type: none"> - Heat Treatment and Mechanical / other testing reports 	R (Heat treatment charts and other reports) W (Mechanical testing)	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part D: Fabrication Inspection (Shell, Head, Cone Section, Skirt, Nozzles)						
13	Marking, cutting/rolling of plates for shell/skirt/nozzles (as applicable) - Template guide - Transfer of heat number & Identification of item. - Thickness check - Dimensions & cutting allowance etc.	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
14	Head/crown petal forming inspection: - Template guide - Visual & Dimensional inspection - Thickness check - Heat treatment (as applicable) - LPT/MPT (as applicable)	- Applicable Codes & Standards. - Approved Fabrication procedure	- Fabrication report	R	100%	-
15	CuSO ₄ test after clad removal for welding (as applicable)	- Applicable Codes & Standards. - Approved Drawing / Fabrication Procedure	- Inspection report	W R	10% 100%	- Applicable for fabrication from integrally clad plates - TPI shall review test reports carried out by vendor

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16	UT of clad plates after forming/rolling to check for dis-bonding (as applicable)	- Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure	- UT report	W	100%	- Applicable for fabrication from integrally clad plates - UT results to be interpreted by ASNT Level-II Qualified Personnel
17	Visual of edges to be welded (check cracks & laminations)	- Applicable Codes & Standards. - Visual Inspection Procedures	- Visual inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
18	LPT / MPT (as applicable) of edges to be welded to check cracks and laminations	- Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO	- NDT reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
19	UT of the edges to be welded (check cracks & laminations), as applicable	- Applicable Codes & Standards. - Approved UT Procedures - Approved Drawing/PO	- UT reports	W R	10% 100%	- TPI to review 100% of the UT inspection report. - UT results to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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20	Fit up & Welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Fabrication Procedures 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
21	Intermediate stress relief / Dehydrogenation treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedures 	<ul style="list-style-type: none"> - Heat Treatment report 	R	100%	<ul style="list-style-type: none"> - ISR/Dehydrogenation treatment charts mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
22	LPT / MPT after Back chip (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
23	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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24	PMI of completed welds except CS welds from inside and outside (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
25	LPT / MPT of all completed welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
26	RT or UT (as applicable) for completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
27	UT of the completed Nozzles Neck attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedures 	<ul style="list-style-type: none"> - UT Reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
28	Pneumatic testing of RF pads / Lined nozzles (as applicable)	<ul style="list-style-type: none"> - Approved drawing - Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> -

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Part E: Inspection of Weld Overlay / Cladding Restoration						
29	Visual Inspection after weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
30	Dilution test (by PMI / wet chemical analysis)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
31	Free iron check on weld overlay surface: <ul style="list-style-type: none"> • Ferricyanide test on Monel & Cu-Ni weld overlay material and CuSO₄ test on other weld overlays materials 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
32	Ferrite check of weld overlay (for DSS & Austenitic Material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
33	Thickness checking of overlay to check minimum overlay thickness	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
34	LPT of weld overlay	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
35	UT of weld overlay (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel.
Part F: Inspection of External attachment (such as lifting lugs, earthing connection etc.) & Internal attachments (such as Supporting bars etc.)						
36	Fit up inspection of the attachments	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing 	<ul style="list-style-type: none"> - Fabrication reports 	R	100%	-

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37	LPT / MPT after Back chip (for lifting lugs and other full penetration welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures - Approved Drawing/PO 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
38	Visual inspection of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	R	100%	-
39	LPT/MPT of the completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
40	PMI of the attachment welds except carbon steel material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	One spot on each completed welds	-

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41	UT of full penetration completed welds (to check weld discontinuity)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	R	100%	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
42	Pneumatic testing of RF pads	<ul style="list-style-type: none"> - Approved drawing - Approved Pneumatic Test procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
Part G: Final Inspection Prior to PWHT						
43	Final Visual, dimensional & alignment check of the equipment along with its fixed internals (integral with vessel)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional inspection reports 	W	100%	-

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44	LPT/MPT of the temporary attachment removal areas	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
45	Trial assembly of the internals (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO - Approved Trial Assembly Procedure 	<ul style="list-style-type: none"> - Assembly report 	W	100%	-
Part H: PWHT & Inspection after PWHT						
46	PWHT of the Pressure vessel	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with Heat treatment charts 	R	100%	<ul style="list-style-type: none"> - PWHT charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
47	Hardness test of all the pressure retaining welds & Skirt to shell welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO / Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR REACTORS

**TPI No. : TPI-KNPC-17-REACTORS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
48	LPT/MPT of all welds after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT / MPT Procedures 	<ul style="list-style-type: none"> - NDT Reports 	W R	10% 100%	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
49	RT or UT of the pressure retaining welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved UT Procedure 	<ul style="list-style-type: none"> - RT Reports / UT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
50	Visual inspection of the final overlay on the gasket grooves of the vessel nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedure - Approved Drawing/PO 	<ul style="list-style-type: none"> - Visual Inspection Reports 	R	100%	-
51	Dilution test (by PMI / wet chemical analysis) on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Test report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

KUWAIT NATIONAL PETROLEUM COMPANY



SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR REACTORS

TPI No. : TPI-KNPC-17-REACTORS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
52	Ferrite check of weld overlay on the gasket groove of the nozzles (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
53	LPT of weld overlay surface after PWHT	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
54	UT of weld overlay after PWHT (to check for dis-bonding)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved UT Procedure 	<ul style="list-style-type: none"> - UT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - UT results to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor
55	Final Visual & dimensional check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	W	100%	-
56	Initial Thickness measurement of all components	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part I: Pressure Testing of the Pressure Vessel						
57	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p><u>H:</u> for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment or more than 50 ppm chloride by mass. - After hydoteat, the reactorl shall be immediately drained, cleaned and dried out.
58	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part J: Inspection of Internals (as applicable)						
59	Trays	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For trays refer to TPI-KNPC-19-TOWER TRAYS
60	Pipes & Pipe fittings	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For pipes refer to TPI-KNPC-02-PIPES & pipe fittings refer to TPI-KNPC-03-PIPE FITTINGS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
61	Grid / Demister / Coalescer / Packing / Filter Elements	- See Remarks	- See Remarks	- See Remarks	- See Remarks	- For Grid / Demister / Coalescer / Packing / Filter Elements refer to TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING / FILTER ELEMENTS
Part K: Inspection of Painting						
62	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure	- Painting report	W	100%	-
Part L: Inspection of Packing & Issuance of Release Note						
63	Packing Inspection - Internal Cleaning - All parts / segments are properly packed to avoid damages during transit & handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been	- PO - Applicable Codes & Standards. - Approved Packing Procedure	- Packing report	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	inspected and content tally with packing list - Shipping Markings					
64	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
65	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
66	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

TPI No. : TPI-KNPC-18-DESUPERHEATERS
(Sheet 1 of 7)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations - Vendors Inspection & Test Plan	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	H: for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Desuperheater is new, the drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-18-DESUPERHEATERS	- Approved Inspection & Test Plan	R	100%	H: for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - Ferrite Measurement - PMI - Heat Treatment	- PO Requirement - Applicable Codes & Standards.	- Document Procedure	R	100%	H: for KNPC - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Hardness Measurement - Fabrication - Repair - Hydrotest - Initial Thick Measurement - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 	-	-		-	
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size - Material Identification and Correlation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - For pipes refer to TPI-KNPC-02-PIPES
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report 	R	100%	-
6	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures Drawings 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W (Visual) W (Dimension check) R	100% 5% 100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
8	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
9	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-
Part C: Welding Document						
10	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	H: for KNPC - Final approval by KNPC
Part D: Fabrication Inspection						
11	Visual inspection of welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual Inspection Report 	R	100%	-
12	PMI of Low alloy steel / SS welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI report of weld joints 	W	One spot on each completed weld joints	-

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
13	LPT/MPT of welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved NDT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
14	RT (check of films & reports)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved RT Procedures 	<ul style="list-style-type: none"> - RT reports 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - Radiograph to be interpreted by ASNT Level-II Qualified Personnel
15	PWHT & hardness tests (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - PWHT Report with record chart & hardness report 	<ul style="list-style-type: none"> R 	<ul style="list-style-type: none"> 100% 	<ul style="list-style-type: none"> - Heat treatment chart must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
16	LPT/MPT of all welds after PWHT (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved NDT Procedures 	<ul style="list-style-type: none"> - NDT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

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17	RT after PWHT (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures 	<ul style="list-style-type: none"> - RT reports 	R	100%	<ul style="list-style-type: none"> - Radiograph to be interpreted by ASNT Level-II Qualified Personnel
18	Final Visual & dimensional check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensions report 	W	100%	-
19	Performance Test <ul style="list-style-type: none"> - Check the degree of atomization, uniform flow pattern etc. of spray nozzle assembly 	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & PO - Approved Procedure 	<ul style="list-style-type: none"> - Performance Test Report 	W	100%	-
20	Initial Thickness measurement before surface preparation & painting	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
21	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Hydrotest Procedure - Approved Drawing / PO 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
						- After hydrotest, the desuperheater shall be immediately drained, cleaned and dried out.
22	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	- Inspection Report	R	100%	-
Part E: Inspection of Painting						
23	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	- Painting report	W	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
24	Packing Inspection: <ul style="list-style-type: none"> - Internal Cleaning - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from sea water 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. - Approved Packing Procedure 	- Packing report	W	100%	- It should be supported with load bearing sections / members.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR DESUPERHEATERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping mark 					
25	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.
26	Issue of Release Note	<ul style="list-style-type: none"> - All required Inspection satisfactorily completed 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
27	Final Inspection Report & Manufacturer's Data Report	<ul style="list-style-type: none"> - As per PO 	<ul style="list-style-type: none"> - Inspection Report 	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

KUWAIT NATIONAL PETROLEUM COMPANY



KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR TOWER TRAYS

TPI No. : TPI-KNPC-19-TOWER TRAYS
(Sheet 1 of 3)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	Material Test Certificates: - Chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports.	- Applicable Specified standards (Latest Edition) and purchase order requirements	- Material test reports	R	100%	- Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate. - All SS plates must be in solution annealed condition as per applicable standards.
2	Intergranular Corrosion (IGC) test for Austenitic SS Material, as applicable	- A 262 practice E.	- IGC report.	R	100%	-
Part B: Welding Document (As applicable)						
3	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
Part C: Fabrication Inspection						
4	Visual inspection	- Free from defect.	- Inspection report	R	100%	-
5	PMI of all material except CS material	- Applicable Standard	- PMI Report	W R	One sample per heat number 100%	- Plate must be stenciled by TPI for identification of PMI. - Review records of PMI carried out by vendor.
6	LPT/MPT of weld joints (as applicable)	- Applicable Codes & Standards. - Approved NDT Procedures	- NDT reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
7	Dimensional check	- Applicable Specified STD	- Dimensional report	W	5%	<ul style="list-style-type: none"> - Check tray size, size of all segments, tray hole size, pitch etc. - Wt. of valve of valve trays. - Dimensional record carried out by Vendor - Tray assembly. - Flatness check. - Review records of dimensions carried out by Vendor.
8	Thickness measurement.	- Applicable Specified STD.	- Thickness report.	R	100%	<ul style="list-style-type: none"> - Thickness record carried out by Vendor.
9	Pickling & Passivation of SS welds (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedure 	- Inspection Report	R	100%	-

Part C: Packing Inspection & Issuance of Release Note

10	Packing Inspection: <ul style="list-style-type: none"> - All parts / segments of Trays are properly packed to avoid damages during transit & handling - Packing suitable for protection against corrosion from sea water 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Packing reports. 	W	100%	-
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Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR TOWER TRAYS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	- Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping markings					
11	Issue of release note.	- PO - Approved Drawing	- Inspection release note	H	100%	- TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, stamped and signed TPI reports and after its approval KNPC will issue the release note for shipment.
12	Final Inspection report and manufacturer test reports.	- As per PO	- Inspection report.	H	100%	- To be sent to KNPC for record.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

KUWAIT NATIONAL PETROLEUM COMPANY



**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR GRID / DEMISTERS / COALESCER / PACKING / FILTERS ELEMENTS**
**TPI No. : TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING /
FILTERS ELEMENTS**
(Sheet 1 of 3)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	Material Test Certificates for Grid / Demisters / Coalescer / Packing / Filter Elements: - Chemical composition (Heat & Product Analysis). - Mechanical properties. - Heat treatment reports (if applicable).	- Applicable Specified Standards purchase order requirements and approved drawing.	- Material test reports	R	100%	- Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate. - All SS plates must be in solution annealed condition as per applicable standards.
Part B: Welding Document						
2	WPS, PQR and WPQ	- ASME Sec. IX.	- WPS, PQR, WPQ	H	100%	- Final approval by KNPC before proceeding with welding.
Part C: Fabrication Inspection						
3	Visual inspection	- Free from defect. - Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Visual inspection report	R	100%	-
4	PMI of all SS and Alloy Steel materials (Except CS).	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- PMI Report	W R	One sample per heat number 100%	- All checked materials to be stenciled by TPI for identification of PMI. - Review records of PMI carried out by vendor.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR GRID / DEMISTERS / COALESCER / PACKING / FILTERS ELEMENTS**
**TPI No. : TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING /
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
5	LPT of welds.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - LPT report. 	R	100%	<ul style="list-style-type: none"> - LPT report carried out by Vendor.
6	Dimensional check, as applicable	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Dimensional report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 5% 100% 	<ul style="list-style-type: none"> - Check mesh size, size of all segments, grid hole size, pitch etc. - Dimensional record carried out by Vendor for Packing, Grid / Coalescer / Demister / Filter Elements. - TPI shall review test reports carried out by vendor
7	Thickness measurement.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Thickness report. 	R	100%	<ul style="list-style-type: none"> - Thickness record of plates / sheets / pipes carried out by Vendor.
Part D: Inspection of Packing & Issuance of Release Note						
8	Packing Inspection: <ul style="list-style-type: none"> - All parts / segments are properly packed to avoid damages during transit & handling - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion from sea water 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Packing report 	W	100%	-

