

**PROCESS DESIGN BASIS**  
**(PLOT PLAN AND WATER)**  
**FOR**  
**REVERSE OSMOSIS – MIXED BED BASED**  
**DEMINERALIZATION PLANT (RO-DMP)**  
**AND**  
**ZERO LIQUID DISCHARGE PLANT (ZLDP)**  
  
**PANIPAT REFINERY EXPANSION PROJECT (P-25)**  
**IOCL- PANIPAT REFINERY, HARYANA, INDIA**

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## List of Acronyms

AVU	Atmospheric and Vacuum Distillation Unit
ARU	Amine Regeneration Unit
CCRU	Catalytic cracking reformer unit
CDWU	Catalytic Dewaxing Unit
CDU	Crude Distillation Unit
CR LPGT	CR LPG Treater
CPU	Condensate Polishing Unit
DHDT	Diesel Hydrotreater
EIL	Engineers India Limited
ETP	Effluent Treatment Plant
HCl	Hydrogen Chloride
HGO	Heavy Gas Oil
HRSCC	High Rate Solid contact Clarifier
HVGO	Heavy Vacuum Gas Oil
HGU	Hydrogen Generation Unit
IOCL	Indian Oil Corporation Limited
NHT	Naphtha Hydrotreater
PP	Polypropylene
PRU	Propylene recovery unit
RHCU	Resid Hydrocracker Unit
RO	Reverse osmosis
SARU	Sulphuric Acid Regeneration Unit
SR LPGT	SR LPG Treater
SRU	Sulphur recovery unit
SWS	Sour water stripper
TBP	True Boiling Point
U&O	Utility / Offsite
VDU	Vacuum Distillation Unit
VGO-HDT	Vacuum gasoil Hydrotreater
ZLD	Zero Liquid Discharge

## 1. INTRODUCTION

Indian Oil Corporation Limited (IOCL) operates 15.0 million metric tons per annum (MMTPA) refinery at Panipat in state of Haryana, India. The refinery is currently implementing facilities to manufacture 100% BS-VI fuel mandated by Auto Fuel Policy.

In order to meet the demand growth of petroleum products and also to increase its profitability and competitiveness in the long run, IOCL intends to enhance the refinery capacity from 15 to 25 MMTPA. The Expansion Project consists of a new Crude / Vacuum Distillation unit (CDU/VDU) of capacity of 10 MMTPA followed by a SR LPG Treater (SR LPGT), MS Block comprising of NHT, CCRU & Isomerization Unit, Alkylation/ SARU, DHDT, VGO-HDT, RHCU, INDMAX including CR LPG Treater, and PRU. A new PP unit and Catalytic De-waxing Unit are included as value augmentation unit. Auxiliary facilities i.e., HGU, SWS/ARU and SRU and Utility / Offsite (U&O) facilities for the entire project are included in the facility.

Engineers India Limited has been retained by IOCL as the Engineering Consultant for the Upgradation Cum Expansion project and for design of all open art facilities which include AVU, PRU, SWS, ARU and the U&O facilities. Basic Engineering Design Basis (BEDB) for all facilities, containing technical information decided between IOCL and EIL, shall be binding on the process design and engineering of units, utility systems and offsite facilities.

A New RO based DM water plant is envisaged in the project which shall process the Cooling tower blow down, Treated Effluent from the ETP, blow down from the boiler and treated Raw water make-up to generate the DM water of required Quantity and Quality.

The reject water from the DM plant shall be routed to the Zero Liquid Discharge Plant which shall process the Waste stream from the RODM Plant to generate Condensate and Distillate equivalent to Treated Raw Water quality which shall be recycled and Dried Solids that shall be sent for Disposal.

This document constitutes the Design Basis for the New RO based Demineralised Water Plant and the Zero Liquid Discharge Plant for the Panipat Refinery Expansion (P-25) Project and shall be a part of the Water Block Package in the Complex.

## 2. DESIGN OF RO-DM AND ZLD PLANT

The Design Basis of the RO-DM Plant and the ZLD Plant for P-25 project are indicated in the subsequent sections.

### 2.1. DESIGN CAPACITY OF RO-DM PLANT

The Design Capacity of the RO-DM Plant shall be 850 m<sup>3</sup>/h of Net treated Demineralised Water production.

The DM water produced in the RO-DM plant shall be transferred to the boiler and Process units through pumping.

### 2.1.1. FEED STREAMS TO THE RODM PLANT

The RO-DM plant shall treat the following feed streams to generate DM quality water.

S. No.	Description	Quantity (m3/h) (Normal)	Quantity (m3/h) (Design)
1.	Cooling Tower Blow down from CT-1 & CT – 2	301	434
2.	Blow Down from Process Units	14	35
3.	Blow down from Utility Boiler	13	32
4.	ETP Treated Water	360	450
5.	Treated Raw Water	149 (Note-1)	20 (Note-1)

Note-1: Treated Raw water (380M3/HR) from Raw Water Treatment Plant shall be kept as backup feed for the RO-DM Plant in case of non-availability of one largest feed to RO-DM plant) and during start-up if required.

### 2.1.2. DESIGN INLET STREAMS FOR THE RO-DM PLANT

Feed influent design quality for various effluent streams to RO-DM Plant shall be as follows:

#### 2.1.2.1. COOLING TOWER BLOW DOWNS FROM CT-1&CT-2.

Feed flow to the RO-DM Plant : 301 m3/h (Nor)  
Design Feed flow to the RO-DM Plant : 434 m3/h (Max)

Cooling tower blow-down quality shall be as indicated in Table-1 below.

