

		“HP S&T EXCHANGERS- HYDROCRACKER UNIT(UOP)”	OUR REF.
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1. **SCOPE OF SUPPLY AND OF WORK**

Our offer takes into account a scope of supply including the following activities :

YES	NO	ACTIVITY
X		Mechanical Design
X		Process Design & vibration verification
X		Assembly and Detail Fabrication Drawings
X		Construction Program
X		Welding Procedures
X		Materials Procurement
X		Equipment Manufacturing
X		Testing and Control Program
X		Heat Treatment
X		Inspections
X		Data Book
X		Packing & Shipping preparation
X		Delivery Ex Works

2. **DESIGN OF THE OFFERED EQUIPMENT/S**

The equipment/s will be designed, fabricated, inspected and tested according to the following codes and regulations :

YES	NO	CODES and REGULATIONS
X		ASME VIII Div 1 2004Ed + 2006 Addenda U STAMP
	X	ASME VIII Div 2 2004Ed + 20069 Addenda
X		TEMA 8th Edition, class R
	X	AD Merkblatter 2001 Edition
	X	PD 5500 Latest Ed
	X	European Pressure Vessels Directive (PED)

The equipment/s will be designed taking into account the following loads :

YES	NO	DESIGN LOAD
X		Internal Pressure
X		Nozzle Loads
X		Self Weight (also for lifting calculation)
	X	Differential Thermal Expansions Between Shell & Tubes for fixed tubesheet ex-changers
X		Wind Loads
X		Earthquake Loads
	X	Blast Loads
	X	Cyclic Loadings (Fatigue)

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3. **REFERENCE DOCUMENTS**

The quotation has been made in accordance what indicated in the “SCOPE OF WORK”

4. **DESCRIPTION OF THE SUPPLY**

4.1 Equipment/s Materials Description:

4.1.1

EQUIPMENT SERVICE : FEED EFFLUENT EXCHANGER		
ITEM :		
TEMA TYPE : DEU 2		
SHELL SIDE		
Element	Material	Notes
Flat Cover	-	
Shell Ellipsoidal Head	A-516 Gr. 70	Thk = 13 mm
Shell Barrel	A-516 Gr. 70	Thk = 13 mm
Shell Side Girth Flanges	A-266 Gr. 2	
Nozzle Hubs	A-266 Gr. 2	
Nozzle Flanges	A-105	
Bolts / Nuts	A-193 Gr. B7 / A-194 Gr.2H	ANSI threads / metric threads ; tightened with tensioners when d > 2.0”
Gaskets	Spiral Wound 316 SS + Inner Ring	
Baffles	A-285 Gr.C	
Tie Rods	Tp 316 SS	
Spacers	Tp 316 SS	
Saddles / Supports	A-516 Gr 70 / A-285 Gr.C	
TUBE SIDE		
Element	Material	Notes
Exchanger Tubes	A-213 Tp 316L	Seamless, MW
Flat Cover	A-266 Gr.2	
Channel Ellipsoidal Head	-	
Channel Barrel	A-516 Gr.70 + 316L clad	Thk = 50+3 mm
Channel Side Girth Flanges	A-266 Gr.2 + 316L W.O.	
Pass Partition Plates	A-240 Tp 316L	
Nozzle Hubs	A-266 Gr. 2 + 316L W.O.	
Nozzle Flanges	A-105 + 316L W.O.	
Bolts / Nuts	A-193 Gr. B7 / A-194 Gr.2H	ANSI threads / metric threads ; tightened with tensioners when d > 2.0”
Stationary Tubesheet	A-182 F316L	Bolted-Thru
Floating Head Flange	A-182 F316L	
Floating Head Back.Ring	A-182 F316L	
Floating Tubesheet	A-182 F316L	Not Bolted-Thru
Floating Head Dished Cover	A-240 F316L	
FH Bolts Nuts	A-193 Gr.B8M	ANSI threads / metric threads ; tightened with

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		tensioners when d > 2.0”
Gaskets	Spiral Wound 316 SS + Inner Ring	
Internal Expansion Joint	Inconel 625	Thin Wall Single Ply
External Expansion Joint	-	-

DESIGN NOTES :	
1	Ref. Spec. : The limit ratio 1.2 between nozzle thickness and shell thickness has NOT been considered since nozzles have been considered to be “swept-type” (i.e. with hub for butt-welding)
2	Ref. : Equipment Data Sheet : The Design Pressure shown in the datasheet has been assumed to include any pressure drop and/or static head. Client to confirm.
3	The following mean metal temperatures have been assumed for the purpose of sizing the internal expansion joint : Shell Side MMT = 50°C / Tube Side MMT = 120°C. No different design conditions have been accounted for.