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR GRID / DEMISTERS / COALESCER / PACKING / FILTERS ELEMENTS

**TPI No. : TPI-KNPC-20-GRID / DEMISTERS / COALESCER / PACKING /
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	<ul style="list-style-type: none"> - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping markings 					
9	Issue of release note.	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, stamped and signed TPI reports and after its approval KNPC will issue the release note for shipment.
10	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR CS, ALLOY STEEL, STAINLESS STEEL, NICKEL ALLOY &
PARALLOY PLAIN / STUDDED AND FINNED HEATER & REFORMER TUBES**
TPI No. : TPI-KNPC-21-HEATER TUBES
(Sheet 1 of 11)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Final Vendor's Inspection Test Plan (to discuss the ITP with vendor & ensure understanding of all fabrication procedures)	<ul style="list-style-type: none"> - PO - Approved Drawing - TPI-KNPC-21- HEATER TUBES 	<ul style="list-style-type: none"> - Approved Inspection & Test Plan 	R	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Raw Material Inspection						
2	Material test certificate for chemical composition (Heat & Product Analysis): <ul style="list-style-type: none"> - Mechanical properties. - Heat treatment reports. - Stabilization heat treatment reports for stabilized grade SS. - Grain size. - Hardness. - Flattening Test. 	<ul style="list-style-type: none"> - Applicable Specified Codes & Standards. - PO 	<ul style="list-style-type: none"> - Material test reports. 	R	100%	<ul style="list-style-type: none"> - Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate and mode of cooling employed.
3	Intergranular Corrosion (IGC) test for Austenitic SS & other Austenitic alloy tubes, as applicable	<ul style="list-style-type: none"> - A 262 practice E. 	<ul style="list-style-type: none"> - IGC report. 	R	100%	-
4	Ensure tubes are in single length.	<ul style="list-style-type: none"> - As per PO. 	<ul style="list-style-type: none"> - Test report. 	W	100%	<ul style="list-style-type: none"> - TPI to ensure Tubes are free of Circum. Welds
Part C: Additional Requirement if Circumferential Weld Exist to Join Two Tubes to Make Larger Length						
5	WPS, PQR & WPQ.	<ul style="list-style-type: none"> - ASME SEC. IX 	<ul style="list-style-type: none"> - WPS, PQR, WPQ 	H	100%	<ul style="list-style-type: none"> - Final approval by KNPC before proceeding with welding.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR CS, ALLOY STEEL, STAINLESS STEEL, NICKEL ALLOY & PARALLOY PLAIN / STUDDED AND FINNED HEATER & REFORMER TUBES

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
6	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II, Part C	- Test report - PMI Report	R	100%	-
7	LPT of root pass (if applicable) and final pass.	- Applicable Codes & Standards & PO Specifications.	- Drawing.	W	100%	-
8	Post weld heat treatment.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Heat treatment chart.	R	100%	- Heat treatment chart shall indicated. Heat treatment temperature, holding time, heating / cooling rate and mode of cooling employed.
9	RT (check of films & report) of butt weld joint after PWHT.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- RT report.	R	100%	- Radiography interpreted by ASNT Level-II Qualified Personnel.
10	LPT of butt weld joint after PWHT.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- NDT report.	W	100%	- NDT to be interpreted by ASNT Level – II Qualified Personnel.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
11	Hardness measurement after PWHT.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Hardness report. 	W	100%	-
12	Ferrite test of weld joint for SS tubes / reformer Tubes.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Ferrite test report. 	W	100%	-
Part D: Fabrication Inspection						
13	Visual Inspection: - Straightness, material finish, edges.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Visual inspection report. 	W	100%	-
14	In case of any finding during visual inspection witness -LPT.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - LPT report. 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
15	Dimensional Check: - Specified length. - Permissible variation in wall thickness. - OD & ID - Out of roundness (Ovality). - Eccentricity. - Straightness	- Approved Drawing / PO - Applicable Codes & Standards. - For Straightness, Latest ASTM A 999 / A 1016.	- Dimensions Test report.	W R	5% 100%	- For other tubes. - Dimensional Check done by the vendor
16	Seamless Tubes: Macro etch test for seamless construction.	- Latest applicable STD (ASTM E-340) and PO.	- Inspection Test report.	W	One sample from each heat number.	-
17	Thickness measurement using pulse echo method E797.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Thickness report.	W R	10% 100%	- Thickness measurement to be done by Vendor.
18	Eddy current examination of Tubes.	- As per ASTM E-309 and E426.	- NDT report.	W R	10% (For Reformer tubes) 100%	- Eddy current record carried out by Vendor.
19	PMI of Heater Tubes of all materials except CS Materials	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- PMI report.	W	100%	- PMI record carried out by Vendor. - Tubes must be stenciled by TPI for identification of PMI. - Reformer tubes shall be marked using vibra-etch or marking paint free of harmful elements.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Additional Requirement for Finned Tubes						
20	Material Test Certificate: - Check the MTC of Fin material before Finning.	- Applicable Specified Codes & Standards. - PO	- Material Test Report.	W	100%	- Co-relate Fin material with MTC.
21	Finning procedure (Including WPS/ PQR wherever applicable) for finned tubes.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- WPS / PQR - Approved Finning Procedure	R	100%	-
22	Visual Inspection of Fins & Visible section of Tubes.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Inspection Test Report.	W	100%	-
23	Check for extrusion or extrusion & serration.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Inspection Test Report.	W	100%	-
24	Dimensional Inspection: - Fins OD & Pitch. - Bare both Ends. - Length.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Dimensions Report.	W R	5% 100%	- Dimensional record of Tubes of Vendor.
Part F: Additional Requirement for Studded Tubes						
25	Stud welding procedure.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Procedure.	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
26	Visual Inspection of studs & Visual section of Tubes.	<ul style="list-style-type: none"> - Approved Drawing / PO. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Inspection Test Report. 	W	100%	-
27	Dimensional Inspection: <ul style="list-style-type: none"> - Stud OD & Pitch. - Bare both Ends. - Length. 	<ul style="list-style-type: none"> - Approved Drawing / PO - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Dimensions Report. 	W R	5% 100%	<ul style="list-style-type: none"> - Dimensional record of tubes carried out by Vendor.
28	Check stud material before fixing studs.	<ul style="list-style-type: none"> - Approved Drawing / PO. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Inspection Test report. 	W	100%	<ul style="list-style-type: none"> - Co-relate stud material with MTC.
29	Hammer test of studded tubes to verify adequacy of stud to tube weld.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Hammer Test Report. 	W	100%	-
Part G: Additional Requirement for Reformer Tubes						
30	Dimensional Check: <ul style="list-style-type: none"> - Specified length. - Permissible variation in wall thickness. - OD & ID. - Out of roundness (Ovality). - Eccentricity. - Straightness 	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Dimensions Test report. 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
31	Macro etch test: - Testing (Cold and Hot ends) on transverse and longitudinal sections from any tube to check for % of equiaxed structure from inside, sound uniform material within specified sound wall area, free from injurious / laminations and objectionable defects.	- Latest applicable STD (ASTM E-340)	- Test report.	W	10% from each heat.	-
32	If rejected based on macro etch test then 6" additional tube to be cropped from defective end and new etched ring specimen to be prepared.	- Latest applicable STD (ASTM E-340) and PO.	- Test report.	W	100%	- If second sample is not accepted then subject tube shall be scrapped.
33	Micrograph to check for carbides and grain size.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Report.	R	1% of each heat number, minimum 1 no. from 10% of Micro etch rings sample.	- Suitably identified as to tubing size, wall thickness and heat number.
34	Laser optic examination of reformer tubes to get initial tube readings.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Report.	W	100%	-

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35	LPT of tubes	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - LPT report. 	R	Two diameters of the outside and inside surface including bevel edges.	-
36	Creep rupture test.	<ul style="list-style-type: none"> - As per specification (ASTM E-139) and as per PO. 	<ul style="list-style-type: none"> - Stress rupture report. 	R	15% of tube samples (same heat with tube less than 100) and 10% of tubes samples (same heat with tube 100 or more)	-
37	Boroscopic examination of inside surface of each weld.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. 	<ul style="list-style-type: none"> - Boroscopic examination report. 	W R	10% of tubes per heat. 100%	<ul style="list-style-type: none"> - Boroscopic examination record carried out by Vendor.
38	Ball test / plug gage examination.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. 	<ul style="list-style-type: none"> - Report. 	R	100% of tubes.	<ul style="list-style-type: none"> - Ball test record carried out by Vendor.
39	Eddy current test of tubes.	<ul style="list-style-type: none"> - Approved Drawing / PO Specifications. - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Eddy current report. 	W R	20% of tubes / per heat. 100%	<ul style="list-style-type: none"> - Eddy current test record carried out by Vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
40	Air pressure Test.	- Approved Drawing / PO Specifications.	- Test report.	W R	10% of tubes per heat. 100%	- Air pressure test record carried out by Vendor.
Part H: Pressure Testing of Tubes						
41	Hydrotesting of Carbon Steel Tube Materials	- No leakage - As per specification and PO.	- Hydrotest Report - Gauge Calibrations	W R	10% 100%	- Hydrostatic test to be done after finning / stud welding / center welding (circumferential welding) - Potable water to be used for hydro testing purpose. - Hydrotest report carried out by the vendor
42	Hydrotesting of Reformer Tubes & Heater Tubes of all other materials except CS Materials	- No leakage - As per specification and PO.	- Hydrotest Report - Water Test Certificates - Gauge Calibrations	W	100%	- Hydrostatic test to be done after finning / stud welding / center welding (circumferential welding) - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass.

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Part I: Inspection of Marking, Packing & Issuance of Release Note						
43	Marking on Tubes with: - Manufacturer's Name. - Heat No. - Applicable Standards / Specification. - Grade. - OD (Outside Diameter). - Thickness. - Length.	- Approved Drawing / PO Specifications. - Physical Check	- Reports.	W	100%	- Heat # marked on tubes shall correlate with Heat # on MTC. - Reformer tubes shall not be die stamped. - Reformer tubes shall be identified using Vibra-etch or by marking paint free from harmful elements.
44	Packing Inspection: - Tubes plugged with plastic caps at both ends to protect from corrosion. - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - Heater tubes are color coded (with adhesive tapes and not with paint) and Metal Tag containing details of tubes. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection	- PO - Applicable Codes & Standards.	- Packing reports.	W	100%	Color coding as per Annexure – III.

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	<ul style="list-style-type: none"> - against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	-	-			
45	Issue of release note.	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Inspection release note. 	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified and stamped TPI includes MTCs, all test reports and after its approval KNPC will issue the release note for shipment.
46	Final Inspection Report and Manufacturers data report.	- As per PO.	- Inspection report.	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect.



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KUWAIT NATIONAL PETROLEUM COMPANY

**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR CARBON STEEL, ALLOY STEEL, STAINLESS STEEL &
NICKEL ALLOY HEATER FITTINGS**

**TPI No. : TPI-KNPC-22-HEATER FITTINGS
(Sheet 1 of 5)**

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	Material test certificate for chemical composition (Heat & Product Analysis): - Mechanical properties. - Heat treatment (Solution Annealing and Stabilizing Treatment for SS) reports. - Grain size. - Hardness.	- Applicable Specified Codes & Standards. - PO	- Material test reports.	R	100%	- Heat treatment reports should indicate heat treatment temperature, holding time, heating & cooling rate and mode of cooling.
2	Intergranular Corrosion (IGC) test for Austenitic SS & other Austenitic alloy material, as applicable	- ASTM A 262 practice E.	- IGC report.	R	100%	-
Part B: Fabrication Inspection						
3	Visual Inspection - Straightness, material finish, edges etc.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Visual inspection report.	W	100%	-
4	In case of any finding during visual inspection witness -LPT.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- LPT report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect First Lining Operation and 5% Random for Subsequent Operation.

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR CARBON STEEL, ALLOY STEEL, STAINLESS STEEL & NICKEL ALLOY HEATER FITTINGS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
5	Dimensional Check - Specified length. - Permissible variation in wall thickness. - OD (Outside Diametric). - ID (Inside Diameter) - Out of roundness (Ovality etc.)	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Dimensional report.	W R	5% 100%	- Co-relate the MTCs with fittings. - Dimensional check records carried out by Vendor.
6	LPT of bevel ends of fittings (Elbow / Bend / Tee / Cap)	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- LPT report.	W	5% or as specified in PO.	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
7	Seamless Fittings: - Macro etch test for seamless construction.	- Latest applicable STD (ASTM E-340) & PO.	- Inspection Test report.	W	One sample from each heat number.	-
8	Thickness measurement using pulse echo method E797.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Thickness report.	W	100%	- Co-relate record with heater fittings. - Thickness record carried out by vendor.
9	PMI Fittings of all other materials except CS.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- PMI report.	W	100%	- Fittings must be stenciled by TPI for identification of PMI.
10	Hydro-test of Fittings (as specified in the PO)	- No Leakage - Approved Drawing /	- Hydrotest Report - Water Test	W	100%	- Potable water to be used for hydro testing purpose.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect First Lining Operation and 5% Random for Subsequent Operation.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
		- PO Specifications. - Applicable Codes & Standards.	- Certificates Gauge Calibrations			<ul style="list-style-type: none"> - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - Fitting shall be drained and dried after Hydro-test. - Hydro-test record of Tubes carried out by Vendor. - The quantity of hydrotest to be done by the vendor will be specified in PO.

