

		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SPECIFICATION FOR PRETREATMENT CUM ONSTREAM CLEANING OF RECIRCULATING COOLING WATER.	Project No. 080557C001	Document No. 080557C-000-JSC-0093-002		Rev. No. 0	Page 1 of 7

## JOB SPECIFICATION FOR PRETREATMENT CUM ONSTREAM CLEANING OF RECIRCULATING COOLING WATER

0	04/12/2019	ISSUED FOR IMPLEMENTATION	KMK	TNVS	TNVS	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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## TABLE OF CONTENTS

1. Introduction:.....	3
2. Definitions & Abbreviations.....	3
3. General .....	4
4. Pre Treatment Inspection.....	4
5. Flushing .....	4
6. Cleaning with Low pH Water .....	4
7. Phosphate/Phosphonate Cleaning cum Passivation .....	5
8. Monitoring.....	5
9. Pre-Treatment Evaluation .....	6
10. Specification of Chemicals.....	6
11. Safety Precautions.....	6
12. Technical Supervision and Quality Acceptance .....	7



 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
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## 1. Introduction:

**INDIAN OIL CORPORATION LIMITED (IOCL)** has awarded Fax of Acceptance (FOA) dated 29<sup>th</sup> August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

## 2. Definitions & Abbreviations

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

 	<b>PROJECT</b>		<b>Standby SRU &amp; Additional Tanks</b>	
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JOB SPECIFICATION FOR PRETREATMENT CUM ONSTREAM CLEANING OF RECIRCULATING COOLING WATER.	<b>Project No.</b> 080557C001	<b>Document No.</b> 080557C-000-JSC-0093-002	<b>Rev. No.</b> 0	Page 4 of 7

### **3. General**

- 3.1** The recommended procedure provides the measures for on-stream cleaning and passivation of metal surfaces of cooling water cooled exchangers. The pretreatment involves two steps.

STEP 1: The thorough cleaning of metal surface

STEP 2: The development of a protective (passive) film on the metal surface.

- 3.2** Pre-treatment applies to all metals excepting stainless steel but is directed primarily to carbon steel equipment. Pre-treatment applies to pipeline, piping and coolers and any equipment, which will come in contact with cooling water.
- 3.3** Normally microbiological fouling, deposits of phosphates, iron oxides and calcium carbonate scales are expected on cooling water side. For effective film formation/maintenance by the corrosion inhibitors, the metal surfaces shall be free from the foulants and deposits. Fouled surfaces can give rise to severe pitting and localized corrosion.
- 3.4** Pre-treatment shall be applied to the entire cooling water system.
- 3.5** After the pre-treatment is over the system shall be rapidly switched over to the normal treatment.
- 3.6** In case, the specific CW cooled heat exchanger need to be done cleaning and passivation, the procedure can be followed by making arrangement with temporary circuit pumps, tanks, separately.

### **4. Pre Treatment Inspection**



- 4.1** Prior to pre-treatment, equipment shall be inspected and if found to contain excessive corrosion products, deposits or foulant, the equipment shall be cleaned with an appropriate cleaning procedure. The Cooling water treatment vendor shall check whether the inspection and cleaning have been done.

### **5. Flushing**

- 5.1** Cooling tower basin and sump shall be drained and cleaned. All sludge shall be removed.
- 5.2** The cooling system shall be flushed out thoroughly. All extraneous matter and debris such as loose scale, corrosion products, microbiological debris, mud, lumber chips, paper etc. shall be removed from the system including main horizontal headers.
- 5.3** Fill the system with fresh clean raw water with the blow down valve closed and circulate the water.
- 5.4** Open the blow down valve and flush the system with fresh raw water make up for 24hrs.

### **6. Cleaning with Low pH Water**

- 6.1** All the equipment shall be taken into circuit and the system shall be put into circulation. Blow down shall be stopped.
- 6.2** PH of circulating water SHALL be adjusted to around 6.0 (6.0-6.2) by addition of sulphuric acid. pH shall be held in this range for 48 to 72 hours without addition of phosphate / phosphonate and without blowing down.
- 6.3** After three days of circulation, blow down shall be started and continued till Suspended solids are < 30ppm. or close to make up water quality.

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
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## 7. Phosphate/Phosphonate Cleaning cum Passivation

- 7.1** The pH of the circulating water shall be adjusted to around 7.5 (7.5 – 8.0) by reducing the acid dose and SHALL be held in this range throughout the phosphate / phosphonate cleaning operation. All blows down from the system shall be closed.
- 7.2** 5% organo- phosphonate (HEDP) shall be added by gravity to build up a level of 80-100 mg/l as PO<sub>4</sub>.
- 7.3** \* HEDP – Hydroxy Ethylidene Di-phosphonic Acid.
- 7.4** \*\* Organophosphate (HEDP) shall be dosed very slowly as this will depress the pH of C.W. If necessary, caustic soda may be added in C.W. system to maintain pH in the range of 7.0-8.0.
- 7.5** 5% Sodium Hexametaphosphate (SHMP) clean solution shall be added to build up a level of 40-50 mg/l as PO<sub>4</sub> Sodium Hexametaphosphate shall be dosed after HEDP addition is complete and pH is stabilized.
- 7.6** When phosphate/phosphonate level and pH are stabilized by preferably Ethylene oxide based non-ionic surfactant or Alkyl Aryl sulphonate based anionic surface active agent @ 30 ppm based on total hold up shall be dosed. This shall also be dosed at the same rate again after 24 hrs. This may produce foam in the system hence precaution shall be taken for operation of C.W. pumps. This shall be added slowly.
- 7.7** Circulation shall be continued under this condition for a period of 7 days and following levels of chemicals shall be maintained in C.W. system for this period.