MATERIALS NOTES :	
1	Ref. Spec. : According to our understanding of this Specification, no intergranular corrosion tests have been considered on 316L SS plates and forgings. Client to confirm.
2	Ref. Spec. : No HIC testing have been considered on carbon steel plates as we understand that the equipment is NOT in sour service. Client to confirm.
3	Ref. Spec. : mechanical tests frequency considered is one per each heat and not one per each plate. Client to confirm our understanding is correct.
4	Ref.Spec. : Channel plates are cladded by lamination / or weld overlayed
5	Ref.Spec. : weld overlayed cylindrical courses are done using a one-layer ESW welding process, using 309L Nb strip to achieve the required chemical analysis at 3 mm depth ; nozzles are weld overlayed with a two-passes process.
6	Ref. Spec. : Ferrite Content will be from min 3% to max 10% befor PWHT if applicable

OTHER NOTES :	
1	Tube-to-tubesheet Welded Joints : strength welded with single pass weld + light expansion
2	Tubesheet-to-shell attachment to Fig.Uw.13.2(i) (without hub) / to Fig.Uw.13.3 (with hub)
3	Bolted Tubesheets are NOT “bolted-thru” i.e. the tubesheet OD is less than the mating flange OD

5. **INSPECTION GUIDELINES**

The inspection of the equipment will be done by Mangiarotti personnel. Off course Client’s representatives will have free admittance to Mangiarotti facilities.

The following certificates will be provided to record the inspections performed :

5.1 **Material Certificates**

Mill test certificates will be provided for all the materials utilised for the equipment manufacturing, and for all pressure parts and for main non-pressure or structural components and shall be in accordance with the applicable specifications.

Certificates **3.1.B** shall include :

- origin of materials
- grade of material and relevant specification

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- number of heats
- chemical analysis
- mechanical properties

5.2 Destructive & Non-Destructive Test Certificates

A certificate will be supplied to specify type, extensions, and conditions of the controls. These certificates will be examined by the Inspectors for completeness and correctness of execution and results against Code and order requirements.

The certificates shall at least cover the following :

- magnetic particle examination
- dye penetrant control
- ultrasonic examination
- radiographic examination
- welded coupons certificates

When required by the applicable Code or by the applicable order specifications, the production welded coupons shall be tested according to the relevant specifications. Compliance with specs shall be verified by the Inspectors. A “Quality Control Plan” will be issued for approval summarizing the type and extent of the controls to be performed.

5.3 Visual Inspection & Dimensional Check

The inspections will be performed inside & outside by visual inspection. The following items will be inspected :

- general metal surface conditions (check of flaws, slags, lamination)
- flange facings
- welded joints
- alignment of circumferential and longitudinal joints
- check of back welding
- etc

At least the following dimensional checks will be performed :

- elevation and orientation of nozzles and other connections
- diameters of nozzles and connections
- main equipment dimensions
- anchor plates dimensions
- wall thicknesses of pressure and structural components

The results of the above dimensional checks will be reported on the dimensional check certificates. Any non-conformance with the applicable specs etc will be highlighted in the relevant acceptance report.

5.4 Engineering and Quality Control Documentation

The following documents will be submitted to Client for approval and or review :

YES	NO	DOCUMENT
X		Setting Plan Completed With Baseplate Info and Foundation Loads
X		Fabrication Drawings Including Foundation Loads
X		Calculation Dossier (Mechanical) for Pressure and Main Structural Parts
	X	Process Calculations
	X	Finite Element Analysis Report
X		Quality Control Plan
X		Welding Book including Welding Procedures and Procedure Qualification Records
X		NDE Procedures
	X	Heat Treatment Procedure
X		Soapy Solution Leak Test Procedure
X		Hydrotest Procedure

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X		General Fabrication Plan
X		Lifting and Shipping Instructions
X		Handling and Preparation for Shipment Procedure

5.5 Non Destructive Examinations

Based on the wall thicknesses of the equipment, on the applicable Code and on the order specifications, the following non-destructive examinations examinations are included :

