Purchase Specification for Plate & Frame Heat Exchangers

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Rev.	Date	Notes	By	Checked	Approved

Contents

1. GENERAL

1.1. Scope

1.1.1. This Specification together with the Requisition and Purchase Order with all Attachments covers the minimum requirements to be met by Supplier in the design, engineering, materials, fabrication, testing, inspection, painting, packing and delivery of Plate & Frame Heat Exchangers (here-in-after ; PHE) as shown in the following table.

Item No.	Q'ty	Description	Remarks
1-HE108	1	Lean Solution Water Cooler	
1-HE109	1	Lean Solution / Demi. Water Preheater	
1-HE112	1	Lean / Semi-Lean Solution Exchanger	

1.1.2. In the event that Supplier obtains any element of PHE from a Sub-Supplier, Supplier shall ensure that the requirements of this Specification and any associated documentation are incorporated in the sub-Order.

1.2. Alternative Design

Supplier may offer the alternative design, which is favourable for Purchaser from technical and commercial points of view. (Alternative design with another type of exchanger can be offered.) Purchaser will evaluate the alternative design, offered by Supplier, whether it is acceptable or not. The offering design shall include detailed specification, reference experience and standard criteria, if any.

2. INDUSTRY CODES and STANDARDS, and PROJECT SPECIFICATIONS

2.1. Industry Codes and Standards

2.1.1. The following Codes and Standards shall be applicable to this Order and form part of the Order. Current editions of the Codes and Standards including all mandatory addenda in effect at the time of the Order shall apply. If Supplier proposes other international Codes and Standards, Supplier shall inform Purchaser of its details in advance and shall obtain Purchaser's prior approval.

a) ASME Boiler and Pressure Vessel Code
Section VIII Division 1: Rules for Construction of Pressure Vessels
(ASME Code Certification Mark is required.)

b) API 662 Part-1 Plate Heat Exchangers for General Refinery Service

2.1.2. Any deviations from those Codes and Standards shall be submitted with the Quotation for Purchaser's acceptance, using SDR-5 format, but essential deviations will not be accepted by Purchaser.

2.1.3. Supplier shall ensure that the differences between various Codes and Standards can be well interfaced, coordinated and adaptable.

2.1.4. Supplier and Purchaser shall mutually determine the measures that must be taken to comply with local codes, regulations, ordinances and statutes, which will be applicable in the country where the PHEs are to be supplied and installed.

2.2. Applicable Project Specifications

2.2.1. Various Project Specifications listed in Paragraph 19 of “Documents attached to this Requisition” in the Requisition shall also be applicable for this Order.

3. SCOPE OF SUPPLY AND WORK

3.1. The Scope of Supply and Work shall be defined in the following Tables, but not be limited to these tables;

a) Table - 1 for Scope of Supply

b) Table - 2 for Scope of Work

Notes;

- Items marked with ■ at the column of “Supplier” shall be included in Supplier’s scope

- Items marked with ■ at the column of “Purchaser” shall be excluded from Supplier’s scope

- Scope of Supply / Work marked with “N/A” is not applied to this specification.