Part C: Inspection of Marking, Packing & Issuance of Release Note

11	Marking on fittings with: - Manufacture's Name. - Heat No. - Applicable Standards / Specification. - Grade. - OD (Outside Diameter) - Minimum wall thickness.	- Approved Drawing / PO Specifications. - Physical Check	- Inspection Reports.	W	100%	-
12	Packing Inspection: - Fittings plugged with plastic caps at both ends to protect the beveled edges and from corrosion.	- PO - Applicable Codes & Standards.	- Packing reports.	W	100%	- Color coding as per Annexure – III (Only with adhesive tapes and not with paint).

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect First Lining Operation and 5% Random for Subsequent Operation.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - Fittings are color coded. - Properly packed to avoid damages during transit & handling. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Packing suitable for protection against corrosion resulting from seawater. - Shipping markings. 					
13	Issue of release note.	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Inspection release note. 	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, signed and stamped TPI reports and after its approval KNPC will issue the release note for shipment.

Abbreviations: H- Hold, W- Witness, R- Review, I- Inspect First Lining Operation and 5% Random for Subsequent Operation.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	Final Inspection Report and Manufacturers data report.	- As per PO	- Inspection report.	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR FIRED HEATERS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Fired Heater is new, the drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-23-FIRED HEATERS	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Vendor's Inspection Procedures						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT/VT) - Ferrite Measurement - PMI - Fabrication - Repair	- PO Requirement - Applicable Specified Codes & Stds.	- Document Procedure	R	100%	<u>H:</u> for KNPC - Final approval by KNPC

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	<ul style="list-style-type: none"> - Heat Treatment - Hardness Measurement - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Refractory Installation/dry out - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
5	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
6	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	- ASME Sec IX	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<u>H: for KNPC</u> <u>- Final approval by KNPC</u>
7	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part D: Fabrication Inspection of Radiation & Convection Coils						
8	All Raw Material Inspection & Reports: - Heater Tubes & Fittings.	- Applicable Specified Codes & Standards.	- Material Inspection reports / charts	R	100%	- Ensure the raw material meets the applicable requirements of TPI-KNPC-21-HEATER TUBES & TPI-KNPC-22-HEATER FITTINGS
9	PMI of raw materials excluding CS materials	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.
10	Visual & Dimensional verification of raw material	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Visual & Dimensional report	W (Visual) W (Dimension check) R	100% 5% 100%	- TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor
11	LPT (as applicable) of edges to be welded	- Applicable Codes & Standards. - Approved LPT Procedures	- NDT reports	W R	10% 100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
12	Visual inspection of Fit up and alignment	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Visual & Dimensional report	R	100%	- TPI shall review test reports carried out by vendor

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13	LPT on the root pass welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.
14	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
15	PMI of completed welds except CS welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.
16	LPT of all completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
17	Ferrite Testing of completed welds (for Austenitic Stainless steel material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor

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18	RT of the completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
19	PWHT/Thermal Stabilization Heat treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - Heat Treatment Report with charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
20	Hardness test after Heat Treatment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
21	LPT of all welds after PWHT (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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22	RT of the completed Butt welds joints after Heat Treatment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
23	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-
24	Initial Thickness measurement of the Coils	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-

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25	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Applicable Codes & Standards. - Approved Hydrotest Procedure - Approved Drawing 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - After hydro test, the heater shall be immediately drained, cleaned and dried out.
26	Pickling & Passivation of Austenitic SS Welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	-
Part E: Inspection of Casting Tube supports for Convection and Radiation Coil						
27	Material Test Certificates: - Chemical & Mechanical Properties	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-

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28	Visual & Dimensional Check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W (Visual) W (Dimension check) R	100% 10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
29	LPT Check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
30	Radiography Examination: 100% on critical area of cast tube supports, 10% on critical area of cast tube support bracket	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved RT Procedures 	<ul style="list-style-type: none"> - RT reports 	R	100%	<ul style="list-style-type: none"> -
31	PMI Check	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	<ul style="list-style-type: none"> -
32	Marking & Tagging	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedure 	<ul style="list-style-type: none"> - Marking Report 	R	100%	<ul style="list-style-type: none"> -

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part F: Inspection of Skin Point Thermocouple						
33	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
34	Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Visual & Dimensional report 	H	100%	<ul style="list-style-type: none"> - H: for KNPC - Final approval by KNPC
35	Visual Inspection of the weld joint	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedure 	<ul style="list-style-type: none"> - Visual Inspection Report 	W	100%	-
36	LPT of the weld joint	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	W	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
37	Function Test Report TC (performance)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Function Test Procedure 	<ul style="list-style-type: none"> - Function Test Report 	H	100%	<ul style="list-style-type: none"> - H: for KNPC - Final approval by KNPC

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
38	Calibration Test Report TC (performance)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Calibration Test Procedure 	<ul style="list-style-type: none"> - Calibration Test Report 	H	100%	<ul style="list-style-type: none"> - <u>H: for KNPC</u> - Final approval by KNPC
Part G: Fabrication Inspection of Burners						
39	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
40	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	-
41	Fit up inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
42	Visual Inspection of the weld joint	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedure 	<ul style="list-style-type: none"> - Visual Inspection Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
43	LPT of the all weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
44	PMI of welds (except CS welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
45	Leak Test	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Leak test Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
46	Gun Assembly inspection & drilling/position / orientation of tip	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
47	Inspection of muffle block / burner tile integrity & dimensions	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
48	Inspection of Prototype including pilot	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
49	Performance Test (Main & pilot)	<ul style="list-style-type: none"> - Approved Burner Test Procedure 	<ul style="list-style-type: none"> - Burner Performance Report 	W	100%	-

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50	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-
51	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part H: Fabrication Inspection of Steel Structure, Casing, Stack & Dampers, Ducts & Misc. Structures (Platform, ladders etc.)						
52	Material Test Certificates: - Chemical & Mechanical Properties	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
53	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI report 	W	100%	-
54	Visual & Dimensional check of the all raw material issued for fabrications (e.g. casing panel/ shell plate after rolling for stack fabrication, as applicable etc.)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO & Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W R	10% 100%	- TPI shall review test reports carried out by vendor

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55	Trial assembly	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Trial Assembly report 	W	100%	-
56	Fit up & welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Fabrication Reports 	R	100%	-
57	Visual Inspection of all competed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual Inspection Reports 	W R	10% 100%	- TPI shall review test reports carried out by vendor
58	RT of the butt weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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59	LPT of all welds and lifting lug attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
60	Ferrite Testing of completed welds (for Austenitic Stainless steel material)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Ferrite Measurement Procedure 	<ul style="list-style-type: none"> - Ferrite test reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
61	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
62	Operational/ Function Test of the dampers	<ul style="list-style-type: none"> - Approved Drawing/PO/Data sheet - Approved Procedure 	<ul style="list-style-type: none"> - Function Test Report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	-
63	Leakage test of the dampers	<ul style="list-style-type: none"> - Approved Drawing/PO/Data sheet & Procedure 	<ul style="list-style-type: none"> - Inspection Report 	<ul style="list-style-type: none"> W 	<ul style="list-style-type: none"> 100% 	-

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64	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part I: Inspection of APH						
65	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
66	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI report 	W	100%	-
67	Fit up & welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Fabrication Reports 	R	100%	-
68	Visual Inspection of all competed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Visual Inspection Reports 	W	10%	

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		- Approved Visual Inspection Procedure	R	100%		- TPI shall review test reports carried out by vendor
69	LPT of the all weld joints	- Applicable Codes & Standards. - Approved LPT Procedures	- LPT reports	W R	10% 100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
70	Final Assembly and Dimensional Inspection	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
71	Air Leak test	- Approved Drawing/PO/ Datasheet - Approved Air Leak Test Procedures	- Inspection Reports	W	100%	-
72	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure	- Painting report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part J: Inspection of Castable Refractory / Brick Work Lining / Ceramic Fiber Refactory (on Casing, Stack, APH as applicable)						
73	Material Test Certificates: - Refractory Material Test Certificates as applicable: o Chemical Analysis, Mechanical properties such as Load test, Cold crushing strength, Modulus of rupture, Reheat change, Thermal conductivity, Density, Setting time, Bulk density, Consistency, Apparent porosity, Water absorption, Apparent Sp. Gravity, Abrasion resistance and other test reports. - Anchor Material Test Certificates	- Applicable Specified Codes & Stds. - Approved drawing/PO requirements	- Material Inspection reports / charts	R	100%	- Ensure Raw material storage as per original Manufacturer recommendations & KNPC standards.
73.1	For Bricks & Castable Inspection: - Cold crushing strength. - Modulus of rupture.	- As per PO and applicable Standard / Code.	- Inspection report.	W R	One piece per Batch 100%	- Review test records carried out by Vendor.
74	PMI of Anchors (except CS material)	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
75	Anchor welding - Check location and - Spacing	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection report	W R	10% 100%	- TPI shall review test reports carried out by vendor
76	Torque Test of stud weld anchors	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor
77	Bend Test of the Anchors	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor
78	Refractory Applications (as applicable) : For Castable refractory: - Water quality check - Ambient temperature and humidity check - Mixing Water temperature check - Shuttering/formwork etc. - Checking thickness of lining For Ceramic Fiber: - Check direction of blanket installed. - Check the Overlap	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Refractory Installation report / map	R	100%	-

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	<ul style="list-style-type: none"> - Check for approved brand/grade/density/size of CF material. - Check Fixing of final washer - Check Lining thickness <p>For Brick Lining:</p> <ul style="list-style-type: none"> - Check for Mixing/ preparation of mortar (as applicable) - Check laying of bricks - Expansion Joint filling - Check Mortar Joints 					
79	Laboratory Test of the sample during installation (as applicable)	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Installation Procedure 	<ul style="list-style-type: none"> - Laboratory Test Report 	R	100%	-
80	Visual & Dimensional inspection after curing	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Installation Procedure 	<ul style="list-style-type: none"> - Visual & Dimension check 	W (Visual) W (Dimension check) R	100% 10% 100%	- TPI shall review test reports carried out by vendor



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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
81	Pre Dry out / Final Dry out (as applicable)	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Dry out Procedure 	Heater Dry out report/charts	R	100%	Dry out chart must mention the temperature, rate of heating/cooling, holding time at each stage and mode of heating/cooling.
82	Final Visual Inspection & Hammer testing	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Installation Procedure 	Hammer Test report	W	100%	-
Part K: Inspection of Non-metallic Expansion Joint						
83	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	Material Test Certificates / Reports	R	100%	-
84	Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	Visual & Dimensional Inspection Reports	R	100%	-
85	PMI of SS and Alloy steel material (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved PMI Procedure 	PMI Report	W	100%	-
86	Final Assembly Check	- Approved Drawing/PO	Inspection report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part L: Inspection of Packing & Issuance of Release Note						
87	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning All parts / segments are properly packed to avoid damages during transit & handling. - Fittings/tubes plugged with plastic caps at both ends to protect the beveled edges and from corrosion. - Tubes/fittings are color coded - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings 	<ul style="list-style-type: none"> - PO - KNPC Standard - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - Color coding as per Annexure – III (Only with adhesive tapes and not with paint).
88	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.

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89	Issue of Release Note	- As per PO	- Inspection release note	H	100%	<u>H:</u> for KNPC - KNPC will review the final TPI report and after its approval, KNPC will issue release note for shipment.
90	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

(I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.

(II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's fabrication drawings and calculations	- PO - Drawing & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the boiler is new, the drawing and calculations both will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-24-BOILER	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Vendor's Inspection Procedures						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT/VT) - Ferrite Measurement - PMI - Fabrication - Repair	- PO Requirement - Applicable Specified Codes & Stds.	- Document Procedure	R	100%	<u>H:</u> for KNPC - Final approval by KNPC

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	<ul style="list-style-type: none"> - Heat Treatment - Hardness Measurement - Hydrotest - Pneumatic Test - Initial Thk. Measurement - Refractory Installation/dry out - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Qualification certificates 	R	100%	-
5	Painter & Blaster Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Qualification certificates 	R	100%	-
Part C: Welding Document						
6	<ul style="list-style-type: none"> - WPS,PQR & WPQ - Weld Map 	<ul style="list-style-type: none"> - ASME Sec IX 	<ul style="list-style-type: none"> - WPS,PQR,WPQ - Weld map 	H	100%	<ul style="list-style-type: none"> - H: for KNPC - Final approval by KNPC
7	<ul style="list-style-type: none"> - Welding Consumables - Batch Testing - PMI Check (Except CS material) 	<ul style="list-style-type: none"> - PO - ASME Sec II Part C 	<ul style="list-style-type: none"> - Test report - PMI Report 	R	100%	-
Part D: Fabrication Inspection of Steam & Water Drums (For Boilers)						
8	<ul style="list-style-type: none"> - Steam & Water Drum 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - See Remarks 	<ul style="list-style-type: none"> - For Fabrication inspection of Steam Drums and Water drums refer to TPI-KNPC-13-PLAIN PRESSURE VESSELS.