Referenced Specification : which has been interpreted as follows :		
YES	NO	TYPE OF NDE
X		X-Rays or Gamma Rays (before PWHT if required) on main longitudinal and circular joints
	X	UT before PWHT on main longitudinal and circular joints
X		UT (before PWHT if required) where the geometry does not make it possible to perform the X-RAYS
	X	X-Rays or Gamma Rays after PWHT on main longitudinal and circular joint
	X	UT after PWHT on main longitudinal and circular joints
	X	TOFD before PWHT on main longitudinal and circumferential joints
	X	TOFD after PWHT on main longitudinal and circumferential joints
X		MT or PT or UT on nozzles as required by the applicable Code
X		Other NDE's as required by the Applicable Code
X		DPI examination for tube-to-tubesheet end welds
X		Soapy solution air test for tube-to-tubesheet joints
	X	Helium testing for tube-to-tubesheet end welds
	X	X-Ray examination for tube-to-tubesheet end welds

5.6 Heat Treatments

Referenced Specification : which has been interpreted as follows :		
YES	NO	TYPE OF HEAT TREATMENT
X		PWHT
	X	Intermediate Stress Relieving (ISR) – for 2-1/4 Cr 1 Mo plates
X		Dehydrogenation Heat Treatment after welding (DHT) in lieu of ISR – for 2-1/4 Cr 1 Mo plates

5.7 Final Inspection Book

A final inspection book will be provided including the following :

- fabrication drawings
- calculations
- material certificates
- WPS's and welders/operators qualifications
- certificates of inspections and controls performed including dimensional controls
- certificates of RX/UT test
- certificates of production test coupons

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- certificates of hydrotest
- final release note

6. **SURFACE PREPARATION**

The external surfaces of the equipment will be prepared in accordance with the following :

Referenced Specification : which has been interpreted as follows :		
YES	NO	TYPE OF EXTERNAL SURFACES PREPARATION :
X		Sandblasting SA 2-1/2
X		Primer Coat - 75 µ dft
	X	Intermediate Coat
	X	Finish Coat
X		Bolting Coated with protective Molikote P37
	X	Bolting are Cadmium Plated

The internal surfaces of the equipment will be prepared in accordance with the following :

Referenced Specification : which has been interpreted as follows :		
YES	NO	TYPE OF INTERNAL SURFACES PREPARATION :
X		Drying
X		Cleaning
	X	Pickling & Passivation
	X	Internal Sandblasting
	X	Mechanical or Electro-Polishing
	X	Internal Linings (Glass Flake, Epoxy, Teflon...)

7. **SHIPPING PREPARATION**

The equipment will be dried after the hydrotest, then cleaned, and the following preparation will be adopted for the shipping :

Referenced Specification : which has been interpreted as follows :		
YES	NO	TYPE OF PREPARATION
X		Plastic covers for non-blinded nozzles
X		Protection against moisture using dessiccant bags
	X	Equipment filled with Nitrogen, including all the accessories (gauge, hoses, spare bottle)
	X	Equipment filled with Rust Inhibitor
X		Wooden / Steel Temporary Shipping Saddles

8. **LIMITS OF SUPPLY**

The following items are included in our supply :

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INTERNALS		
YES	NO	Item
X		Impingement Plate
X		Bundle Runners
	X	Sacrificial Anodes

EXTERNAL ATTACHMENTS, ACCESSORIES		
YES	NO	Item
X		Supporting Element : Skirt / Saddles / Brackets / Legs
X		External Clips for Platforms / Ladders / Piping : up to the a maximum amount of 50 Kg ; exceeding kilograms will be accounted for at a per-kilo rate
X		Lifting Lugs / Trunnions / Lifting Cover and Tailing Lugs for Lifting the Equipment
X		Insulation Supports (assumed insulation thk is mm ; client to confirm)
	X	Template for Anchor Bolts
X		Earthing Bosses
X		Nameplate and relevant Bracket
X		Blind Flanges completed with bolts, nuts, and gaskets for manholes & handholes
	X	Companion Flanges c/w bolts, nuts, and gaskets for the rest of the nozzles
	X	Anchor Bolts
	X	Instruments & Valves if / where required
	X	Lifting Beam or Lifting Frame including Ropes and Shackles
	X	Insulation / Fireproofing : Supply & Installation
	X	Bolt Tensioning Device (Heads, Connection Hoses, Pump System)

INSPECTIONS & CERTIFICATIONS		
YES	NO	Item
	X	U Stamp
	X	National Board Registration
X		TPI Inspection (in addition to the inspection made by the ASME Authorised Inspector)
	X	CE Marking
	X	Design Appraisal (as required to comply with CE marking)
	X	Compliance with EN Directive 94/9/CE (ATEX) for equipments in potentially explosive atmospheres

SPARE PARTS		
Startup & Commissioning Spares		
YES	NO	Item
X		2 sets of gaskets excluding welded diaphragms / lip seal gaskets
X		10% bolts