3.2. Scope of Supply

Table - 1 Scope of Supply

No.	Item of Supply	Scope		Remarks
		Supplier	Purchaser	
A. MAIN PARTS				
1	Heat Transfer Plates with their Gaskets	■	□	For Gasket PHE
2	Fixed Cover	■	□	For Gasket PHE
3	Movable Cover	■	□	For Gasket PHE
4	Tie Bolts and Nuts	■	□	For Gasket PHE
5	Carrying Bar (Top side)	■	□	For Gasket PHE
6	Guide Bar (Bottom side)	■	□	For Gasket PHE
7	Support Columns	■	□	For Gasket PHE
8	Follower Rollers for Movable Covers	■	□	For Gasket PHE
9	Sliding Plates for Sliding Side of Support Structure	■	□	For Gasket PHE
10	Welded Heat Tansfer Plate Packs	N/A	N/A	For Welded PHE
11	Top / Bottom Covers with Internal Lining Plates	N/A	N/A	For Welded PHE
12	Side Flanged Covers with Internal Lining Plates	N/A	N/A	For Welded PHE
13	Studs, Nuts and Gaskets for Flanged Covers	N/A	N/A	For Welded PHE
14	Guide Columns / Bars	N/A	N/A	For Welded PHE
15	Baffle Plates (Pass Plates)	N/A	N/A	For Welded PHE
16	Exchanger Supports (inc. Base Plate)	N/A	N/A	For Welded PHE
17	Nozzle Necks and Flanges for Connections	■	□	If necessary
18	Studs, Nuts, and Gaskets for Connections	■	□	
19	Liners in Nozzles or Connections	■	□	
20	Cover Flange with Bolts, Nuts and Gaskets for all of the Blanked-off Nozzles such as Vent/Drain	■	□	
21	Lifting Devices such as Lifting Lugs	■	□	
B. EXTERNAL ATTACHMENTS & ACCESSORIES				
1	Anchor / Set Bolts and Nuts	■	□	See Para. 4.7.12 & 4.7.13
2	Shim Liner Plates (For Height Adjustment)	□	■	
3	External Clips / Supports for Insulation / Fireproofing	■	□	
4	Plastic Thread Protections for Tie Bolts	■	□	For Gasket PHE
5	Earth Lug	■	□	
6	Name Plate and its Bracket	■	□	
7	Companion Flanges for Connections	□	■	

Table - 1 Scope of Supply (Continued)

No.	Item of Supply	Scope		Remarks
		Supplier	Purchaser	
8	Protective Metal Shround (Sprash Plate)	□	■	
9	Drip Tray	□	■	
10	Fire Protection Shround	□	■	
11	Welding Electrodes for Site Welding Portions	N/A	N/A	
12	Other External Attachments specified in Drawing, Datasheet and Specifications attached	■	□	If any
C. TRANSPORTATION PARTS				
1	Steel Covers for all Opening for Transportation	■	□	
2	Transportation Lugs, Saddles, Supports and/or Protections	■	□	If necessary
3	Pressure Gauge and Valves for Nitrogen Purge	■	□	Both Sides
4	Nitrogen Bottle for Nitrogen Purge into PHE during Transportation and Site Storage	■	□	If required
D. SPECIAL MATERIALS				
1	Insulation / Fireproofing Material	□	■	
2	Safety Valves and Other Valves	□	■	
3	Thermocouple and Pressure Gauge for Operation	□	■	
4	Instruments	□	■	
E. SPARE PARTS & SPECIAL TOOL				
1	Spare Parts - For Erection & Commissioning	■	□	See Appendix A
2	Spare Parts – For 2 Years Operation	■	□	See Appendix A
F. OTHERS				
1	All Parts shown on dwgs, datasheets and specifications attached	■	□	
2	Special Tool for Maintenance	■	□	If necessary
3	Touch-up Paint	□	■	

3.3. Scope of Work

Table – 2 Scope of Work

No.	Name of Work	Scope		Remarks
		Supplier	Purchaser	
A. DESIGN AND ENGINEERING				
1	Basic Design inc. Thermal and Hydraulic Performance Design	■	□	
2	Detail Design	■	□	
3	Code Calculation	■	□	
4	Structual Calcucation (including Wind Load / Seismic Load, and Site Hydrostatic Test Condition)	■	□	
5	Stress Analysis (inc. External Nozzle Load Calc.) (When Required by Code and/or other Documents)	■	□	
6	Design for Shop Fabrication	■	□	
7	Design for Transportation Condition	■	□	
8	Design for Site Welding	N/A	N/A	
B. PROCUREMENT				
1	All Material Procurement including Welding Rods / Consumables for shop welding, etc	■	□	
2	All Pre-Fabricated Parts Procurement	■	□	
3	Spare Parts Procurement	■	□	
C. FABRICATION				
1	Welder / Welding Operator Qualification Test	■	□	
2	Welding Procedure Specification (WPS)	■	□	
3	Welding Procedure Qualification Test (PQR)	■	□	
4	Welding	■	□	
5	Fabrication and Assembly	■	□	
6	Postweld Heat Treatment (PWHT) (According To Code and/or Datasheet)	■	□	If required
7	Edge Preparation for Site Welding	N/A	N/A	
D. INSPECTION AND TESTING				
1	Inspection and Testing	■	□	
2	Completion of Manufacturer’s Data Report	■	□	
3	ASME Code Certification Mark	■	□	See Para. 2.1.1.
4	Third Party Inspection (TPI)	■	□	See Para. 4.1.2.