Sodium hexameta phosphate (SHMP) as PO <sub>4</sub>	40-50 mg/l
Organo phosphonate as PO <sub>4</sub> (HEDP, 50-60% active acid content)	80-100 mg/l
pH	7.5 – 8.0
Non-ionic/Anionic Surfactant* (Calculated quantity)	30 mg/l
*Shall be added twice only as given in item 5.4	

- 7.8** After circulating for seven days, the system shall be heavily blows down without pH adjustment and regular treatment shall be started when. TSS is being less than 30 mg/l or close to make up water quality HEDP is less than 10mg/l as PO<sub>4</sub>.

## 8. Monitoring



- 8.1** pH, phosphate and phosphonate level shall be monitored regularly throughout the entire operation and recommended levels shall be maintained.

Frequency of analysis is as follows: -

- 8.1.1** During cleaning with low pH water (step 6)

pH: Once in two hours

TSS/Turbidity : Once in four hours

 	<b>PROJECT</b>		<b>Standby SRU &amp; Additional Tanks</b>	
	<b>CLIENT</b>		<b>IOCL Paradip Refinery</b>	
JOB SPECIFICATION FOR PRETREATMENT CUM ONSTREAM CLEANING OF RECIRCULATING COOLING WATER.	<b>Project No.</b> 080557C001	<b>Document No.</b> 080557C-000-JSC-0093-002	<b>Rev. No.</b> 0	Page 6 of 7

#### 8.1.2 During phosphate cleaning (step 7)

pH : Once in two hours

Inorganic phosphate : Once in two hours'

Organic phosphate(Phosphonate) : Once in four hours

### 9. **Pre-Treatment Evaluation**

- 9.1 To assure that cleaning and passivation have been effective, slightly rusted carbon steel corrosion specimen can be inserted into standard coupon testing assembly fitted to the cooling water line or the specimen may be immersed in the cold-water channel of the cooling tower inspected visually from time to time.

### 10. **Specification of Chemicals**

- 10.1 The chemicals shall conform to the following specifications:

a) Organo phosphonate (HEDP, Active acid content 50-60%)	Testing as per ASTM D515-72 and to be obtained from reputed manufacturer.
b) Sodium hexameta phosphate(SHMP)	IS : 574, 1980
c) Surfactant Kemidet B-300 (or)Surfa Additive X-100 (or) Lissopol	Surfactant manufactured by M/s, Chemisynth, New Delhi M/s, Kunchem Ltd.Mumbai M/s ICI Chemicals Ltd, Thane
d) H <sub>2</sub> SO <sub>4</sub> (98%)	IS : 266 (latest)
e) Caustic Soda	Rayon grade or IS:252 (latest) Technical grade



### 11. **Safety Precautions**

- 11.1 Normal safety precautions shall be taken for handling of chemicals. Protective clothing and safety items shall be used to prevent any injury during the pretreatment operation.

#### 11.2 NOTES:

- C.W. System shall be started with above pre-treatment program prior to normal treatment.
- Approximate chemicals requirement for 1000 M<sup>3</sup> hold up of cooling water system:

a) Organo phosphonate (HEDP, Active acid content 50-60%)	140-180Kgs. to maintain level of 80-100 mg/l as PO <sub>4</sub>
b) Sodium hexameta phosphate (SHMP)	50-60Kgs. To maintain a level of 40-50mg/l as PO <sub>4</sub>
c) Surfactant	30Kgs. To maintain a level of 30mg/l

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**11.3** Actual requirement of chemicals shall be calculated based on actual hold-up of the system and dosed to maintain specified levels. Further additions of chemicals will depend on laboratory results and to be dosed to maintain specified levels for entire operation.

**11.4** NOTES:

- HEDP shall only be used. ATMP (Amino tri methylene phosphoric acid) shall not be used.
- During onstream cleaning if cooling water temperature exceeds 400 C, Sodium hexameta phosphate level as specified in item nos. 7.3 and 7.5 shall be reduced to 20-25mg/l as PO<sub>4</sub>

**11.5** **MANUFACTURERS OF HEDP**

- Aquapharm Chemical Co. Pvt. Ltd.  
S-113/2 MIDC  
Bhosari, Pune-411026  
Phone 82942, Tlx.0145-440,  
Cable Aquapharm
- Excel Industries Limited  
184/84 Swami Vivekananda Rd., Jogeswari,  
Mumbai 400102  
Phone : 571 431, Tlx:011-3307, Cable Excel  
Bombay

**11.6** **MANUFACTURERS OF NON-IONIC SURFACTANT**

- ICI Speciality Chemicals,  
P.O. Box no.87, Thane-Belapur Road,  
Thane-400001. Tel: 022-7681200 Product:  
LISSAPOL
- Kumchem, Mumbai
- Chemisynth, New Delhi

**11.7** **MANUFACTURERS OF SHMP**

- Albright Morarji & Pandit, Mumbai
- Transpec, Vadodara

**12. Technical Supervision and Quality Acceptance**

**12.1** The chemical cleaning operation shall be conducted under close chemical controls by the contractor and PMC site construction department. The acceptance of cleaning shall be done by Owner /PMC as per the contractual requirements.