**Table -1: Cooling Towers Blow-down Quality**

S. No.	Parameter	Normal	Maximum
1.	pH	7.5-8.0	8.0
2.	Turbidity, NTU (5 Min settled)	10-15	30
3.	Total Hardness as CaCO <sub>3</sub>	360-500	650
4.	Ca Hardness as ppm CaCO <sub>3</sub>	260-340	450
5.	Total Silica as SiO <sub>2</sub> , mg/l	35-40	100
6.	TDS, mg/l	400-650	800
7.	MO-Total alkalinity as CaCO <sub>3</sub> , mg/l	90-100	125
8.	Chlorides as ppm Cl <sup>-</sup>	55-65	75
9.	Free Chlorine, mg/l	0.5-0.3	1.0
10.	Fe as ppm, Fe	1.0	1.0
11.	Sulphate as SO <sub>4</sub> ,mg/l	300-450	600

12.	Organo-phosphate as PO <sub>4</sub> , mg/l	8-10	10
13.	Inorganic phosphate as PO <sub>4</sub> , mg/l	4-6	6
14.	Polymeric Dispersant, mg/l	20-30	10
15.	Zinc Sulphate as Zn, mg/l	1-2	3
16.	Azole (BZT), ppm	0.2-0.5	0.5
17.	KMnO <sub>4</sub> consumption at 100 <sup>0</sup> C, ppm	30-40	50
18.	Oil Content, ppm	-	-/10

## 2.1.2.2. BOILER BLOW DOWN

### A. BLOW DOWN FROM UTILITY BOILER

Feed flow to the RO-DM Plant : 13.0 m<sup>3</sup>/h (Nor)

Design Feed flow to the RO-DM Plant : 32.0 m<sup>3</sup>/h (Max)

Boiler Blow Down quality shall be as indicated in Table-2 below.

### B. BLOW DOWN FROM PROCESS UNITS

Feed flow to the RO-DM Plant : 14.0 m<sup>3</sup>/h (Nor)

Design Feed flow to the RO-DM Plant : 35.0 m<sup>3</sup>/h (Max)

Boiler Blow Down quality shall be as indicated in Table-2 below.

**Table - 2 Blow down Quality**

S. No.	Parameter	Unit	Value (Design)
1.	TDS	mg/l	50

## 2.1.2.3. TREATED ETP EFFLUENT

Design Feed flow to the RO-DM Plant : 360 m<sup>3</sup>/h

Maximum Feed flow to the RO-DM Plant : 450 m<sup>3</sup>/h

Treated ETP effluent quality shall be as indicated in Table-3 below.

**Table - 3: Treated ETP Effluent Quality**

S. No.	Parameter	Unit	Value (Design)
1.	pH	-	6.0 - 8.5
2.	Oil & Grease	mg/l	≤ 5
3.	BOD <sub>3 days, 27<sup>0</sup> C</sub>	mg/l	≤ 10
4.	COD	mg/l	≤ 90
5.	Phenols	mg/l	≤ 0.35
6.	Total Suspended Solids	mg/l	<10
7.	Alkalinity	mg/l	<120
8.	Total Dissolved Solids	mg/l	3000
9.	Sulphides as S	mg/l	≤ 0.5
10.	Ammonia as N	mg/l	≤ 11

S. No.	Parameter	Unit	Value (Design)
11.	Ammonia as NH <sub>4</sub>	mg/l	≤ 20
12.	TKN	mg/l	≤ 40
13.	Phosphorous as P	mg/l	≤ 1.5
14.	Cyanide as CN	mg/l	≤ 0.2
15.	Nitrate as NO <sub>3</sub>	mg/l	Traces
16.	Hexavalent Chromium	mg/l	Traces
17.	Total Chromium as Cr	mg/l	Traces
18.	Lead as Pb	mg/l	Traces
19.	Mercury as Hg	mg/l	Traces
20.	Zinc as Zn	mg/l	Traces
21.	Nickel as Ni	mg/l	Traces
22.	Copper as Cu	mg/l	Traces
23.	Vanadium as V	mg/l	Traces
24.	Benzene	mg/l	≤ 0.1
25.	Benzo Pyrene	mg/l	Traces
26.	Reactive Silica	mg/l	Traces
27.	Colloidal Silica	mg/l	Traces

#### 2.1.2.4. TREATED RAW WATER

In case the normal feed streams to the RO-DM plant are not available, backup of Treated Raw Water equivalent to one largest feed to RO-DM plant shall be considered from the Treated Water Reservoir to produce required quantity of DM water.

The treated raw water as backup feed to the RO-DM plant shall be routed directly to the RO treatment section bypassing the Ultra Filtration sections of the RO-DM Plant.

Treated Raw Water quality shall be as indicated in Table-4 below.