Table – 2 Scope of Work (Continued)

No.	Name of Work	Scope		Remarks
		Supplier	Purchaser	
5	PMI(Positive Material Identification) for Pressure Parts and Non-Pressure Parts including Weld Materials except Carbon Steel	■	□	See Para. 6.1.2.
E. CLEANING AND PROTECTION				
1	Surface Preparation and Anti-Corrosive Painting	■	□	See Para. 5.1.1.
2	Finish Painting at Shop	■	□	
3	Painting for Transportation	■	□	See Para. 5.1.1. to 5.1.3
4	Cleaning and Descaling	■	□	
5	Acid Pickling and/or Solvent Cleaning	■	□	
6	Nitrogen Gas Purge for Transportation	■	□	See Para. 7.2.2. & 7.2.3
7	Chemical Cleaning at Shop	■	□	If required
F. PACKING AND SHIPPING PREPARATION				
1	Seaworthy Export Packing, Marking and Protection including Internal Protection	■	□	See Para. 7.3.2.
2	Fumigation Stamp (ISPM No. 15)	■	□	
3	FOB International Port	■	□	
4	Match Marking for Site Assembly	■	□	If necessary
G. CONTROL AND MANAGEMENT				
1	Schedule Control and Report	■	□	
2	Control Work for Sub-Supplier	■	□	
3	Arrangement for Meeting with KHI / Client	■	□	
4	Documents Preparation (For Review and Final) and Transportation	■	□	
5	Photographs During Fabrication	■	□	
H. SITE WORK				
1	Supplier Serviceman at Site	N/A	N/A	
2	All of Work at Site	□	■	

3.4. Extent of Assembly

3.4.1. PHE shall be fully assembled / completed at shop. All accessories including insulation supports shall be completely installed on the exchanger body at shop before shipping, unless otherwise specified.

3.5. Information for Quotation Purpose

The following information is tentatively prepared for the quotation purpose.

3.5.1. Nozzle projection;
When nozzle projection is not specified on datasheet at bid stage, nozzle projection shall be estimated using nozzle height from the outside surface of Fixed Plate or Flanged Covers as shown below. (This requirement shall be ignored when studded connection is applied.)

Nozzle size	Nozzle height from the outside surface of Fixed Plate/Flanged Covers
1/2" to 3"	150mm
4" to 8"	180mm
10" to 16"	230mm
18" to 20"	250mm
24"	280mm

3.5.2. [Intentionally Blank]

4. DESIGN AND FABRICATION

4.1. General

4.1.1. All items and materials used to construct PHE shall be designed and fabricated in accordance with the applicable Codes / Standards, and Drawings / Datasheets / Specifications listed in Paragraph 19 "Documents Attached to This Requisition" of the Requisition, where such items fall within the scope of those documents.

4.2. Language

4.2.1. All Supplier's and Sub-Supplier's documents and drawings shall be in both English and Russian languages. In case of any discrepancies between the text in Russian and English languages, English text will prevail.

4.3. Measuring Units

4.3.1. All Supplier's and sub-Supplier's documents and drawings shall have SI units, except the units specified in Appendix-B.

4.4. Site Climatic Conditions

a) The lowest one-day mean ambient temperature (LODMAT): -35 °C

b) Design Wind Data;
Wind design load for equipment shall be referred to the Project specification "9103-U00DS01: Wind Design Loads for Structures and Equipment".