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8.1	Visual & Dimension Inspection: - Drum holes, Expansion grooves - Tube Expansion	- As per Drawing - Applicable Codes & Standards.	- Inspection Reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
8.2	- LPT of weld joints between boiler tubes & drum (as applicable)	- Applicable Codes & Standards. - Approved Procedure	- Inspection Reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
Part E: Fabrication Inspection of Boiler Tubes (Including boiler banks, furnace tubes, economizer tubes, super heater tubes etc.)						
9	All Raw Material Inspection & Reports: - Boiler Tubes & connected piping	- Applicable Specified Codes & Standards.	- Material Inspection reports / charts	R	100%	- Ensure the raw material for boiler tubes meets the applicable requirements of TPI-KNPC-05-TUBES, for Piping and pipe fittings TPI-KNPC-02-PIPES & TPI-KNPC-03-PIPE FITTINGS
10	PMI of raw materials excluding CS materials	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.
11	Visual & Dimensional verification of raw material	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Visual & Dimensional report	W (Visual) W (Dimension check) R	100% 5% 100%	- TPI shall co-relate MTCs with items used for fabrication of pressure vessel. - TPI shall review test reports carried out by vendor

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12	Visual inspection of Fit up and alignment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
13	Visual inspection of completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedures 	<ul style="list-style-type: none"> - Visual inspection reports 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
14	PMI of completed welds except CS welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedures 	<ul style="list-style-type: none"> - PMI Report 	W R	10% 100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor.
15	LPT of all completed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	W R	10% 100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
16	RT of the completed Butt welds joints.	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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17	Post weld Heat treatment (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Heat Treatment Procedure 	<ul style="list-style-type: none"> - Heat Treatment Report with charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
18	Hardness test after Heat Treatment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing /PO - Approved Hardness Test Procedure 	<ul style="list-style-type: none"> - Hardness Test Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
19	LPT of all welds after PWHT (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
20	RT of the completed Butt welds joints after Heat Treatment	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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21	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-
22	Initial Thickness measurement of the Coils	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
23	Hydrostatic Test of complete boiler assembly	<ul style="list-style-type: none"> - No leakage - Applicable Codes & Standards. - Approved Hydrotest Procedure - Approved Drawing 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p><u>H:</u> for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - Potable water to be used for hydro testing purpose. - After hydro test, the boiler shall be immediately drained, cleaned and dried out.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part F: Fabrication Inspection of Burners						
24	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
25	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	-
26	Fit up inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
27	Visual Inspection of the weld joint	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Procedure 	<ul style="list-style-type: none"> - Visual Inspection Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
28	LPT of the all weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved LPT Procedures 	<ul style="list-style-type: none"> - LPT reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor

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29	PMI of welds (except CS welds)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
30	Leak Test	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Leak test Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
31	Gun Assembly inspection & drilling/position / orientation of tip	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
32	Inspection of muffle block / burner tile integrity & dimensions	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
33	Inspection of Prototype including pilot	<ul style="list-style-type: none"> - Approved Drawing/PO 	<ul style="list-style-type: none"> - Inspection Report 	R	100%	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
34	Performance Test (Main & pilot)	<ul style="list-style-type: none"> - Approved Burner Test Procedure 	<ul style="list-style-type: none"> - Burner Performance Report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
35	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	W	100%	-
36	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part G: Fabrication Inspection of Steel Structure, Casing, Stack & Dampers, Ducts & Misc. Structures (Platform, ladders etc.)						
37	Material Test Certificates: - Chemical & Mechanical Properties	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
38	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI report 	W	100%	-
39	Visual & Dimensional check of the all raw material issued for fabrications (e.g. casing panel/ shell plate after rolling for stack fabrication, as applicable etc.)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO & Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	W R	10% 100%	- TPI shall review test reports carried out by vendor

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40	Trial assembly	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Trial Assembly report 	W	100%	-
41	Fit up & welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Fabrication Reports 	R	100%	-
42	Visual Inspection of all competed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Visual Inspection Procedure 	<ul style="list-style-type: none"> - Visual Inspection Reports 	W R	10% 100%	- TPI shall review test reports carried out by vendor
43	RT of the butt weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved RT Procedure 	<ul style="list-style-type: none"> - RT Reports 	R	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

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44	LPT of all welds and lifting lug attachment welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved LPT Procedure 	<ul style="list-style-type: none"> - LPT Reports 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
45	Final Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional report 	<ul style="list-style-type: none"> W R 	<ul style="list-style-type: none"> 10% 100% 	<ul style="list-style-type: none"> - TPI shall review test reports carried out by vendor
46	Operational/ Function Test of the dampers	<ul style="list-style-type: none"> - Approved Drawing/PO/Data sheet - Approved Procedure 	<ul style="list-style-type: none"> - Function Test Report 	W	100%	-
47	Leakage test of the dampers	<ul style="list-style-type: none"> - Approved Drawing/PO/Data sheet - Approved Procedure 	<ul style="list-style-type: none"> - Inspection Report 	W	100%	-

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48	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part H: Inspection of APH (as applicable)						
49	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
50	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	<ul style="list-style-type: none"> - PMI report 	W	100%	-
51	Fit up & welding	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Fabrication Procedure 	<ul style="list-style-type: none"> - Fabrication Reports 	R	100%	-
52	Visual Inspection of all competed welds	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Visual Inspection Reports 	W	10%	

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		- Approved Visual Inspection Procedure	R	100%		- TPI shall review test reports carried out by vendor
53	LPT of the all weld joints	- Applicable Codes & Standards. - Approved LPT Procedures	- LPT reports	W R	10% 100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel. - TPI shall review test reports carried out by vendor
54	Final Assembly and Dimensional Inspection	- Applicable Codes & Standards. - Approved Drawing/PO - Approved Procedure	- Inspection reports	W R	10% 100%	- TPI shall review test reports carried out by vendor
55	Air Leak test	- Approved Drawing/PO/ Datasheet - Approved Air Leak Test Procedures	- Inspection Reports	W	100%	-
56	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure	- Painting report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part I: Inspection of Castable Refractory / Brick Work Lining / Ceramic Fiber Refactory (on Casing, Stack, APH as applicable)						
57	Material Test Certificates: - Refractory Material Test Certificates as applicable: o Chemical Analysis, Mechanical properties such as Load test, Cold crushing strength, Modulus of rupture, Reheat change, Thermal conductivity, Density, Setting time, Bulk density, Consistency, Apparent porosity, Water absorption, Apparent Sp. Gravity, Abrasion resistance and other test reports. - Anchor Material Test Certificates	- Applicable Specified Codes & Stds. - Approved drawing/PO requirements	- Material Inspection reports / charts	R	100%	- Ensure Raw material storage as per original Manufacturer recommendations & KNPC standards.
57.1	For Bricks & Castable Inspection: - Cold crushing strength. - Modulus of rupture.	- As per PO and applicable Standard / Code.	- Inspection report.	W R	One piece per Batch 100%	- Review test records carried out by Vendor.
58	PMI of Anchors (except CS material)	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
59	Anchor welding - Check location and - Spacing	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection report	W R	10% 100%	- TPI shall review test reports carried out by vendor
60	Torque Test of stud weld anchors	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor
61	Bend Test of the Anchors	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Inspection Test report	W R	10% 100%	- TPI shall review test reports carried out by vendor
62	Refractory Applications (as applicable) : For Castable refractory: - Water quality check - Ambient temperature and humidity check - Mixing Water temperature check - Shuttering/formwork etc. - Checking thickness of lining For Ceramic Fiber: - Check direction of blanket installed. - Check the Overlap	- Approved Drawing/PO - Approved Refractory Installation Procedure	- Refractory Installation report / map	R	100%	-

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	<ul style="list-style-type: none"> - Check for approved brand/grade/density/size of CF material. - Check Fixing of final washer - Check Lining thickness <p>For Brick Lining:</p> <ul style="list-style-type: none"> - Check for Mixing/ preparation of mortar (as applicable) - Check laying of bricks - Expansion Joint filling - Check Mortar Joints 					
63	Laboratory Test of the sample during installation (as applicable)	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Installation Procedure 	<ul style="list-style-type: none"> - Laboratory Test Report 	R	100%	-
64	Visual & Dimensional inspection after curing	<ul style="list-style-type: none"> - Approved Drawing - Approved Refractory Installation Procedure 	<ul style="list-style-type: none"> - Visual & Dimension check 	W (Visual) W (Dimension check) R	100% 10% 100%	- TPI shall review test reports carried out by vendor

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65	Pre Dry out / Final Dry out (as applicable)	<ul style="list-style-type: none"> - Approved Drawing/PO - Approved Refractory Dry out Procedure 	Refractory Dry out report/charts	R	100%	- Dry out chart must mention the temperature, rate of heating/cooling, holding time at each stage and mode of heating/cooling.
66	Final Visual Inspection & Hammer testing	<ul style="list-style-type: none"> - Approved Drawing/PO - Approved Installation Procedure 	<ul style="list-style-type: none"> - Hammer Test report 	W	100%	-
Part J: Inspection of Non-metallic Expansion Joint						
67	Material test Certificates	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing/PO 	<ul style="list-style-type: none"> - Material Test Certificates / Reports 	R	100%	-
68	Visual & Dimensional Inspection	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection Reports 	R	100%	-
69	PMI of SS and Alloy steel material (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing / PO & Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	-
70	Final Assembly Check	<ul style="list-style-type: none"> - Approved Drawing / PO 	<ul style="list-style-type: none"> - Inspection report 	W	100%	-

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Part K: Inspection of Packing & Issuance of Release Note						
71	Packing Inspection - Internal Cleaning - All parts / segments are properly packed	- PO - KNPC Standard - Approved Packing	- Packing report	W	100%	- Color coding as per Annexure – III (Only with adhesive tapes and not with paint).
Part L: Inspection of Packing & Issuance of Release Note						
72	Packing Inspection - Internal Cleaning All parts / segments are properly packed to avoid damages during transit & handling. - Fittings/tubes plugged with plastic caps at both ends to protect the beveled edges and from corrosion. - Tubes/fittings are color coded - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping Markings	- PO - KNPC Standard - Approved Packing Procedure	- Packing report	W	100%	- Color coding as per Annexure – III (Only with adhesive tapes and not with paint).

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73	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
74	Issue of Release Note	- As per PO	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval, KNPC will issue release note for shipment.
75	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PRESSURE SAFETY VALVES (CONVENTIONAL, BALANCED & PILOT OPERATED)

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Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations - Technical specifications - Datasheet	- PO - Drawing, Datasheet, Technical Specifications & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Pressure safety valve is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing & Datasheet - TPI-KNPC-25-PRESSURE SAFETY VALVES	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PMI - Fabrication	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H:</u> for KNPC - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR PRESSURE SAFETY VALVES (CONVENTIONAL, BALANCED & PILOT OPERATED)

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	<ul style="list-style-type: none"> - Pressure Testing Procedure (Hydro / Pneumatic) - Function Test - Initial Thick Measurement - Painting - Pickling & Passivation - Packing / shipping - Other procedure etc. 	-	-		-	
4	<ul style="list-style-type: none"> All Raw Material Inspection (body, bonnet & all Internal parts) - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness Test - Ferrite Test - Microstructure / Average grain size - Material Identification and Co-relation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.

Abbreviations: H- Hold, W- Witness, R- Review,

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**SCOPE OF WORK FOR
THIRD PARTY INSPECTION
FOR PRESSURE SAFETY VALVES (CONVENTIONAL,
BALANCED & PILOT OPERATED)**
TPI No. : TPI-KNPC-25-PRESSURE SAFETY VALVES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
5	Safety Valve Spring Range	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing & Datasheet 	- Test Report	R	100%	-
6	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
7	NDT test (RT, LPT/MPI) of the raw material (Body & Bonnet)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved NDT Procedure 	- NDT test report	R	100%	<ul style="list-style-type: none"> - The Quantity of testing shall be as per Annexure -II. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
8	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved PMI Procedure 	- PMI Report	W	100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs.
9	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures - Approved Drawings 	- Visual & Dimensional report	R	100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication.
10	NDT Personnel Qualifications (as applicable)	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
11	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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**SCOPE OF WORK FOR
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part C: Welding Document (As applicable)						
12	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	R	100%	-
13	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
Part D: Fabrication & Assembly						
14	RT of the Bonnet butt welds (as applicable)	- Applicable Codes & Standards. - Approved Drawing - Approved RT Procedure	- RT Report	R	100%	-
15	Visual Inspection & LPT of Bellows	- Applicable Codes & Standards. - Approved Drawing	- NDT report	W	100%	-
16	Inspection of Hard facing/stelliting of the seat (as required): - LPT check - Hardness test	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- LPT report & Hardness report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
17	Coating thickness for electroplated (Cadmium, Nickel etc.) spring (as applicable)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Electroplating Report 	R	100%	-
18	Final Visual & dimensional check of the assembly	<ul style="list-style-type: none"> - Applicable Codes & Standard. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual Inspection Report - Dimensions Report 	W W R	100% 10% 100%	The TPI shall inspect: <ul style="list-style-type: none"> - Size (inlet / outlet port, orifice size), ANSI Rating - For threaded connections, appropriate Go/No-Go gauges shall be used to check its conformity. - Orifice Dimensions. - TPI shall review test reports carried out by vendor
19	Initial thickness measurement of body before surface preparation & painting	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
20	Hydrostatic / Pneumatic Testing of the pressure containing parts (body bonnet, cap & nozzles)	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Hydrostatic test / Pneumatic Test Report - Water Test Certificates - Gauge Calibrations 	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> - Final approval by KNPC - For Hydrotesting of Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
						- After hydostest, the equipment shall be immediately drained, cleaned and dried out.
21	Function test: - For Conventional & Balanced safety valve: Pop / set pressure and reseat pressure Test, Seat Leak Test & Bellow pneumatic test. - For Pilot Operated Safety Valve: Crack open / dome pressures for the pilot & Pop / set pressure and reseat pressure Test, Seat Leak Test & Bellow pneumatic test for main valve.	- Latest API Std. 527 - Approved Drawing - Approved Function Test Procedure	- Test Report	H	100%	<u>H: for KNPC</u> - Final approval by KNPC.
Part E: Inspection of Painting						
22	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Stds. - Approved Painting Procedure	- Painting report	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part F: Inspection of Packing & Issuance of Release Note						
23	Packing Inspection: - Internal Cleaning - Ends are protected by plugs (Preferably plastics) - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping mark	- PO - Applicable Codes & Stds. - Approved Packing Procedure	- Packing report	W	100%	-
24	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
25	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H:</u> for KNPC - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
26	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR VACCUM RELIEF VALVES & BREATHER VALVES

TPI No. : TPI-KNPC-26-BREATHER VALVES
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations - Technical specifications - Datasheet	- PO - Approved Drawing, Datasheet, Technical Specifications & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Breather valve is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-26-BREATHER VALVES	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: - NDE (UT/MT/LPT/RT) - PMI - Fabrication - Function Test - Initial Thk. Measurement	- PO Requirement - Applicable Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size - Material Identification and Correlation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI. - MTC shall comply with ISO 10474 type 3.1 / EN 10204 type 3.1 and for corrosive service ISO 10474 Type 3.2 / EN 10204 type 3.2.
5	NDT test (RT, LPT/MPT) of the raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved NDT Procedure 	<ul style="list-style-type: none"> - NDT test report 	R	100%	<ul style="list-style-type: none"> - The Quantity of testing shall be as per Annexure –II. - All NDTs to be interpreted by ASNT Level-II Qualified Personnel.