**Table – 4: Treated Raw Water Quality**

S. No.	Parameters	Unit	Treated Raw Water Quality (Design)
1.	pH	--	7.5-8.0
2.	Turbidity	NTU	<1
3.	Silt Density Index (SDI)	-	<3
4.	Total Suspended Solids (TSS)	mg/l	<0.5
5.	Total Dissolved Solids (TDS)	mg/l	100-160
6.	MO Alkalinity as CaCO <sub>3</sub>	Mg/l	60-90
7.	Calcium Hardness as Ca	mg/l	65-85
8.	Total Hardness as CaCO <sub>3</sub>	mg/l	90-125

S. No.	Parameters	Unit	Treated Raw Water Quality (Design)
9.	Chlorides (as Cl <sup>-</sup> )	mg/l	13-15
10.	Sulphates (as SO <sub>4</sub> <sup>2-</sup> )	mg/l	15-55
11.	Iron (as Fe)	mg/l	<0.1
12.	Reactive Silica as SiO <sub>2</sub>	mg/l	8-10
13.	Ammonia	mg/l	-
14.	Sulphides as S	mg/l	-
15.	ORP Value	mV	-

### 2.1.2.5 BATTERY LIMIT CONDITIONS

	Pressure, Kg/cm <sup>2</sup> g				Temperature, °C			
RO DM Plant	Min.	Nor.	Max.	Mech. Design	Min.	Nor.	Max.	Mech. Design
<b>Incoming Lines</b>								
Cooling Tower Blow downs, Boiler Blow downs, Process Unit Blow downs	-	2.5	-	15	-	33	-	75
Treated Effluent from ETP	-	3.0	-	10	-	Amb	-	65
<b>Outgoing Lines</b>								
DM Water	As per Process Datasheet No.: B269-475-02-42-DS-1601				-	Amb	-	65

## 2.2. DESIGN CAPACITY OF ZERO LIQUID DISCHARGE PLANT



The Design Capacity of the Zero Liquid Discharge (ZLD) Plant shall be **60 m<sup>3</sup>/hr**. The Zero Liquid Discharge Plant shall comprise of a multi-effect Evaporator Unit followed by a Dryer Unit. Three (2 working and 1 standby) Multi-Effect Evaporator Units, each with processing capacity of **30 m<sup>3</sup>/hr** Feed Water for and Two Units (1 working and 1 standby) Dryer Unit, each with processing capacity of **5 m<sup>3</sup>/hr** for processing the Concentrated Brine from the Evaporator Outlet envisaged.

The Condensate and Distillate water generated from the evaporator and dryer units shall be sent to the UF Feed Collection Tank of RODMP.

### 2.2.1. DESIGN FEED QUALITY TO THE ZERO LIQUID DISCHARGE PLANT

Feed influent design quality for Zero Liquid Discharge Plant shall be as follows

#### 2.2.1.1. REJECT WATER FROM RO-DM PLANT



The Reject Water from the RO-IV in the Reject Recovery Section of the RO-DM plant shall be feed to the ZLD plant. The Design feed Quality to the ZLD plant from the RO-DM shall be as indicated in the Table-5.

**Table-5: RO-DM plant Reject Water Quality**

S.No.	Parameters	Unit	Specifications
1	pH		7.0-9.0
2	Conductivity	μmho/cm	60000
3	Total Hardness as CaCO <sub>3</sub>	mg/l	2000
4	TSS	mg/l	<1
5	Total (reactive) Silica as SiO <sub>2</sub>	mg/l	200
6	Total Iron	mg/l	5
7	Total Copper	mg/l	1
8	Turbidity	NTU	<1
9	KMnO <sub>4</sub> at 100 deg C	mg/l	10
10	Sodium as Na <sup>+</sup>	mg/l	15000
11	Chloride	mg/l	24000
12	Oil	mg/l	Nil
13	TDS	mg/l	40000
14	Colloidal Silica as SiO <sub>2</sub>	mg/l	BDL

**Note:**

1. The RO-DM reject water quality is calculated by RO projection software and is based on quality of RO-DM feed streams. The ionic balance of water shall vary based on feed water quality.

## 2.3. TREATED WATER QUALITY

The Treated Water specifications from the RODM and ZLD Plant are indicated in the following Section.

### 2.3.1. DEMINERALIZED WATER QUALITY

The DM Water Quality from the RO-DM Plant at the Outlet of the Mixed Bed (MB) exchanger unit shall be indicated in the Table-7.

**Table-7: DM Water Quality (at the outlet of MB Exchanger)**

S. No.	Parameter	Unit	Specification
1.	pH		6.7 - 7.3 #
2.	Conductivity at 20 °C	μmho/cm	<0.2 #

S. No.	Parameter	Unit	Specification
3.	Total Dissolved Solids	mg/l	< 0.1
4.	Total Hardness as CaCO <sub>3</sub>	mg/l	NIL #
5.	Total Suspended Solids	mg/l	NIL #
6.	Total (reactive) Silica as SiO <sub>2</sub>	mg/l	<0.02 #
7.	Turbidity	NTU	BDL #
8.	Total Chlorides	mg/l	NIL #
9.	Total Iron as Fe	mg/l	<0.01 #
10.	KMnO <sub>4</sub> value at 100 <sup>0</sup> C	mg/l	<1 #
11.	Total Copper as Cu	mg/l	<0.003 #
12.	Sodium + K	mg/l	<0.01 #
13.	Oil	mg/l	NIL #
BDL : Below Detectable Limit			
# Parameters to be considered for Process Guarantee (at MB Exchanger outlet).			

### 2.3.2. DESIGN TREATED WATER QUALITY AT DIFFERENT STAGES IN RO-DM PLANT

The treated permeate water quality as required from different treatment sections of the RO-DM plant is indicated in Table-8 below. The same shall be considered for design of the RO-DM plant.