Average wind speed: 4.3m/s
Wind load (at height of 10m above ground level): 0.23 kPa

c) Design Seismic Data;
No Earthquake design is required.

d) Design Snow Load: 1,200 N/m^2

e) Condition of Cooling Water;

Constituent	Unit	Cooling Water
Calcium	mg/l as $CaCO_3$	< 250
Chloride	mg/l as Cl	< 175
Total Dissolved Solid	mg/l	< 1,320
PH	-	7 - 8.5
Total Suspension Solid	mg/l	< 20

4.5. Materials

4.5.1. The use of the items containing asbestos exceeding 0.1% of the weight is prohibited.

4.5.2. Normally the individual material specifications are specified on the drawing and/or datasheet. When the individual material specifications are not specified on the drawing and/or datasheet, materials for both pressure parts and non-pressure parts of PHE shall be selected in accordance with Table I of Project specification "9103-D00DS01: Material Selection / Pressure Vessel, Heat Exchanger and Tank".

4.5.3. For material restriction in fertilizer plants, refer to Project specification "9103-P50DS04".

4.5.4. Each heat transfer plate should be press formed from one plate material without any welding. Welding construction with two or more sheets / plates will never be accepted.

4.5.5. Nozzles up to NPS 12 shall be of seamless pipe.

4.5.6. The weld neck flanges and their cover flanges of all ratings shall be of the following construction:

a) Carbon steel, low and intermediate alloy steel: Solid forged or as specified

b) Stainless steel: Solid forged S.S. or Forged C.S with 3 mm th'k min. S.S lining or weld deposit

4.5.7. Carbon Content and Carbon Equivalent for Carbon Steel;
Carbon content and carbon equivalent for carbon steel shall satisfy requirements of Paragraph 4.1 of Project specification 9103-D00DS01.

4.6. Performance Design (Thermal / Hydraulic Design)

4.6.1. PHE shall be thermally / hydraulically designed by Supplier under Supplier's full responsibility.

4.6.2. Thermal / hydraulic design of PHE shall be performed in accordance with all requirements specified in the applicable code / standard, datasheet and Project specification "9103-H10DS01: Supplement Specification for API 662 /ISO 15547 Plate Heat Exchangers".

4.6.3. PHE shall be designed minimum 25% of excess overall heat transfer coefficient as an overall fouling allowance, unless otherwise specified in this Purchase specification or datasheet. (See Para.7.4 of Project specification 9103-H10DS01.)

4.6.4. All PHE shall be thermally / hydraulically designed for 110% design duty, unless otherwise specified in this Purchase specification or datasheet.

4.7. Mechanical Design

4.7.1. Mechanical design of PHE shall be carried out in accordance with the applicable code / standard and Project specification 9103-H10DS01.

4.7.2. PHE shall be mechanically designed for the static and dynamic loading imposed, based upon the volumes and densities indicated on datasheets and specified wind and earthquake code requirements.

4.7.3. PHE shall be designed so that those can withstand 50% of design wind load during the site hydrostatic test at corroded condition as specified in Paragraph 7.1.8 of Project specification 9103-H10DS01. Calculations shall be submitted to Purchaser for review.

4.7.4. Minimum design metal temperature (MDMT) of PHE ;
The lowest one-day mean ambient temperature (LODMAT) is -35 °C . (See Paragraph 4.4.a).)
Supplier shall advise the minimum permissible operating temperature in the full pressurized condition, in accordance with the code, to be stated in the nameplate.
Metal temperature of PHE at full pressurized condition during start-up shall be assumed as same temperature as LODMAT.
If there is a possible need to conduct a hydrostatic test at midwinter, then MDMT shall be at least 17°C colder than the anticipated hydrostatic test water temperature.
The minimum design metal temperature (MDMT) must not be warmer than -35°C at the design pressure.