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
6	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
7	PMI of all material except CS material	- Applicable Codes & Standards. - Approved PMI Procedure	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.
8	NDT Personnel Qualifications (as applicable)	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-

Part C: Fabrication & Assembly Inspection

10	Final Visual & dimensional check of the assembly	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensions report	W	100%	-
11	Coating thickness for electroplated spring (as applicable)	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Coating thickness report	W	100%	-
12	Initial Thickness measurement before surface preparation & painting	- Applicable Codes & Standards. - Approved DWG. / UT Procedure	- Thickness Measurement Report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
13	Function test: - Seat Leak Test - Set/Vacuum Pressure Test	- Latest API Std. 2000/PO/Drawing - Approved Function Test Procedure	- Test Report	H	100%	<u>H:</u> for KNPC - Final approval by KNPC.
Part D: Inspection of Painting						
14	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards / Painting Procedure	- Painting report	W	100%	-
Part E: Inspection of Packing & Issuance of Release Note						
15	Packing Inspection: - Internal Cleaning - Ends are protected by plugs (Preferably plastics) - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled	- PO - Applicable Codes & Standards. - Approved Packing Procedure	- Packing report	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection by TPI	Extent of Inspection	Remarks
	to ensure that packing has been inspected and content tally with packing list - Shipping mark					
16	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
17	Issue of Release Note	- All required Inspection Satisfactorily Completed	- Inspection release note	H	100%	<u>H:</u> for KNPC - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
18	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR RUPTURE DISKS

TPI No. : TPI-KNPC-27- RUPTURE DISKS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Vendor's drawings, Calculations & Datasheet	<ul style="list-style-type: none"> - PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements 	<ul style="list-style-type: none"> - Approved Drawing, Datasheet & Calculations 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the rupture disk is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan, if applicable	<ul style="list-style-type: none"> - PO - Approved Drawing - TPI-KNPC-27- RUPTURE DISKS 	<ul style="list-style-type: none"> - Approved Inspection & Test Plan 	R	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which shall include but not limited to: <ul style="list-style-type: none"> - PMI - Fabrication - Pressure Testing 	<ul style="list-style-type: none"> - PO Requirement - Applicable Codes & Stds. 	<ul style="list-style-type: none"> - Document Procedure 	R	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	- Painting - Packing / shipping - Other procedure etc.					
4	All Raw Material Inspection - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size - Material Identification and Co-relation	- Applicable Specified Codes & Stds.	- Material Inspection reports / charts	R	100%	- Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of all material except CS material	- Applicable Codes & Stds. - PMI Procedure	- PMI Report	W	100%	-
7	Painter & Blaster Personnel Qualifications	- Applicable Codes & Stds.	- Personnel Qualification certificates	R	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part C: Fabrication & Assembly						
8	Final Visual & dimensional check of the assembly	<ul style="list-style-type: none"> - Applicable Codes & Stds. - Approved Drawing & datasheet - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection report 	W (Visual) W (Dimension check) R	100% 10% 100%	- TPI to review the test reports of the vendor
9	Pressure test: <ul style="list-style-type: none"> - Pressure Test of Holder - Burst Test 	<ul style="list-style-type: none"> - Applicable Codes & Stds. - Approved Drawing & Datasheet - Approved Procedure 	<ul style="list-style-type: none"> - Test Report - Gauge Calibrations 	R	100%	- Review the Manufacturers test reports.
Part D: Inspection of Painting						
10	Surface preparation and painting inspection	<ul style="list-style-type: none"> - PO - Applicable Codes & Stds. 	<ul style="list-style-type: none"> - Painting report 	R	100%	-
Part E: Inspection of Packing & Issuance of Release Note						
11	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion 	<ul style="list-style-type: none"> - PO - Applicable Codes & Stds. - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	-

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Packing suitable for protection against corrosion from sea water. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list - Shipping mark 					
12	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.
13	Issue of Release Note	<ul style="list-style-type: none"> - All required Inspection satisfactorily completed. 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> - KNPC will review final TPI report and after its approval KNPC will issue release note for shipment.
14	Final Inspection Report & Manufacturer's Data Report	<ul style="list-style-type: none"> - As per PO 	<ul style="list-style-type: none"> - Inspection Report 	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Notes:

- (I) Any deviation to PO requirement observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,



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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

TPI No. : TPI-KNPC-28- METALLIC EXPANSION JOINTS
(Sheet 1 of 6)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Vendor's drawings and calculations	<ul style="list-style-type: none"> - PO - Drawing & Calculations - Quality & Inspection Requirements 	<ul style="list-style-type: none"> - Approved Drawing & calculations 	H	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the metallic expansion joint is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	<ul style="list-style-type: none"> - PO - Approved Drawing - TPI-KNPC-28- METALLIC EXPANSION JOINTS 	<ul style="list-style-type: none"> - Approved Inspection & Test Plan 	R	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: <ul style="list-style-type: none"> - NDE (LPT/RT) - PMI - Fabrication - Heat Treatment 	<ul style="list-style-type: none"> - PO Requirement - Applicable Specified Codes & Standards 	<ul style="list-style-type: none"> - Document Procedure 	R	100%	<p><u>H: for KNPC</u></p> <ul style="list-style-type: none"> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

TPI No. : TPI-KNPC-28- METALLIC EXPANSION JOINTS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Hardness Test - Pressure Testing - Painting - Packing / shipping - Installation 					
4	<ul style="list-style-type: none"> - All Raw Material Inspection - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size - Material Identification and Correlation 	<ul style="list-style-type: none"> - Applicable Codes & Standards 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report 	R	100%	-
6	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards - PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	<ul style="list-style-type: none"> - TPI shall co-relate PMI report with MTCs.
7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards - Approved Procedures & Drawings 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	<ul style="list-style-type: none"> - TPI shall co-relate MTCs with items used for fabrication

Abbreviations: H- Hold, W- Witness, R- Review,

KUWAIT NATIONAL PETROLEUM COMPANY



KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

TPI No. : TPI-KNPC-28- METALLIC EXPANSION JOINTS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
8	NDT Personnel Qualifications	- Applicable Codes & Standards	- Personnel Qualification certificates	R	100%	-
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	WPS, PQR & WPQ	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	R	100%	H: for KNPC - Final approval by KNPC
Part D: Fabrication & Assembly						
11	RT of bellow long seam weld before forming	- Applicable Codes & Standards - Approved RT Procedure	- RT Reports	R	100%	- Radiograph to be interpreted by ASNT Level-II Qualified Personnel
12	LPT of bellow long seam weld after forming (inside & outside accessible surface)	- Applicable Codes & Standards - Approved LPT Procedure	- LPT Reports	W	100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel
13	LPT of the attachment welds	- Applicable Codes & Standards - Approved LPT Procedure	- LPT Reports	W	100%	- LPT results to be interpreted by ASNT Level-II Qualified Personnel

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	Heat treatment of the bellow to pipe weld as applicable	- Applicable Codes & Standards - Approved Heat Treatment Procedure.	- Heat Treatment report	R	100%	- Heat treatment chart must mention soaking temperature, loading temperature, heating, cooling rate & mode of heating/cooling.
15	Hardness test after heat treatment (as applicable)	- Applicable Codes & Standards - Approved Heat Treatment Procedure	- Hardness Reports	W	10%	-
16	RT of all butt weld joints after heat treatment (as applicable)	- Applicable Codes & Standards - Approved RT Procedure	- RT Reports	R	100%	- Radiograph interpreted by ASNT Level-II Qualified Personnel
17	LPT of all fillet welds after heat treatment (as applicable)	- Applicable Codes & Standards - Approved LPT Procedure	- LPT Reports	W	100%	- LPT to be interpreted by ASNT Level-II Qualified Personnel
18	Pickling & Passivation of welds (as applicable)	- Applicable Codes & Standards - Approved Procedure	- Inspection report	R	100%	-
19	Final Visual & dimensional check of the assembly	- Applicable Codes & Standards - Approved Drawing - Approved Procedure	- Visual & Dimensional Inspection report	W R	10% 100%	- TPI to review the test reports of the vendor

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
20	Pressure Test - Check Leakages Any deformations	- No leaks - Applicable Codes & Standards - Approved Drawing - Approved Pressure Test Procedure	- Test Report - Water Test Certificates - Gauge Calibrations	H	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC. Potable water should be used for Hydrotesting and it shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - After hydoteat, the equipment shall be immediately drained, cleaned and dried out.
Part E: Inspection of Painting						
21	Surface preparation and painting inspection (as applicable)	- Approved Drawing/PO - Applicable Codes & Standards - Approved Painting Procedure	- Painting report	R	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
22	Packing Inspection - Internal Cleaning. - All parts /segments are properly packed to avoid damages during transit and handling. - Properly preserved to avoid any corrosion.	- PO - Applicable Codes & Standards - Approved Packing Procedure	- Packing report	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR METALLIC EXPANSION JOINTS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping mark. 					
23	Final stamping & record checks	<ul style="list-style-type: none"> - PO - Approved Drawing 	<ul style="list-style-type: none"> - Manufacturer record book 	R	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
24	Issue of Release Note	<ul style="list-style-type: none"> - All required Inspection satisfactorily completed 	<ul style="list-style-type: none"> - Inspection release note 	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
25	Final Inspection Report & Manufacturer's Data Report	<ul style="list-style-type: none"> - As per PO 	<ul style="list-style-type: none"> - Inspection Report 	H	100%	<ul style="list-style-type: none"> - To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR THERMOWELLS

TPI No. : TPI-KNPC-29- THERMOWELLS

(Sheet 1 of 5)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Raw Material Inspection						
1	Material Test Certificates for all Components: - Chemical composition. - Mechanical properties. - Hardness test. - Heat treatment. - Inter granular corrosion test reports as required.	- Applicable Specified Codes & Standards. - PO	- Material test reports.	R	100%	- Ensure that base material such as flanges, bar stock & coupling etc. meets the KNPC TPI requirement (KNPC-TPI-03 Fittings). - Heat treat chart shall include heat treatment temperature, soaking time, heating & cooling rate and mode of cooling employed.
Part B: Welding Document (Applicable for any Welding Requirements)						
2	- WPS,PQR & WPQ - Weld Map	- ASME Sec. IX.	- WPS, PQR WPQ	H	100%	- Final approval by KNPC before proceeding with welding.
3	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
Part C: Fabrication Inspection						
4	Visual Inspection: - Material finish. - Edges.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Visual Inspection report.	W	100%	-
5	Dimensional check. - Taper. - Outside diameter. - Specific length. - Minimum wall thickness.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Dimensional report.	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR THERMOWELLS

TPI No. : TPI-KNPC-29- THERMOWELLS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
6	Check Thermowell pipe is made from single bar and not two-piece.	- Approved Drawing / PO Specifications.	- Inspection Report	W	100%	- Ensure that tip is not welded to Thermowell.
7	Thickness measurement.	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Thickness report.	W	100%	- Thickness measurement at hot end (tip) and sidewall.
8	LPT of body and weld joint (in case of flanged Thermowell).	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- LPT report.	W	100%	- All NDTs to be interpreted by ASNT Level-II Qualified Personnel.
9	RT (check of films & reports) of butt weld joints	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Radiography report.	R	100%	- Radiograph interpreted by ASNT Level – II qualified personnel. - Radiograph shall cover: <ul style="list-style-type: none">o Well portion.o Transition from screwed head for checking defects, concentricity and uniformity of wall thickness (hot end and sidewall).
10	Hardness Test: - Screwed Thermowell - At head, tip and well. - Flanged Thermowell - At weld joints / HAZ, tip, well and head (coupling)	- Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Hardness report.	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR THERMOWELLS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
11	PMI of all Thermowells except of CS material - Check well, flange head and weld.	- Applicable Codes & Standards. - Approved Procedure	- PMI report.	W	100%	- Thermowell must be stenciled / engraved by TPI on flange and head for identification of PMI.
12	Hydro test of Thermowells.	- No Leakage - Approved Drawing / PO Specifications. - Applicable Codes & Standards.	- Hydrotest Report - Water Test Certificates - Gauge Calibrations	H	100%	- Thermowell shall be tested from both internally and externally. - Potable water to be used for hydro testing purpose. - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment or more than 50 ppm chloride by mass. - After hydotest, the Thermowell shall be immediately drained, cleaned and dried out.
Part D: Inspection of Marking, Packing & Issuance of Release Note						
13	Markings: - All Thermowells (Flanged and screwed) shall have material specifications stenciled / engraved on flange and head respectively. Screwed thermowell shall have SS Tag with PO no. and Manufacturer's Name. - Flange Thermowell shall have PO number and Manufacturer's Name marked on the flange OD	- Approved Drawing / PO Specifications. - Physical Check	- Inspection Report.	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR THERMOWELLS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	<p>Packing Inspection:</p> <ul style="list-style-type: none"> - Thermowell ends to be plugged with plastic caps to protect from corrosion. - Packed in strong sea worthy wooden boxes and properly protected against corrosion. - Properly packed to avoid damages during transit & handling. - Packing suitable for protection against corrosion resulting from seawater. - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list. - Shipping markings. 	<ul style="list-style-type: none"> - PO - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Packing reports. 	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR THERMOWELLS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
15	Issue of release note.	- PO - Approved Drawing	- Inspection releases note.	H	100%	<ul style="list-style-type: none"> - TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed. - KNPC will review the final duly certified, stamped and signed TPI inspection reports MTCs & test certificates and after its approval KNPC will issue the release note for shipment.
16	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection report.	H	100%	- To be sent to KNPC for records.