**Table – 8: Design Treated Water Quality for RO-DM Plant**

Parameters	Unit	Specification – DM Water				Specification – RO Reject Recovery Section		
		UF-I Outlet	RO-I Permeate	RO-II Permeate	MB Outlet	RO-III Permeate	UF –II Outlet	RO-IV Permeate
pH					6.5-7.0			
Conductivity	µmho/cm				< 0.2			
Total Hardness as CaCO <sub>3</sub>	mg/l				Nil			
TSS	mg/l	<1	Nil	Nil	Nil	Nil	<1	Nil
Total (reactive) Silica as SiO <sub>2</sub>	mg/l				≤0.02			
Total Iron	mg/l				≤0.01			
Total Copper	mg/l				≤ 0.003			
Turbidity	NTU	<1	Nil	Nil	Nil	Nil	<1	Nil
SDI	-	< 3					< 3	
KMnO <sub>4</sub> at 100 <sup>0</sup> C	mg/l				1 Max			
Sodium as Na+	mg/l				≤ 0.01			
Oil	mg/l	Nil	Nil	Nil	Nil	Nil	Nil	Nil
TDS	mg/l		≤100	≤10	< 0.1	≤250		≤350

Parameters	Unit	Specification – DM Water				Specification – RO Reject Recovery Section		
		UF-I Outlet	RO-I Permeate	RO-II Permeate	MB Outlet	RO-III Permeate	UF –II Outlet	RO-IV Permeate
Colloidal Silica	mg/l	BDL	Nil	Nil	Nil	Nil	BDL	Nil

**Notes**

- Other parameters in UF-I, RO-I, RO-II, RO-III, UF-II and RO-IV permeate shall be as per UF/RO projections

### 2.3.3. TREATED WATER QUALITY AT ZERO LIQUID DISCHARGE PLANT OUTLET

The Quality of the recovered Condensate / Distillate at the Outlet of the Zero Liquid Discharge Plant shall be as indicated in the Table-9.

**Table-9: Recovered Condensate Quality at ZLDP Outlet**

S. No.	Parameter	Unit	Specification
1.	Temperature	Deg C	40 (Max)
2.	pH	-	6.5 - 7.5
3.	Total Dissolved Solids (TDS)	ppm	300(Max)
4.	Total Suspended Solids (TSS)	ppm	<1.0

The distillate/condensate from the plant shall be condensed, stored and pumped for reuse as treated water in the UF Feed Collection Tank. The plant shall be provided with a collection tank & transfer pumps to collect and discharge the distillate/condensate from the ZLD Plant. Any additional treatment system envisaged to treat the Condensate / Distillate to the above quality shall be provided and considered in the scope of the contractor.

## 3. TREATMENT PHILOSOPHY

The Treatment Philosophy and Scheme for the treatment of different feed streams in the RO-DM plant and the Zero Liquid Discharge Plant are described in this Section.

The Treatment systems provided in the Plants are to ensure maximum recovery of Water for production of DM quality water and Treated water for Recycle and Reuse in the Refinery Complex.

### 3.1. TREATMENT PHILOSOPHY OF THE RO-DM PLANT

The treatment process in the RO-DM plant consists of four stages of treatment as below:

- Pre-Treatment Section
- Ultra filtration Section
- Reverse Osmosis (DM Water)
- Degasification and Mixed Bed Stage

- RO Reject Recovery Section

### **Pre-Treatment Section**

CTBD, Boiler blow down streams from Utility boiler & blowdowns from process units (received at RO-DMP B/L at pressure) shall be stored in storage tanks before pumping to HRSCC-I. Clarified water from HRSCC-I shall be further treated in Dual Media Filter (DMF-I) for filtration followed by Activated Carbon Filter (ACF-I) for removal of any oil /organics.

Sludge from HRSCC-I shall be routed to sludge sump-I and then pumped to sludge dewatering unit. Centrate from dewatering unit shall be collected and then pumped back to HRSCC-I for further treatment, whereas dewatered Sludge shall be sent outside RO-DMP for disposal.

ACF-I treated water shall be stored in UF-I Feed tank. Treated effluent from ETP (received at RO-DMP B/L at pressure) and ZLD Distillate shall also be received in UF-I Feed tank.

The UF feed Tank shall be utilized to homogenise and equalize the blow down streams treated in the pre-Treatment section with the ETP Treated Effluent. The combined feed shall be routed to the Ultra-Filtration Treatment Section for removal of fines and particulates.

### **Ultra Filtration (UF) Section**

The Combined treated Effluent from the UF feed Tank shall be further processed in Auto Backwash Filter (ABF-I) followed by Ultra Filtration-I system for removal of the residual micro impurities, which are still slipping through the previous filtration stages.

UF-I permeate along treated Raw water shall be stored before feeding to RO-I System. The backwash & chemical cleaning waste from the UF-I, DMF-I, ACF-I& ABF-I shall be collected in Backwash Sump-I and then pumped to HRSCC-I as recycle water for further treatment.

### **Reverse Osmosis (RO) – DM Water Section**

DM water section consists of Two Pass RO system. The UF Permeate from the RO-I Feed tank shall be pumped to the RO-I skid for processing. The RO-I permeate is then sent to an intermittent hold-up tank for RO-II. The RO-II shall process the RO-I permeate along with the provision of processing Permeate Water from RO-III and RO-IV to produce MB Feed Quality water.

Reject from RO-I shall be sent to the RO Reject Recovery Section for further processing and production of recycle water. RO-II reject is sent back to RO-I inlet for reprocessing.