4.7.5. Stainless steel lining may be provided on the inside surface of C.S. fixed plates / movable covers instead of solid stainless steel covers. The lining thickness on cover plates and connections shall be 3 mm as a minimum.

4.7.6. Threads of all pressure bolting shall be in accordance with ASME B 1.1 as follows : Threads of all the other bolting shall be metric threads.

a) 1” and smaller : Coarse Thread Series (UNC) Class 2A/ 2B
b) 1-1/8” and larger : 8 Thread per Inch Series (8UN) Class 2A/ 2B

4.7.7. Supplier shall design PHE to withstand the nozzle loads stated in Project specification “9103-D00DS05: Standard Drawings for Vessels, Tanks and Heat Exchangers (D-180E: Nozzle Loads)”.

4.7.8. All standard flanges including class 150 shall be welding neck or long welding neck type, unless the application of the studded connection is specified in datasheet

4.7.9. All connections shall be located on Fixed Cover Plate for Gasket Type Plate Heat Exchangers.

4.7.10. All connections shall be attached by welding completely through the total thickness of Fixed Plate / Flanged Covers.

4.7.11. Any nozzle opening on weld seam of Fixed Plate / Flanged Covers is not acceptable.

4.7.12. Anchor bolt;

Anchor bolts shall be designed in accordance with the following assumption.

a) Anchor bolt shall be selected from Project specification “9103-C02DS02: Anchor Bolt Standard”.

b) Type of anchor bolt: Per Paragraph 2.2 of Project specification 9103-C02DS02.
Although single nut is indicated on 9103-C02DS02, double nuts shall be adopted for this Project. In addition, projection from top of concrete shall also be adjusted.

c) Grout thickness shall be 50mm.

d) Embedded length (H) shall be verified using allowable adhesive stress of 1.8 N/mm^2.
Embedded length shall be adjusted based on the calculation results.

e) In case of alloy anchor bolt such as SA193 Gr.B7, welding between anchor bolt and sleeve is prohibited.

4.7.13. 3 mm corrosion allowance on the diameter shall be considered for anchor bolts / set bolts.

4.7.14. Gaskets for heat transfer plates shall be installed on them without any glue.

4.8. Fabrication

4.8.1. Fabrication shall be carried out in accordance with the applicable code and Project specification 9103-H10DS01.

4.8.2. Welding shall be carried out in accordance with the applicable code and Project specification "9103-G57GS01: General Welding Requirements".

4.8.3. Laser welding may be applied on assembly welding of plate packs for welded plate type heat exchangers, if accepted by Purchaser.

4.8.4. FCAW shall not be used as specified in Para.4.2.9.1 of 9103-G57PGS01.

4.8.5. Preheating, Postheating and Postweld Heat Treatment shall be carried out in accordance with the applicable code and Project specification "9103-D00PS15: General Requirements for Preheating, Postheating and Postweld Heat Treatment".

4.8.6. Stainless steel and high alloy steel used for PHE shall meet all requirements of Project specifications "9103-D00PS17: General Requirements for Stainless Steel and High Alloy Steel / Cleaning and Storage" and "9103-D00PS19: General Requirements for Stainless Steel and High Alloy Steel / Handling During Fabrication".

5. PAINTING AND INSULATION / FIREPROOFING

5.1. Painting

5.1.1. Painting shall be carried out in accordance with Project specification "9103-Z51PPS02: "Specification for Supplier's Standard Paint and Coatings". Supplier shall advise the applicable coating specification for each PHE for Purchaser's review.

5.1.2. All external pressure bolting, which includes tie bolts for plate pack, shall be coated with anti-seize & lubricating compound. Hot Dip Galvanized bolting may be used instead of coating.