Note:

- (I) Any deviation to PO requirement of chemicals observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

KUWAIT NATIONAL PETROLEUM COMPANY



KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR EJECTORS

TPI No. : TPI-KNPC-30- EJECTORS
(Sheet 1 of 6)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations - Datasheet	- PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Ejector is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-30- EJECTORS	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/MPT/RT) - PMI - Fabrication - Pneumatic Test - Hydrostatic Test	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H:</u> for KNPC <ul style="list-style-type: none"> - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR EJECTORS

TPI No. : TPI-KNPC-30- EJECTORS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Ejector Performance Test - Painting - Pickling & Passivation - Packing/shipping - Other procedure etc. 					
4	<ul style="list-style-type: none"> - All Raw Material Inspection - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size. - Material Identification and Co-relation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE Standards and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion (IGC) test for Austenitic SS material, as applicable	<ul style="list-style-type: none"> - ASTM A262-E 	<ul style="list-style-type: none"> - Test Report 	R	100%	-
6	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	- TPI shall co-relate PMI report with MTCs.
7	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures - Approved Drawings 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	- TPI shall co-relate heat number in MTCs with items used for fabrication

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR EJECTORS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
8	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	- Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
Part D: Fabrication & Assembly						
12	RT (check of films & reports) of butt weld joints	- Applicable Codes & Standards. - Approved RT Procedure	- RT Reports	R	100%	- Radiograph interpreted by ASNT Level-II Qualified Personnel
13	LPT/MPT of fillet weld joints	- Applicable Codes & Standards. - NDT Procedure	- NDT Reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - NDT to be interpreted by ASNT Level-II Qualified Personnel. - TPI to review the Vendor Test reports.

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
14	PMI of completed SS weld joints	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PMI Procedures 	<ul style="list-style-type: none"> - PMI report of weld joints 	W	One spot on each completed weld joints	-
15	Pneumatic testing of Reinforcement Pads	<ul style="list-style-type: none"> - No leak - Approved drawing & PO - Pneumatic Test Procedure 	<ul style="list-style-type: none"> - Pneumatic Test Report 	W	100%	-
16	Final Visual & dimensional check of the assembly	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Visual & Dimensional Inspection report 	W	100%	-
17	Initial Thickness measurement before surface preparation & painting	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
18	Hydrostatic Test	<ul style="list-style-type: none"> - No leakage - Approved Drawing - Approved Hydrotesting Procedure 	<ul style="list-style-type: none"> - Hydrotest Report - Water Test Certificates - Gauge Calibrations 	H	100%	<p>H: for KNPC</p> <ul style="list-style-type: none"> - Final approval by KNPC - For Austenitic SS material (300 series austenitic) potable water shall not contain traces of any type of sediment and more than 50 ppm chloride by mass. - After hydostest, the ejector shall be immediately drained, cleaned and dried out.

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR EJECTORS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
19	Performance Test (As applicable): - Ejector performance Test - Noise Level Test	- Approved Drawing & Datasheet	- Performance Report	R	100%	-
20	Pickling & Passivation of Austenitic SS Welds	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Inspection Report	R	100%	-
Part E: Inspection of Painting						
21	Surface preparation and painting inspection	- Approved Drawing/PO - Applicable Codes & Standards - Approved Painting Procedure	- Painting report	W	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
22	Packing Inspection: - Internal Cleaning - Properly packed to avoid damages during transit and handling. - Name plate rubbing - Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list	- PO - KNPC Standards - Approved Packing Procedure	- Packing report	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR EJECTORS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	- Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from sea water - Shipping mark					
23	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed inspection report with Material Test Certificate and all test certificates duly certified, signed and stamped, to KNPC immediately after Inspection is completed.
24	Issue of Release Note	- All required Inspection satisfactorily completed	- Inspection release note	H	100%	- KNPC will review final TPI report and after its approval will issue release note for shipment.
25	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified Standards / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR SILENCERS

TPI No. : TPI-KNPC-31-SILENCERS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations - Datasheet	- PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements	- Minutes Meeting of	H	100%	<u>H:</u> for KNPC - In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. - In case the Silencer is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-31-SILENCERS	- Approved Inspection & Test Plan	R	100%	<u>H:</u> for KNPC - ITP shall be in line with scope of inspection mentioned here. - Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/RT) - PMI - Fabrication - Pneumatic Test	- PO Requirement - Applicable Codes & Standards.	- Document Procedure	R	100%	<u>H:</u> for KNPC - Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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KNPC

SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR SILENCERS

TPI No. : TPI-KNPC-31-SILENCERS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	<ul style="list-style-type: none"> - Performance Test - Painting - Packing / shipping - Other procedure etc. 					
4	All Raw Material Inspection <ul style="list-style-type: none"> - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size. - Material Identification and Co-relation 	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Material Inspection reports / charts 	R	100%	<ul style="list-style-type: none"> - Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	PMI of all material except CS material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - PMI Procedure 	<ul style="list-style-type: none"> - PMI Report 	W	100%	- TPI shall co-relate PMI report with MTCs.
6	Visual & Dimensional verification of raw material	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Procedures - Approved Drawings 	<ul style="list-style-type: none"> - Visual & Dimensional report 	R	100%	- TPI shall co-relate MTCs with items used for fabrication
7	NDT Personnel Qualifications	<ul style="list-style-type: none"> - Applicable Codes & Standards. 	<ul style="list-style-type: none"> - Personnel Qualification certificates 	R	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
8	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
9	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
Part D: Fabrication & Assembly						
10	RT of butt weld joints	- Applicable Codes & Standards. - Approved RT Procedure	- RT Reports	R	100%	- Radiograph interpreted by ASNT Level-II Qualified Personnel
11	LPT of fillet weld joints	- Applicable Codes & Standards. - Approved LPT Procedure	- LPT Reports	W R	10% 100%	- LPT to be interpreted by ASNT Level-II Qualified Personnel - TPI shall review test reports carried out by vendor.
12	Pneumatic testing of Pads (such as lifting lug pads, support pads etc.)	- Approved drawing - No leak - Pneumatic Test Procedure	- Pneumatic Test Report	W R	10% 100%	- TPI shall review test reports carried out by vendor.
13	Final Visual & dimensional check of the assembly	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensional Inspection report	W	100%	-
14	Performance Test	- Approved Drawing & Datasheet - Approved Performance Test Procedure	- Test Report	R	100%	<u>H: for KNPC</u> - Final approval by KNPC.

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
15	Thickness measurement before surface preparation & painting	<ul style="list-style-type: none"> - Applicable Codes & Standards. - Approved Drawing - Approved Procedure 	<ul style="list-style-type: none"> - Thickness Measurement Report 	W	100%	-
Part E: Inspection of Painting						
16	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Stds. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
17	Packing Inspection <ul style="list-style-type: none"> - Internal Cleaning - All parts /segments are properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion from sea water - Shipping mark 	<ul style="list-style-type: none"> - PO - Applicable Standard - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
18	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.
19	Issue of Release Note	- All required Inspection satisfactorily completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
20	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR FLARE TIPS & PILOTS

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TPI No. : TPI-KNPC-32- FLARE TIPS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part A: Pre Inspection						
1	Pre-Inspection Meeting: - Vendor's drawings and calculations - Datasheet	- PO - Drawing, Datasheet & Calculations - Quality & Inspection Requirements	- Minutes of Meeting	H	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> In case of fabrication drawings copied from existing KNPC Drawing the TPI shall review the drawing and submit to KNPC for final approval. Calculation, if any, submitted by the vendor will be directly reviewed & approved by KNPC. In case the Flare Tip is new, the drawings, datasheets and calculations will be directly reviewed & approved by KNPC.
2	Final Vendor's Inspection Test Plan	- PO - Approved Drawing - TPI-KNPC-32-FLARE TIPS	- Approved Inspection & Test Plan	R	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> ITP shall be in line with scope of inspection mentioned here. Final approval by KNPC
Part B: Procedures & Raw Material Inspection						
3	Approval of applicable Vendors Procedures which may include but not limited to: - NDE (LPT/MPT/RT) - PMI - Fabrication - Performance Test - Painting	- PO Requirement - Applicable Specified Codes & Standards.	- Document Procedure	R	100%	<u>H: for KNPC</u> <ul style="list-style-type: none"> Final approval by KNPC

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR FLARE TIPS & PILOTS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	- Pickling & Passivation - Packing / shipping - Other procedure etc.					
4	All Raw Material Inspection - Applicable Mechanical, chemical properties, Impact properties - Heat Treatment reports / charts - Hardness test - Microstructure / Average grain size. - Material Identification and Co-relation	- Applicable Specified Codes & Standards.	- Material Inspection reports / charts	R	100%	- Heat Treatment charts for the raw materials shall be submitted separately for review to TPI & KNPC. - TPI shall co-relate MTCs with items used for fabrication. - In case the raw materials are ordered to meet NACE MR0175 / 0103 requirements, all the testing specifications in the NACE standard and PO shall be followed by the vendor and the reports shall be reviewed by the TPI.
5	Intergranular Corrosion(IGC) test of Austenitic material, as applicable	- ASTM A262-E	- Test Report	R	100%	-
6	PMI of all material except CS material	- Applicable Codes & Standards. - PMI Procedure	- PMI Report	W	100%	- TPI shall co-relate PMI report with MTCs.
7	Visual & Dimensional verification of raw material	- Applicable Codes & Standards. - Approved Procedures - Approved Drawings	- Visual & Dimensional report	R	100%	- TPI shall co-relate heat number in MTCs with items used for fabrication
8	NDT Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
9	Painter & Blaster Personnel Qualifications	- Applicable Codes & Standards.	- Personnel Qualification certificates	R	100%	-
Part C: Welding Document						
10	- WPS,PQR & WPQ - Weld Map	- ASME Sec IX	- WPS,PQR,WPQ - Weld map	H	100%	<u>H: for KNPC</u> - Final approval by KNPC
11	Welding Consumables - Batch Testing - PMI Check (Except CS material)	- PO - ASME Sec II Part C	- Test report - PMI Report	R	100%	-
Part D: Fabrication & Assembly						
12	Edge preparation, fit up and welding	- Applicable Codes & Standards. - Approved Fabrication Procedure & Drawing	- Fabrication Report	R	100%	-
13	RT (check of films & reports) of butt weld joints	- Applicable Codes & Standards. - Approved RT Procedure	- RT Reports	R	100%	- Radiograph interpreted by ASNT Level-II Qualified Personnel
14	LPT/MPT of fillet weld joints	- Applicable Codes & Standards. - NDT Procedure	- NDT Reports	W R	10% 100%	- LPT : for Austenitic and Non-ferrous materials - MPT: for Ferromagnetic material. - NDT to be interpreted by ASNT Level-II Qualified Personnel. - TPI to review the Vendor Test reports.