### **Degasification and Mixed Bed (MB) Section.**

RO-II permeate shall be routed to degasser towers for removal of dissolved CO<sub>2</sub>. Air is fed to the Degasser Tower by Degasser Air Blower. Degassed water is collected in Degassed

Water Tank, which is further treated in the Mixed Bed Exchanger units. Final polishing of reactive silica and TDS shall be carried out through resin based MB unit to achieve the desired DM quality water. The DM water from the outlet of MB units shall be routed to the DM water Storage Tanks. The DM water from the storage tanks shall be pumped outside the RO-DMP to Process units and Boiler by DM Water Transfer Pumps.

### RO Reject Recovery Section

RO-I Reject effluent is further processed in RO-III to generate low TDS water which is recycled as feed to RO-II system.

RO-III Reject Effluent and MB (DMP & CPU) regeneration waste shall be sent to the HRSCC-II for chemical precipitation of salts and removal of hardness and Silica.

The clarified water from HRSCC-II shall be further treated in Dual Media Filter (DMF-II) for filtration followed by Activated Carbon Filters (ACF-II) for organics removal followed by Auto Backwash Filter (ABF-II) and Ultra Filtration-II for removal of micro impurities.

The filtered water shall be further processed in RO-IV stage for additional water recovery and permeate recycled as RO-II Feed along with RO-III permeate.

The reject of RO-IV shall be routed to the ZLD Feed for processing in the Plant to generate Distillate water and condensate that shall be recycled and reused as UF Feed in RODMP.

The backwash & chemical cleaning waste from the UF-II, DMF-II, ACF-II and ABF-II shall be collected in Backwash Sump-II and then pumped to HRSCC-II for reprocessing. Sludge from HRSCC-II shall be routed to Sludge Sump-II and then pumped to sludge dewatering unit. Centrate from dewatering unit shall be collected and pumped back to HRSCC-II. Sludge from dewatering unit shall be sent outside RO-DM Plant for disposal.

### 3.1.1. RO-DM PLANT CONFIGURATION

RO-DM Plant Treatment Scheme shall have the following Major System/Units (Unit Capacities shall be Finalised as per the Design DM water requirements:

Unit	No. of Units	Design Capacity per Unit/Chain
UF-I Skids (RO-DM Section)	3 Working + 1 Standby	352m <sup>3</sup> /hr Feed Capacity (Minimum 88% recovery as Permeate)
RO-I Skids (RO-DM Section)	4 Working + 1 Standby	250m <sup>3</sup> /hr Feed Capacity (Minimum 75% recovery as Permeate)
RO-II Skids (RO-DM Section)	4 Working + 1 Standby	241m <sup>3</sup> /hr Feed Capacity (Minimum 90% recovery as Permeate)
MB Units (RO-DM Section)	5 Working + 2 Standby	3400m <sup>3</sup> /day Net DM water per Unit.

Unit	No. of Units	Design Capacity per Unit/Chain
RO-III Skids (Reject recovery Section)	2 Working + 1 Standby	125m <sup>3</sup> /hr Feed Capacity (Minimum 65% recovery as Permeate)
UF-II Skids (Reject recovery Section)	1 Working + 1 Standby	130 m <sup>3</sup> /hr Feed Capacity (Minimum 88% recovery as Permeate)
RO-IV Skids (Reject recovery Section)	1 Working + 1 Standby	108 m <sup>3</sup> /hr Feed Capacity (Minimum 55% recovery as Permeate)
Chemical Dosing & Sludge Handling facilities	As per design requirements	

### 3.2. TREATMENT PHILOSOPHY OF THE ZERO LIQUID DISCHARGE PLANT

The Zero Liquid discharge Plant shall consist of the following sections

- Pre-treatment Section
- Evaporator Section
- Dryer Section
- Products (distillate/condensate, concentrated liquor and reject vapors/emissions) handling, treatment & disposal facilities
- Cleaning & Dosing Chemicals handling & dosing facilities

The reject stream from the RO-IV system in the RODM plant shall be routed to the ZLD feed storage tank. The ZLD Feed tank, with storage capacity equivalent to ~ 24 hours of design feed flow shall homogenize the feed and then the same shall be pumped at a controlled rate for further Processing. The ZLD feed storage tank shall also act as a buffer storage tank to provide for the storage of the feed during the Cleaning Cycle of the Evaporator and Dryer units of the ZLDP.

Pre-treatment of the feed stream as required prior to the Evaporator Unit shall be provided in the pre-treatment section. Pre-treatment section is to be proposed by the bidders and may include the following facilities in general (as required):

- Treatment Facilities for Hardness and Silica reduction from the Feed water and making it acceptable for processing in the Evaporator and Dryer units of the ZLDP shall be provided. Lime-Soda Ash Softening process or any other process as recommended by the Evaporator / Dryer Suppliers shall be provided and all associated facilities as required shall be considered in the scope of the water block package contractor. Any effluent generated from the pre-treatment section of the ZLDP shall be suitably treated within the ZLDP or the Water Block Package and it must be ensured that **NO Liquid Effluent** is discharged outside the water block package.
- Acid dosing for converting bicarbonates to carbonates before feeding to the evaporators.

- Additive/Anti-scalant dosing to prevent calcium salts depositing on the wall of the evaporator or Dryer / crystallizer units.
- Neutralization for pH correction shall be done if required with Caustic.

The feed to the evaporator unit from the ZLD feed tank shall be through the ZLD feed pumps. Intermittent Tank and pumping facilities if envisaged in the ZLDP pre-treatment section shall be considered in the Package and Feed Control to the Evaporator Unit shall be adequately controlled.