5.1.3. Temporary supports and covers which will be removed at site shall be coated with yellow paint.

5.2. Insulation/Fireproofing

5.2.1. Insulation and/or Fireproofing will be installed at site by others as specified in PHE Datasheet.

5.2.2. Unless otherwise specified, the following density of Insulation/Fireproofing shall be adopted for loading data.

a) Insulation: 2,000 N/m^3
b) Fireproofing: 5,000 N/m^3

6. INSPECTION AND TESTING

6.1.1. Inspection and testing shall be carried out in accordance with applicable code, Project specification "9103-G41QC12: QA/QC Requirements for Equipment and Materials", 9103-H10DS01 and "Inspection and Test Plan (ITP)"(See Appendix C) for each item. Detailed inspection procedures and schedule will be discussed at the Pre-Inspection Meeting or by the correspondence, and agreed by Purchaser before commencement of fabrication.
Pre-Inspection Meeting on ITP is changed from "W" (witness) to "H" (hold point).

6.1.2. Positive Material Identification (PMI) per Project specification "9103-G40QC10: Positive Material Identification (PMI)" is required for all pressure parts and non-pressure parts including weld materials except for carbon steel.

6.1.3. Minimum 5% of heat transfer plate shall be dimensionally inspected after cold pressing for each plate type.

6.1.4. Minimum 5% of heat transfer plate shall be PT examined after cold pressing for each plate type.

6.1.5. Hydrostatic test shall be separately performed for hot side / cold side with atmospheric pressure on the other side.

6.1.6. Supplier's standard inspection and testing of heat transfer plates after press forming and the extent of them shall be advised. Supplier's standard inspection may be accepted instead of the requirements on Para. 6.1.3 and 6.1.4 after the review of Supplier's standard inspection.

6.1.7. Inspection of third party inspection agency;
Inspection of third party inspection agency assigned by Russian government will be required.
Inspector(s) of third party inspection agency will be dispatched by Purchaser.
Necessary cost and fee in order to obtain inspection by inspector(s) of third party inspection agency shall be included in the scope of Supplier's supply/work at bid stage.

7. PACKING, MARKING, PREPARATION FOR SHIPMENT AND TRANSPORTATION

7.1. General

7.1.1. All PHE shall be properly packed and marked in accordance with the requirements specified in the following project specifications:

a) "9103-G45GS01 : General Packing Instructions"

b) "9103-G50GS01 : Shipping Instructions"

7.1.2. The procedure for the final preparation of shipment shall be submitted to Purchaser for review and approval.

7.2. Rust Prevention

7.2.1. Generally rust prevention shall be carried out in accordance with Project specification "9103-Z60GS03: Rust Prevention Requirements for Equipment and Materials at Supplier's Shop".

7.2.2. Internal rust prevention of PHE shall be nitrogen charge (nitrogen pressure: 1.0 barg) with globe valves, pressure gauge and protection of globe valves and pressure gauge.
The required quantities of globe valves and pressure gauge are as follows.

a) Nitrogen supply side: 2 globe valves (One for nitrogen supply, one for pressure gauge check) with1 pressure gauge

b) Purge side: 1 globe valve

For standard arrangement of globe valves, pressure gauge and protection, see 9103-D00DS05 (D-701E: Valve and Gauge for Nitrogen Supply/Purge).

Application of Vapor Phase Inhibitor (VPI) and/or Desiccant is not acceptable.

7.2.3. Acceptance Criteria of Nitrogen Charge;

Relative humidity of the inside of PHE shall be less than 40% at the lowest ambient temperature (-35 °C) likely to be experienced in shipping and storage.
Actual relative humidity of PHE inside shall be verified by measuring of dew point of purge nitrogen gas from PHE.

7.2.4. For rust prevention of bolts and nuts of flanges portions, all flanged connections shall be covered with heavy-duty plastic bags securely taped to the nozzles in addition to anti-seize & lubricating compound.

7.3. Transportation

7.3.1. Transportation Loads
The following loading conditions shall be taken into consideration for the transportation of PHE. PHE packing shall be suitable for these loading conditions.