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR FLARE TIPS & PILOTS

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
15	PMI of completed SS weld joints	- Applicable Codes & Standards. - PMI Procedures	- PMI report of weld joints	W	One spot on each completed weld joints	-
16	Ferrite check of Austenitic SS welds	- Applicable Codes & Standards. - Ferrite Testing Procedures	- Ferrite Test Report	W R	10% 100%	- TPI to review the test reports of the vendor
17	Final Visual & dimensional check of the assembly	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Visual & Dimensional Inspection report	W	100%	-
18	Trial fit Inspection with pilot and thermocouples, as applicable	- Approved Drawing - Approved Procedure	- Inspection report	R	100%	- TPI to review the test reports of the vendor
19	Performance Test of Pilot, as applicable	- Approved Drawing & Datasheet	- Performance Report	R	100%	-
20	Pickling & Passivation of Austenitic SS Welds	- Applicable Codes & Standards. - Approved Drawing - Approved Procedure	- Inspection Report	W	100%	-

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
Part E: Inspection of Painting						
21	Surface preparation and painting inspection	<ul style="list-style-type: none"> - Approved Drawing/PO - Applicable Codes & Standards. - Approved Painting Procedure 	<ul style="list-style-type: none"> - Painting report 	W	100%	-
Part F: Inspection of Packing & Issuance of Release Note						
22	Packing Inspection: <ul style="list-style-type: none"> - Internal Cleaning - All parts /segments are properly packed to avoid damages during transit and handling. - Name plate rubbing - Properly preserved to avoid any corrosion - Packing suitable for protection against corrosion resulting from sea water Packing is stamped or stenciled to ensure that packing has been inspected and content tally with packing list <ul style="list-style-type: none"> - Shipping mark 	<ul style="list-style-type: none"> - PO - Applicable Standard - Approved Packing Procedure 	<ul style="list-style-type: none"> - Packing report 	W	100%	<ul style="list-style-type: none"> - Each item or loose part shall be properly identified by its specific mark number that is traceable to the shipping list and drawings. - Items not having welded on tags/name plate shall be tagged using stainless steel tags & wire. - All openings shall be covered properly prior to shipment.

Abbreviations: H- Hold, W- Witness, R- Review,

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
23	Final stamping & record checks	- PO - Approved Drawing	- Manufacturer record book	R	100%	- TPI shall submit the detailed Inspection Report with Material Test Certificate and all Test Certificates duly certified, stamped and signed to KNPC immediately after Inspection is completed.
24	Issue of Release Note	- All required Inspection satisfactorily completed	- Inspection release note	H	100%	<u>H: for KNPC</u> - KNPC will review the final TPI report and after its approval KNPC will issue release note for shipment.
25	Final Inspection Report & Manufacturer's Data Report	- As per PO	- Inspection Report	H	100%	- To be sent to KNPC for records.

Notes:

- (I) TPI shall ensure no deviation from PO / latest specified standard / approved drawings & ITP. Notify KNPC immediately of any deviation noticed. Further inspection shall be carried out only after clearance from KNPC.
- (II) The specified 5% / 10% witness by the TPI is the minimum requirement and the witness quantity fractions shall be rounded off to the next higher value (For example: Quantity of inspection 1.1 to 1.9 shall be treated as 2; 2.1 to 2.9 shall be treated as 3 etc.).

Abbreviations: H- Hold, W- Witness, R- Review,

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR INDUSTRIAL CHEMICALS

TPI No. : TPI-KNPC-36-INDUSTRIAL CHEMICALS
(Sheet 1 of 3)

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
1	MSDS Documents / Certificate of Analysis (COA).	- Specification as per PO.	- Certificates and MSDS.	R	100%	-
2	Material Inspection: - Packing in new steel drums or HDPE drums / ISO container / Tote Bin to suit the chemicals.	- Specification as per PO and Physical check.	- Inspection Reports / Certificates.	W	100%	- Chemical Material must be new and not older than 2 months at the time of Inspection.
3	Check validity of ISO container.	- Specification as per PO.	- Inspection Reports.	W	100%	- Ensure gauges (Pressure, Temperature & Level Gauges) are in working condition.
4	For Patented chemicals: - Analytical test report of Manufacturer.	- Specification as per PO.	- Test report.	R	100%	- Material is in conformity to the specification of PO.
5	For Generic chemicals: - Analytical Testing of sample.	- Specification as per PO.	- Test report.	W	100%	- Ensure that analytical test results meet the specification of PO.
6	Check / certify the additives (e.g. Antioxidant/Antistatic etc.)	- PO and Specification.	- Test report.	W	100%	- Ensure that analytical test results meet the specification of PO.
7	Marking of Drum with Heat resistant paint. - Name / Type of chemicals. - Date of production, Expiry & Shelf life. - Net Wt. & Gross Wt. in kg / liters / cubic feet / cubic meter (as specified in PO).	- As per PO and Physical check.	- Inspection Reports.	W	100%	-

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SCOPE OF WORK FOR THIRD PARTY INSPECTION FOR INDUSTRIAL CHEMICALS

**TPI No. : TPI-KNPC-36-INDUSTRIAL CHEMICALS
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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
	- Manufacturer Name. - KNPC Stock No. (ITEM No.) / PO nos.	-				
8	Hazard material label (HAZMAT) on each drum / ISO container / Tote Bin	- As per HSE Document.	- Physical Check.	W	100%	<p>Ensure availability of following information:</p> <ul style="list-style-type: none"> - Name, address and telephone number of the person responsible for supplying the substance (Liquid / Solid) as well as Manufacturer logo. - Name of the substance or the trade name of the preparation / constituents. - The indication of danger and the corresponding hazard warning symbols in black on orange background (European Union, Australia), as in Appendix 10 of the Kuwait EPA regulations or the EU Dangerous Goods Directives, ADR, IMO, IATA. - Risk and safety phrases if applicable as in the EU.

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Sr. No.	Activity	Acceptance Criteria	Verification Document	Type of Inspection By TPI	Extent of Inspection	Remarks
9	Issue of release note.	- All required Inspection Satisfactorily Completed	- Inspection release note.	H	100%	- KNPC will review the final duly certified, stamped & signed TPI reports, quality (analytical test) report and MSDS and after its approval, KNPC will issue the release note for shipment.
10	Final inspection report and manufacturer data report.	- As per PO	- Inspection report.	H	100%	- Inspection report, quality report and MSDS document to send to KNPC for record.

Note:

(I) All certificates issued by Original Manufacturer must be Stamped and Signed by Manufacturer.

(II) Any deviation to PO requirement of chemicals observed by TPI shall be notified to KNPC immediately. Further inspection shall be carried out only after clearance from KNPC.

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ANNEXURE – I , PMI **(Sheet 1 of 2)**

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PMI (POSITIVE MATERIAL IDENTIFICATION) REQUIREMENT FOR VARIOUS ITEMS

1. Pipes, Pipe Fittings, Plates & Valves

Metallurgy	Basic Sample Size (Refer Table -4)
Carbon Steel	P0
Low Alloy Steel	P1
Stainless Steel & Non Ferrous (except valves)	S
Stainless Steel & Non Ferrous (for valves only)	P1
Duplex Stainless Steel & Nickel Alloy	P1

2. Heater Tubes & Heater Fittings

Metallurgy	Basic Sample Size (Refer Table -4)
Carbon Steel	P0
Low Alloy Steel	P1
Stainless Steel	P1
Nickel Alloy	P1

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ANNEXURE – I, PMI (Sheet 2 of 2)

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3. Heat Exchanger Tubes

Metallurgy	Basic Sample Size (Refer Table -4)
Carbon Steel	P0
Low Alloy Steel	S
Stainless Steel & Non Ferrous	S
Duplex Stainless Steel, Nickel Alloy & Titanium	S

4.

Basic Sample Size (Table-4)

Lot Size		P0	Special Inspection Levels	P1
From	To		S	
1	1	No Inspection	1	100% Inspection
2	8		2	
9	15		2	
16	25		3	
26	50		5	
51	90		5	
91	150		8	
151	280		13	
281	500		13	
501	1,200		20	
1,201	3,200		32	
3,201	10,000		32	
10,001	32,000		50	

(Reference: Material Verification Program of KNPC)

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ANNEXURE – II, NDT

Non Destructive Testing Requirement for Valves and PSV's (Sheet 1 of 2)

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TABLE I

RADIOGRAPHY EXAMINATION

MATERIAL	SERVICE	NOTE	ANSI PRESSURE CLASS						EXTENT OF EXAMINATION
			150	300	600	900	1500	2500	
Carbon Steel	Any	(1)	5%	5%	-	-	-	-	Buttweld Ends - Random
		(1)	-	-	5%	100%	100%	100%	Note 2
Ferritic Chrome Alloys	General	(1)	5%	5%	5%	100%	100%	100%	Note 2
	Hydrogen Rich	(1)	10%	10%	10%	100%	100%	100%	Note 2
Stainless Steel, Duplex & Nickel Alloy	General	(1)	5%	5%	5%	100%	100%	100%	Note 2
	Hydrogen Rich	(1)	10%	10%	10%	100%	100%	100%	Note 2

Note:

1. Percentage From each heat. Minimum one Valve.
2. Critical areas as required for special class valves in ANSI B16.34, extend coverage to include overlays for pressure seal gasket contact area. Additional areas may be selected by the inspector based on the results of the radiography of the critical area.

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ANNEXURE – II, NDT

Non Destructive Testing Requirement for Valves and PSV's (Sheet 2 of 2)

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TABLE II

MAGNETIC PARTICLE / LIQUID PENETRANT EXAMINATION

MATERIAL	SERVICE	NOTE	ANSI PRESSURE CLASS						EXTENT OF EXAMINATION
			150	300	600	900	1500	2500	
Carbon Steel	Any	(1)	5%	5%	5%	5%	10%	10%	100% Magnetic Particle
Ferritic Chrome Alloys	General	(1)	5%	5%	5%	10%	10%	10%	100% Magnetic Particle
	Hydrogen Rich	(1)	10%	10%	10%	20%	20%	20%	100% Magnetic Particle
Stainless Steel, Duplex & Nickel Alloy	General	(1)	5%	5%	5%	5%	5%	5%	100% Liquid Penetrant
	Hydrogen Rich		ALL	ALL	ALL	ALL	ALL	ALL	Buttweld Ends – Liquid Penetrant
		(1)	10%	10%	10%	20%	20%	20%	100% Liquid Penetrant

Note:

1. Percentage From each heat. Minimum one Valve.

For PSV, Class rating mentioned in the above table shall be treated as set pressure.

(Reference of Tables- KNPC Engg. Std. 50P2)

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ANNEXURE –III, COLOUR CODING SPECIFICATION

COLOUR CODING REQUIREMENT FOR VARIOUS ITEMS

(Sheet 1 of 7)

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Colour coding of piping bulk materials shall be applied on all items that includes alloy or special alloy systems. Colour coding is one of the QA system tools intended to maintain material traceability. Colour coding is intended to supplement, not replace, the normal standard identification requirements (e.g. manufacturers' markings, ASME, ASTM, MSS, etc.) of components.

The material supplier shall be responsible for the application of colour coding. The coding shall be checked by the supplier's QC department and /or TPI before being released for shipment to site.

1.0 Colour standard

The colour standards detailed in Table on page 64 to 67 shall be applied. The marking on each items shall be similar to that specified in 2.0.

Colour coding paint shall be resistant to saltwater atmosphere and tropical climate, and shall be durable.

Paints and markers shall not contain harmful metals or metal salts such as zinc, aluminum, lead or chlorides, sulphur, or other halogens that may be harmful to the alloy. Material Safety Data Sheet (MSDS) documentation and paint data sheets shall be available for review by the TPI.

2.0 Piping Component Marking Specifications

Colour coding shall be done on all items as mentioned below (For ease of understanding refer the sketch on page 68) with the following precautions:

- Paint shall not be applied, in any circumstances, to the following:
 - inside surfaces of pipe, flanges or fittings;
 - threads;
 - weld bevels;
 - symbols or markings which would obliterate identification;
 - gasket seating surface.
- Colour codes shall be applied when carbon steel & LT carbon steel are handled concurrently.
- In case, the colour of the paint resembles with the finish colour of the item (e.g. Aluminium colour may match with bright CS/SS material), dark colour (the combination colour with Aluminium) shall be applied on either side with Aluminium colour in middle for clear distinction.

2.1 PIPES / BARS

- Each length of pipe shall be painted over the entire length with a 12 mm to a 40 mm wide stripe, depending on pipe size.

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ANNEXURE -III, COLOUR CODING SPECIFICATION

COLOUR CODING REQUIREMENT FOR VARIOUS ITEMS (Sheet 2 of 7)

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2.2 FITTINGS

- Each socket weld fitting, swage or pipe nipple shall be dabbed with a spot of paint 12 mm to 25 mm in diameter.
- The entire length of each butt weld fitting shall be painted on the outside surface with a 12 mm to 40 mm wide stripe, depending on size.

2.3 FLANGES

- The outer peripheral edge of each flange shall be painted over the entire circumference. For flanges thicker than 25 mm, the width of the band may be limited to 25 mm.

2.4 PLATES

- A stripe shall be painted across from corner to corner on each plate.

2.5 VALVES

- Each welded or flangeless (wafer type) valve, shall be painted on the body and bonnet with 12 mm to 40 mm wide stripe, depending on size.
- Screwed / socket welded end valves shall be dabbed with a spot of paint 12 mm to 25 mm in diameter.
- Each flanged valve shall have the outer peripheral edge of each flange painted over the entire circumference. For flanges thicker than 25 mm, the width of the band may be limited to 25 mm.

2.6 HEATER & BOILER TUBE / FITTING / SUPPORTS

- Heater and Boiler tube/fitting/support shall be color coded **by providing a coloured adhesive tape instead of paint.**

2.7 BOLTS

- Each bolt shall be dabbed with a spot of paint on each end.

2.8 NUTS

- In case nut is being procured separately, it shall be colour coded with a spot.

2.9 HEAT EXCHANGER TUBES

- Each box containing heat exchanger tubes shall be provided with a SS 304 metal tag of 3"X3"X1.6mm (thick) with colour as per relevant specification.

2.10 METALLIC GASKETS

- Each gaskets shall be colour coded as per ASME 16.20. RTJ gasket and Double Jacket gasket does not require colour coding as per ASME 16.20.

3.0 Special Notes

- 3.1 Exclusions : Colour coding is not required for instrument tubing / fitting , thermo well, tube bundle in assembled condition, vessel, finned carbon steel tubes (even if the fin is of higher metallurgy).
- 3.2 Bimetallic tube shall be colour coded with both inner and outer metallurgy.