## Evaporation Section

Feed at controlled rate (controlled by a flow control valve) shall pass through pre-heaters, calandrias and vapour separators of various effects. The evaporation takes place under vacuum, which shall be maintained mainly by vacuum system. Steam shall be supplied as a heating medium through thermal vapour recompression (TVR) to the 1<sup>st</sup> effect jacket. The concentrated product at the desired concentration shall continuously be taken out from the system.

**Multiple effects (minimum FOUR EFFECTS for good steam economy and maximum condensate recovery) falling film cum forced circulation evaporators with thermal vapour recompression (TVR) system are envisaged.**

The feed shall be preheated in pre-heaters before going into the 1<sup>st</sup> effect. The circulating brine in the 1<sup>st</sup> effect heating element shall be heated with steam from the discharge of the TVR, and which condenses on the shell side. The heated and concentrated brine slurry which is circulating in the tube side of the heating element shall be discharged from each heating element into its respective vapour separator. The vapours separate from the brine/slurry in the vapour separators. Mesh-pad droplet separators shall be provided to virtually eliminate droplet carry over with vapours leaving the vapour separators. Vapours from the 1<sup>st</sup> effect vapour separator shall be discharged into the shell side of the 2<sup>nd</sup> effect heating element (where they condense) whereas a part of the vapours (depending upon the bidder's design) may be discharged into the suction of the TVR (The choice of the effect from where vapours for TVR are to be taken shall be made by the bidder on the basis of his optimized design). The vapours from the 2<sup>nd</sup> effect vapour separator shall be discharged into the 3<sup>rd</sup> effect heating element and so on. The type (falling film or forced circulation) for each effect shall be as per bidder's design.

The type of evaporator shall be based on bidder's experience. The unit shall be designed for operation under vacuum. The necessary flash vessels, as require, shall be provided so as to recover maximum heat from the feed purge and condensates and at the same time meet the temperature requirements of these streams at the battery limit of the plant. The vapours shall be condensed in a surface condenser or any other suitable system.

## Dryer Section



The concentrated feed shall then be passed through a Dryer Unit with forced circulation type or falling film type (ATFD) or as per bidder's own proven system so as to recover maximum quantity of distillate / condensate from the feed and salts as a dry product shall be provided. The condensate/ Distillate shall be recycled back as treated Water and the solids/salts shall be disposed of as solids or crystals (having moisture content less than 8%) from the plant. The solids shall be discharged to a dumpster. At least two Dumpster units of adequate size/volume shall be provided.

### Steam Station

MP Steam / LP steam shall be made available at the Water Block Battery Limit at the Indicated conditions. The Pressure reduction and De-superheating facilities as required for the ZLD Plant shall be considered in the Water Block Package. MP BFW shall also be made available at the Water Block Battery Limit. The Consumption of steam shall be optimized to achieve the maximum steam economy from the Evaporator Package and Dryer Unit.

### Cleaning Facilities for Vessels/Equipment

During normal operation of the plant, gradual deposition of carbonates, sulphates, silicates etc. due to super saturation may take place. To maintain and operate the system at desired efficiency, provisions (as required) for hot water washing, chemical/acid ( $\text{HNO}_3$ ) cleaning & high-pressure water jet cleaning shall be provided. Sufficient stand by equipment/arrangements shall be provided so that down time for the plant for maintenance is minimized. The necessary tanks & pumps shall be provided for dosing of cleaning chemicals as per the Unit Supplier recommendations.

### Material of Construction

The minimum MOC requirements of the Zero Liquid Discharge Plant shall be as per the following table:

Unit	MOC
<b>Multi-Effect Evaporator</b>	
Calendria	Tubes : Titanium Grade II Shell: SS 304
Preheaters	Tubes : Titanium Grade II Shell: SS 304
Tanks & Vessels	SDSS
<b>Dryer</b>	
ATFD	SDSS (CS Jacketed)
Condensers	SS 304



### 3.2.1. ZERO LIQUID DISCHARGE PLANT CONFIGURATION

The Zero Liquid Discharge Plant Treatment Scheme shall have the following Major System/Units (Unit Capacities shall be Finalised as per the Design Requirements:

Unit	No. of Units	Design Capacity per Unit/Chain
Pre-Treatment Section	1 Working	60 m <sup>3</sup> /hr Net Feed
Multi – Effect Evaporator	2 Working + 1 Standby	30 m <sup>3</sup> /hr Feed Capacity each
Dryer Unit (ATFD or Equivalent)	1 Working + 1 Standby (for each chain of MEE)	05 m <sup>3</sup> /hr Brine Feed Capacity each

## 4. CHEMICALS HANDLING

Tentative list of chemicals proposed to be used in RO-DM/CPU Plant are as follows:

Caustic (NaOH)	Morpholine	Ferric Chloride (FeCl <sub>3</sub> )
Acid (HCl)	Lime	Polyelectrolyte (PE)
Antiscalant	RO Cleaning Chemicals	Sodium Meta Bisulphite (SMBS)
Soda Ash	Sodium Hypochlorite (NaOCl)	De-Oiling Polyelectrolyte (DOPE)

The chemical dosing system in the RO-DM Plant and ZLD plant shall be provided with proper dilution & dosing facilities.

## 5. CONTROL PHILOSOPHY

The RO-DMP/ZLD shall be controlled from the Common Control Building which shall house the Substation and Control room along with associated facilities for the RWTP, RODMP, ZLDP and CPU Plants. The Control system for RWTP, RODMP, ZLDP and CPU shall be PLC based. Separate PLC based control systems are envisaged for RWTP, RO-DMP+CPU and ZLD.