Transportation Mode	Vertical Acceleration		Lateral Acceleration	Longitudinal Acceleration
	Downward	Upward		
Truck	1.7g	0.5g	0.3g	1.8g
Rail	2.0g	2.0g	2.0g	3.0g
Inland Barge	1.0g	0.2g	0.75g	0.4g
Oceangoing Ship or Barge	2.0g	2.0g	0.75g	0.4g

Notes:
a) Where multiple modes of transportation are used, the most severe condition governs.
b) 1.0g would be a load equal to the weight of PHE.

7.3.2. PHE may be transported to the jobsite as above-deck cargo. Supplier shall be responsible for ensuring that PHE is adequately protected during shipment as above-deck cargo. Austenitic and high nickel alloy steels used in PHE shall not be exposed to wetting by salt water or salt spray.

7.3.3. Anchor bolts shall be shipped separately earlier than PHE.
Delivery date will be informed at an order.

8. GUARANTEE

8.1. Supplier shall guarantee that PHE supplied shall achieve the thermal performance, hydraulic performance and mechanical performance as specified in PHE datasheet.

8.2. In the event that any defect is found and/or any guaranteed performance is not satisfied, PHE shall be supplemented, repaired or replaced at Supplier's own expense.

8.3. If insufficient thermal or hydraulic performance is due to Supplier's detail design, fabrication, or inspection, PHE shall be supplemented, repaired or replaced at Supplier's own expense.

8.4. Failure of PHE due to insufficient written instructions submitted by Supplier shall also be considered under Supplier's responsibility. On this case, PHE shall also be supplemented, repaired or replaced at Supplier's own expense.

Appendix A

1. Requirements for Spare Parts

All Spare Parts shall be supplied by Supplier in accordance with Project specification “9103-G65PS01: Spare Parts Requirements”.
Project specification 9103-G65PS01 defines the requirements of "Spare Parts List (SPIR Form) Preparation", "Identification Tags", "Packing" and "Delivery".

2. Applicable Spare Parts List

The following Spare Parts List is applicable for Plate and Frame Heat Exchangers.

Category : **Plate and Frame Heat Exchangers**

No.	Spare Item	Erection & Commissioning Spare	(2 Years) Operational Spare	Remarks
1	Heat Transfer Plates	0%	5% per each type	Q'ty specifed in datasheet to be applied.
2	Gaskets for above Plates	0%	100%	
3	Tightening Bolts/Nuts for Gasketted Heat Transfer Plates	0%	5% (Min. 2sets) per each type	
4	Gaskets for Nozzle Flanges with Cover Flanges	100%	200%	
5	Bolts & Nuts for above Flanges	5% (Min. 2sets) per each type	5% (Min. 2sets) per each type	
6	Gaskets for Studded Port Nozzles	100%	200%	
7	Bolts & Nuts for above Flanges	5% (Min. 2sets) per each type	5% (Min. 2sets) per each type	

Note 1) "% qty" means a percentage for total installed quantity of entire Project. When a calculated value becomes the decimal point, decimal point shall round up to the next whole number.

2) Wherever "Each Type" is specified, it means "of the Type/Make/Model/Size/Rating and correctly Replaceable".

Measuring Units

The following units shall be used for all documents and drawings on this project.

Area	:	m^2
Density, Mass Concentration	:	kg/m^3
Flow Rate, Mass	:	kg/hr
Force	:	N
Heat Capacity, Specific Heat	:	kJ/kg^oC
Heat Content, Enthalpy	:	kJ/kg
Heat Duty	:	W, kW, MW
Heat Transfer Coefficient	:	$W/m^{2o}C$
Length	:	m, mm
Mass	:	kg, ton (= 1,000kg)
Moment, Torque	:	N m
Nominal Size of Pipe/Flange	:	inch
Nominal Size of Pressure Bolting	:	inch
Pressure, Absolute	:	Pa(a), kPa(a), MPa(a)
Pressure Gauge	:	Pa(g), kPa(g), MPa(g)
Pressure, Differential	:	Pa, kPa
Surface Tension	:	N/m
Temperature	:	^oC
Thermal Conductivity	:	$W/m\ ^oC$
Time	:	hr, s
Velocity	:	m/s
Viscosity	:	mPa s
Volume	:	m^3