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ANNEXURE –III, COLOUR CODING SPECIFICATION

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- 3.3 All L grade e.g. 304 L/ 316 L shall be colour coded with one extra strip of grey.
- 3.4 All H grade e.g. 347 H shall be colour coded with one extra strip of black.
- 3.5 **Special item colour code** : As it is difficult to provide separate colour code for each item, add one extra colour strip of purple to identify them as special alloy in addition to basic colour code of nearest alloy (e.g. Alloy nearest to Incoloy – 825's is Incoloy 800). Refer Table (sheet 6 of 7) for colour code of some special items.
- 3.6 Colour coding of bolts and nuts is specified for ASTM specifications. Same shall not be confused with other colour coding which is as per metallurgies.

Copper alloys

Admiralty (inhibited)	black	
Brass (Red)	black and yellow	
Copper	black and blue	
70-30 Copper Nickel	black and green	
90-10 Copper Nickel	black and purple	
Silicon Bronze	black and white	
Aluminum Brass	black and brown	

Titanium

Titanium alloys	Black, Blue and white	
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Steel and cast iron

Carbon steel	none	
Low temperature carbon steel e.g. ASTM A 333 Grade 6	green and blue	
Carbon steel, sour service (complying to MR 0103)	green and red	
Cast iron	green	
Nodular iron (ductile)	Green and aluminum	
Copper-bearing steel	green, black, and yellow	

Duplex Stainless Steel

Duplex SS Alloy	Red	
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Ferritic alloy steels

4140 /4142	low alloy carbon steel	Aluminum, Blue and Purple
4340	low alloy carbon steel	Aluminum and gold
P1/T1/F1	0.15 % carbon, 0.5 % molybdenum	green and red
P11/T11/F11	1¼ % chromium, 0.5 % molybdenum	Aluminum, Black and Purple
P12/T12/F12	1% chromium, 0.5 % molybdenum	Aluminum and Black
P3b	2 % chromium, 0.5 % molybdenum	Aluminum and white
P22/T22/F22	2¼ % chromium, 1 % molybdenum	Aluminum and brown
P5/T5/F5	5 % chromium, 0.5 % molybdenum	Aluminum and blue
P9/T9/F9	9 % chromium, 1 % molybdenum	Aluminum and red
P91/T91/F91	9 % chromium, 1 % molybdenum, modified	Aluminum and purple

Chromium steels

Type 405	11 % to 13 % chromium	Red and Black
Type 410	12 % to 14 % chromium	Red and White
Type 416	12 % to 14 % chromium	Red and Brown

Austenitic stainless steels

TP-17-4pH	17 % chromium, 7 % nickel	yellow and purple
TP304	18 % chromium, 8 % nickel	yellow
TP309	25 % chromium, 12 % nickel	white
TP310	25 % chromium, 20 % nickel	white and blue
TP316	17 % chromium, 12 % nickel , 2% Mo	yellow and brown
TP317	19 % chromium, 12 % nickel molybdenum (spec)	yellow and red
TP321	18 % chromium, 11 % Ni-Ti	Yellow and aluminium
TP347	19 % Chromium, 11 % nickel, Nb	yellow and white
*Alloy 20	20 % chromium, 30 % nickel	yellow and green

* Alloy 20 comes under the trade names of Durimet 20, Carpenter 20, Alloyco 20, and others.

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Nickel and nickel alloys

Nickel	blue	
Monel	blue and red	
Inconel	blue and yellow	
Hastelloy "B"	blue and brown	
Hastelloy "C"	blue, brown and red	
Incoloy 800	blue, red, and yellow	
Inconel 600	blue, white and blue	

Low nickel alloy steels

Grade	Alloy	
3	3½ % nickel	brown and green
5	5 % nickel	brown and white
9	9 % nickel	brown and blue

Bolting

(Colour coding of bolts & nuts is specified for ASTM specification)

Bolts	Nuts	
A 307-B	A 563-A	none
A 193-B7	A 194-2H	none
A 193-B7M	A 194-2H M	grey
A 320-L7	A 194-4	white
A 193 B 6	A 194 -6	green
A 193 B 8	A 194 -8	black
A 193 B 8 C	A 194 -8C	brown
A 193-B8M/M2	A 194-8M	red
A 193 B 8 T	A 194 -8T	purple
A 193-B16	A 194-4	blue
B 473-N08020	B 473-N08020	none
A 453-660	A 453-660	yellow

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Special Items

ASTM Specification	Closer to Alloy	Colour Coding
A 240 UNS 08926	Alloy 20	(Yellow, Green) + Purple
A 249 UNS 31254	SS 310 H	(White, blue, black) + Purple
A 268 TP 430	SS 410	(Red , White) + Purple
SS 420	SS 410	(Red , White) + Purple
A 269 UNS 31254	SS 310 H	(White, blue, black) + Purple
A 312 UNS 08904	Alloy 20	(Yellow, Green) + Purple
B 111 C 71640	70/30 Cu Ni	(Black, Green) + Purple
BS 2871 CN 108	70/30 Cu Ni	(Black, Green) + Purple
B 111 C 60800	Al. Brass	(Black, Brown) + Purple
B 677 UNS 08094	Alloy 20	(Yellow, Green) + Purple
B 668 UNS 08028	Incoloy 800	(Blue, Red , Yellow) + Purple
DIN 1.4713 (6-8% Cr)	9 Cr (P 9)	(Aluminium , Red) + Purple
Incoloy 825	Incoloy 800	(Blue, Red , Yellow) + Purple
Incoloy 625	Incoloy 600	(Blue, White , Blue) + Purple
Phosphor Bronze / Bronze	Copper	Black and Blue + purple
Alum Alloy ASTM-B211 LV GR 6061-T651	Aluminum Alloy	Orange + Purple
DIN 1.4724 (12 Cr-1Al)	SS 410	(Red , White) + Purple

(Reference – Shell DEP 31.10.00.10, ASME 16.20 and Material Verification Program of KNPC)

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ANNEXURE –III, COLOUR CODING SPECIFICATION

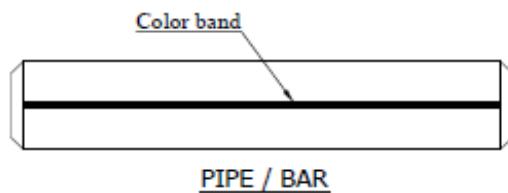
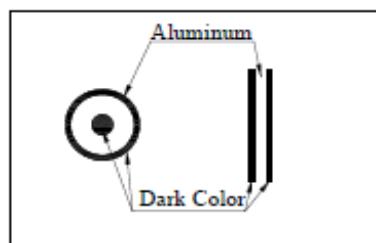
COLOUR CODING REQUIREMENT FOR VARIOUS ITEMS **(Sheet 7 of 7)**

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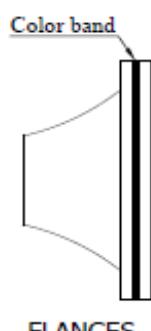
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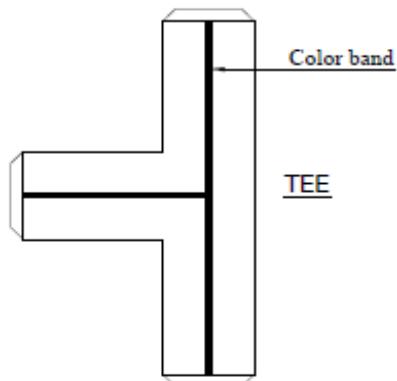
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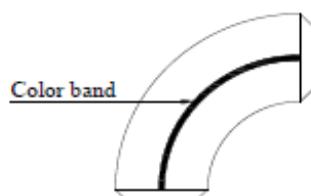
COLOR CODING WITH
ALUMINUM + OTHER PAINT



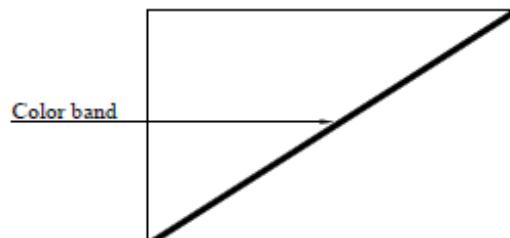
FLANGES



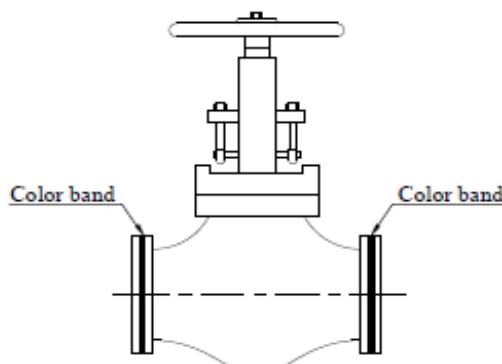
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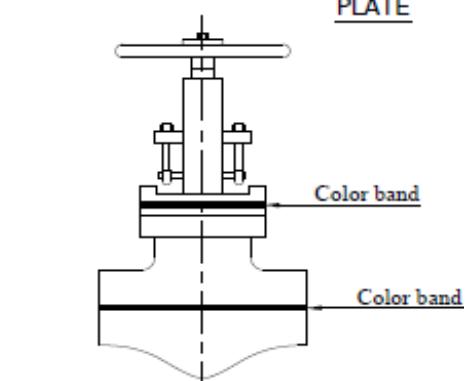
ELBOW



PLATE



FLANGED VALVE



WELDED OR FLANGELESS VALVE

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ANNEXURE – IV,
TESTING OF Cu-Ni ALLOY
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METHOD OF DETECTION OF HARMFUL OXIDE FILMS ON COPPER-NICKEL ALLOY TUBES

**Applicable to all grades of copper nickel tubes
(ASTM B 111, ASTM B 359)**

1.0 GENERAL

Informative: A Cu-Ni tube will passivate rather slowly. Generally, it will take a week before the surface is protected. In the meantime, pitting may occur under severe operating conditions. One reason may be that part of the tube is covered with cathodic oxides. To verify this, a measuring method has been developed. The principle of the method is to compare the corrosion (rest) potential E^a_{corr} of freshly abraded tube alloy with the rest potential E^t_{corr} of the tube bore in the as-received condition. The difference, ΔE , $E^t_{corr} - E^a_{corr}$, is a measure of the "nobility" of films on the tube bore surface. The larger the difference, the more cathodic is the tube. A clean, acceptable tube left in the atmosphere will develop an oxide film, which can be up to +0.070 volts cathodic compared to the bare material. Therefore, the criterion for acceptance has been taken as $\Delta E < +0.070$ volts.

The test shall be carried out by the tube supplier as part of the final quality control procedure. When the tubes are ordered according to ASTM B 111 or ASTM B 359, one (1) tube shall be tested per lot.

2.0 PROCEDURE

2.1 Cleaning

Prior to testing, the tube should be degreased thoroughly by pulling a soft cloth, soaked in a petroleum spirit, through the tube and repeating this until the cloth is clean. Allow the solvent to evaporate. The potential E^t_{corr} is noted 10 minutes after inserting the reference electrode.

2.2 Filling with KCl

One end of the tube is plugged with a rubber stopper and, with the tube either vertical or inclined, it is filled with a potassium chloride solution. To enable the steady-state potential to be reached quickly a dilute solution of potassium chloride (0.02 M or approximately 1.5 g/l) shall be used to fill the tube. Potentials shall be measured against silver/silver chloride reference electrode, also in 0.02 M KCl solution, so avoiding liquid junction potentials.

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TESTING OF Cu-Ni ALLOY

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2.3 Measuring potential of "as delivered condition"

Without undue delay the reference electrode, removed from its storage capsule, is carefully lowered into the tube to dip into the solution, so completing the circuit via high impedance millivolt meter, such as Fluke Model 8000 A. (The connections to the meter are: reference electrode to the ground (or black) terminal tube/crocodile clip (kept dry) to the positive (red) terminal).

Note: It is important to prevent the solution wetting either the tube exterior/crocodile clip junction or a freshly cut end of the tube since either possibility will result in false readings.

2.4 Measuring potential of "bare material"

To obtain the value for the freshly abraded tube alloy a piece of tube is stoppered as before with a rubber bung and the outer surface of the tube is abraded with silicon carbide paper under clean water to obtain a bright surface. This is rinsed first with clean water and then with the potassium chloride (KCl) solution (0.02 M) before being immersed in fresh KCl solution into which the reference electrode is placed. A crocodile clip is attached to a dry portion of the tube and the potential E^a_{corr} noted after 10 minutes.

3.0 INTERPRETATION OF RESULTS

For ASTM B111-C71640 alloy repeated measurements of many tubes have shown that E^a_{corr} determined by this method is -0.230 ± 0.010 volts.

An acceptable tube has the difference, ΔE , below $+0.070$ Volts

where $\Delta E = E^t_{corr} - (-0.230)$ volts,

e.g. for an acceptable tube E^t_{corr} may be found to be -0.180 Volts

so that $\Delta E = -0.180 - (-0.230)$

$= +0.050$ volts

whereas for an unacceptable tube E^t_{corr} would be more positive than -0.160 volts.

4.0 REMOVAL OF AN UNACCEPTABLE CATHODIC OXIDE FILM

Removal of an unacceptable cathodic film ($\Delta E > +0.07$ Volts) may be done by either blast cleaning or acid cleaning. After cleaning the test shall be repeated on representative samples.

5.0 CERTIFICATION

Manufacturers shall issue certificates showing that each (inspection) lot of tubes supplied is free of harmful films.

(Reference : Shell DEP 31.21.01.30 Appendix 2)