The control system shall be provided in line with the engineering specifications/ standards/ drawings. The Operation of the UF-I & UF-II system shall be automatic and Backwash sequence for the UF-I & UF-II skids, DMF-I, ACF-I, ABF-I, DMF-II, ACF-II, ABF-II and regeneration sequence of MB shall be incorporated in the PLC based control system, apart from other requirements to be specified in the P&ID's. The plant shall also have a provision for manual operation. The Instrumentation and Control Philosophy for the Plant shall be as applicable for smooth, safe & trouble free operation of the plant.

PLC shall be serially interfaced with centralized DCS at Refinery Main Control Room (RMCR) for monitoring purposes and mapped to DCS with dedicated graphics.

## 6. EQUIPMENT DESIGN PHILOSOPHY

The Design of the RO-DM plant shall be Modular and the RO skid capacities shall be considered to ensure optimum turndown in the plant.

Hydraulic turndown : 50%  
On-stream factor : Plants shall be able to operate all-round the Year

The Zero Liquid Discharge Plant shall be designed to operate continuously for a minimum of 120hours between every cleaning cycle.

The duration of the cleaning cycle for the individual Evaporator and Dryer Units in the ZLD plant shall not be more than 16 hours (and maximum 24 hours between Stabilized Operation of the Individual Unit)

## 7. REJECT/WASTE WATER IN RO-DM AND ZLD PLANT

Reject/waste water in the RO-DM Plant and the Zero Liquid Discharge Plant shall be handled as per philosophy specified in Table-10 below

**Table-10: Effluent Generation and Handling**

S. No.	Effluent	Handling and Treatment
1.	DMF-I, ACF-I, ABF-I, UF-I and Chemical Cleaning Waste from UF system	Recycled within the RO-DM Plant
2.	RO Reject Recovery Section Backwash Waste (ABF-II, UF-II, DMF-II & ACF-II)	Recycled within the RO-DM Plant
3.	RO-IV Reject	Routed to Zero Liquid Discharge Plant
4.	Regeneration Waste from MB exchanger units of DM and CPU	Recycled within RO-DM Plant
5.	ACF – CPU Backwash	Sent to ETP
6.	Chemical Sludge from HRSCC-I & HRSCC-II	Temporary storage facility (Approx. 7 days) shall be provided for disposal.
7.	<b>Dry Solids from Zero Liquid discharge Plant</b>	Temporary storage facility (Approx. 7 days) shall be provided for disposal.

## 8. GUARANTEED PARAMETERS

The treated water quality to be guaranteed by the contractor shall be as specified in Section 2.3 (indicated by “#”) Apart from this, the following parameters shall also be guaranteed by the contractor.

### 8.1. GUARANTEE PARAMETERS FOR RO-DM PLANT (Including Reject Recovery Section)

The following Parameters shall be guaranteed by the contractor for the RO-DM Section including the Reject Recovery Section in the RO-DM Plant.

System/Parameter	Guaranteed Value
Hydraulic Capacity of the Plant	850 m <sup>3</sup> /hr of Net DM Water Production
UF-I skid	333m <sup>3</sup> /hr Average Feed Capacity(Minimum 88% recovery as Filtrate)
UF-II skid	123 m <sup>3</sup> /hr Average Feed Capacity (Minimum 88% recovery as Filtrate)
RO-I skid	250m <sup>3</sup> /hr Feed Capacity (Minimum 75% recovery as Permeate)
RO-II skid	241m <sup>3</sup> /hr Feed Capacity (Minimum 90% recovery as Permeate)
RO-III skid	125m <sup>3</sup> /hr Feed Capacity (Minimum 65% recovery as Permeate)
RO-IV skid	108m <sup>3</sup> /hr Feed Capacity (Minimum 55% recovery as Permeate)
Mixed Bed Exchanger	3400 m <sup>3</sup> /day Net DM water per Unit.

### Intermediate Treated Water Quality

System/Parameter	Value
SDI at each UF Outlet	≤ 3 #
Total Dissolved Solids in RO-I permeate	≤ 100 mg/l #
Total Dissolved Solids in RO-II permeate	≤ 10 mg/l #
Total Dissolved Solids in RO-III permeate	≤ 250 mg/l #
Total Dissolved Solids in RO-IV permeate	≤350 mg/l #

## 8.2. GUARANTEE PARAMETERS FOR ZLD PLANT

Apart from the guaranteed distillate and condensate Quality from the Zero Liquid Discharge Plant, the following Parameters shall also be guaranteed by the contractor for the ZLD plant.

**Solids Content at the Multi Effect Evaporator Outlet : 30.0 % (Min)**

**Moisture Content in Solids (Salts) at the Dryer Outlet : 10 % (Max)**  
(Suitable for filling and packing in bags/drums for transferring to the landfill site)

## 9. UTILITIES

The following utilities will be supplied at the RO-DM and ZLD Plant battery limit:

- Plant Air
- Instrument Air
- LP Steam / MP Steam
- MP BFW
- Service Water
- Drinking Water
- Nitrogen
- Power
- Fire Water

**Battery limit conditions shall be as per Scope of Works/Supply Document No. B269-475-17-44-SS-1001.**

## 10. UNITS OF MEASUREMENTS

All engineering specifications shall be issued in the MKS system of measurement, with the exception of piping/tubing sizes, which shall be reported in inches