Inspection and Test Plan (ITP)

Abbreviation
Owner : JSC ShchekinoAzot
KHI : Kawasaki Heavy Industries, Ltd.
MOM : Minutes of Meeting
R : Review of Record
W: Witness
- : Not Perform
E : Execute by manufacturer / Sub-Supplier
SW : Spot Witness
H : Hold Point
O : Submit Record

Inspection and Test Item	Inspection by			Record	Remarks
	Owner	KHI	Supplier		
MEETING					
1. Pre-Inspection Meeting	-	H	E	MOM	
MATERIAL					
1. Material Certificate	R	R	E	O	
2. Identification Raw Marking	R	SW	E	O	As Built Sketch
3. NDE(PT) of Material	R	R	E	O	Incl. UT of thicker plates and forgings
4. Visual / Dimension	-	SW	E	O	
5. Positive Material Identification (PMI)	R	SW	E	O	When PMI is required.
PRE-FABRICATED PARTS					
1. Visual / Dimension of Pre-fabricated Parts	-	SW	E	O	Heat Transfer Plates
2. NDE of Pre-fabricated Parts	R	SW/R	E	O	Heat Transfer Plates
WELDING					
1. Material Certificate for Welding Consumables	R	R	E	O	
2. WPS / PQR / Weld Map	R	R	E	O	To be submitted prior to welding
3. New PQR	R	SW	E	O	
4. Welder & Welding Operator Qualification	R	R	E	O	Welder & Welding Operator List
5. Fit-Up Inspection	-	SW	E	-	
6. NDE of Edge Preparation	R	SW/R	E	O	
7. Monitoring of Welding	-	SW	E	-	
8. Back-Chipping Inspection	-	SW	E	O	MT (or PT), if applicable
9. NDE (RT/UT/MT/PT)	R	SW/R	E	O	In case of RT, Films to be reviewed.
10. Visual / Appearance	-	SW	E	-	

Inspection and Test Plan (ITP)

Abbreviation			R : Review of Record	SW : Spot Witness
Owner : JSC ShchekinoAzot			W: Witness	H : Hold Point
KHI : Kawasaki Heavy Industries, Ltd.			- : Not Perform	O : Submit Record
MOM : Minutes of Meeting			E : Execute by manufacturer / Sub-Supplier	

Inspection and Test Item	Inspection by			Record	Remarks
	Owner	KHI	Supplier		
11. Heat Treatment	R	R	E	O	When required (Heat Treatment Chart)
12. Hardness Test	R	SW	E	O	When required
13. Production (Impact) Test	R	SW	E	O	When required
14. Ferrite Check for S.S. Weld	R	SW	E	O	When required
15. PMI	R	SW	E	O	When required
16. Chemical Analysis for Overlay Weld	R	SW	E	O	When required
ASSEMBLY					
1. Visual / Appearance	SW	SW	E	O	
2. Dimensions	SW	W	E	O	
3. Assembly	-	SW	E	O	
4. Hydrostatic Test	W	H	E	O	
5. Cleaning Check	-	SW	E	-	
6. Painting / Coating	R	W	E	O	
7. Nitrogen Gas Purge	-	SW	E	-	
8. Marking Inspection	-	W	E	-	Tag, Accessories
9. Nameplate	R	SW	E	O	
10. Final Inspection Report	R	R	E	O	
11. Inspection of Quantities	SW	W	E	-	Packing List
12. Packing Inspection	SW	W	E	-	Packing List

Note 1. Based on this Inspection Plan along with the requisition, datasheets and drawings or other documents in the requisition package, Supplier shall issue the detailed “Inspection and Test Plan” and get acceptance by Purchaser before starting of any inspection.

2. Spare parts and special tools, when required, will be subject to the above inspection items as applicable.
3. Above “Inspection and Test Plan” does not include the Authority Inspection required by Code, Regulation, etc.