Parameter	Unit
Temperature	°C
Pressure (Gauge)	Kg/cm <sup>2</sup> .g
Pressure (absolute)	Kg/cm <sup>2</sup> .a
Mass	Kg
Length	Meters
Relative density (Sp. gravity)	-
Density	Kg/m <sup>3</sup> or g/l
Vacuum	MmH <sub>2</sub> O or mmHg

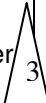




Parameter	Unit
Flowing mass	Kg/h
Flowing liquid	M3/h
Flowing vapour	Nm3/h or kg/h
Heat rate	K Cal/h
Viscosity	Cp
Kinematic viscosity	Cst
Composition	Vol %
Power	KWHR


## 11. REFERENCE DOCUMENTS / DRAWINGS

S. No.	Drawing/Document Name	Drawing/Document No.
1	Schematic Flow Diagram for RO-DM & ZLD Plant (2 Sheets)	B269-475-17-44-0101

**EQUIPMENT LIST**  
**(PLOT PLAN AND WATER GROUP)**  
**FOR**  
**ZERO LIQUID DISCHARGE PLANT**  
**OF**  
**IOCL- PANIPAT REFINERY EXPANSION**  
**PANIPAT, HARYANA**

3	29.04.2022	REVISED & REISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
2	16.06.2021	REVISED & REISSUED FOR TENDER	SC	VS	PKG
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<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

S. No.	DATASHEET NO.	Nos.	Equipment Tag No.	Equipment Description	Size (Each Unit)	MOC
1.	B269-475-17-44-DS-2001	1W	475-T-201	ZLD Feed Tank	Effective Capacity: 1846 m <sup>3</sup> Size: 14 m dia x 12 m LD + 1.0 m FB each + 0.5 M DVD	CS with Glass Flake Vinyl Ester Lining 
2.	B269-475-17-44-DS-2002	2(1W+1S)	475-P-201 A/B	Lime Soda Clarifier Feed Pumps	Capacity: 75 m <sup>3</sup> /hr Head: 15 m	C: SDSS; I: SDSS 
3.	B269-475-17-44-DS-2003	1W	475-CL-201	Lime Soda Clarifier (Including Flocculation Zone)	Capacity: 75 m <sup>3</sup> /hr Size: 10 m dia x 4.5 m SWD + 0.5 m FB	RCC Epoxy Coated 
4.	B269-475-17-44-DS-2004	1W	475-T-202	Evaporator Feed Tank	Effective Capacity: 80 m <sup>3</sup> L x B x H: 5.0 m X 5.0 m x 3.5 m SWD + 0.5 m DVD + 0.5 m FB	RCC Epoxy Coated 
5.	B269-475-17-44-DS-2005	3(2W+1S)	475-P-202 A/B/C	Evaporator Feed Pumps	Capacity: 30 m <sup>3</sup> /hr Head: 30 m	C: SDSS; I: SDSS 
6.	B269-475-17-44-DS-2020	1W	475-LZ-201	MP- LP Pressure Reducer and Desuperheater (including all associated facilities)	Capacity: 30 TPH q	As per Vendor Package

S. No.	DATASHEET NO.	Nos.	Equipment Tag No.	Equipment Description	Size (Each Unit)	MOC
7.	B269-475-17-44-DS-2006	3(2W+1S)	475-LZ-202 A/B/C	Zero Liquid Discharge Plant Package (Including all associated equipment and accessories like Chemical Dosing & Mixing Tank, Deaerator, Pre -Heaters, Flash Vessel, Surface Condenser, Vacuum pumps / Ejector, Vapor ducting, Condensate / Distillate storage, etc.)	Feed Capacity: 30 m <sup>3</sup> /hr each train	
8.	-	-	475-LZ-203 (Note 6)	Dryer Unit	Feed Capacity: 5 m <sup>3</sup> /h each train	
9.	B269-475-17-44-DS-2007	2(1W+1S)	475-P-203 A/B	FeCl <sub>3</sub> Solution Dosing Pumps for Lime Soda Clarifier	Capacity: 20 LPH Head: 20 m	C: PP/ PVDF; D: Teflon
10.	B269-475-17-44-DS-2008	2(1W+1S)	475-P-204 A/B	Polyelectrolyte Solution Dosing Pumps for Lime Soda Clarifier	Capacity: 100 LPH Head: 20 m	C: PP/ PVDF; D: Teflon
11.	B269-475-17-44-DS-2009	2W	475-T-203 A/B	Lime Solution Dosing Tank	Effective Capacity: 32 m <sup>3</sup> each L x B x H: 4 m x 4 m x 2 m LD + 0.2 m DVD + 0.3 m FB each	RCC with Acid/ Alkali Resistant Proof Tiling
12.	B269-475-17-44-DS-2010	2W	475-MX-201 A/B	Lime Solution Dosing Tank Agitator	Diameter: 1200 mm	I: SS316L S: SS431
13.	B269-475-17-44-DS-2011	2(1W+1S)	475-P-205 A/B	Lime Solution Dosing Pumps for Lime Soda Clarifier	Capacity: 5 m <sup>3</sup> /hr Head: 20 m	C: SS304; I: SS304






S. No.	DATASHEET NO.	Nos.	Equipment Tag No.	Equipment Description	Size (Each Unit)	MOC
14.	B269-475-17-44-DS-2012	2(1W+1S)	475-P-206 A/B	Soda Ash Solution Dosing Pumps for Lime Soda Clarifier	Capacity: 5 m <sup>3</sup> /h Head: 20 m	C: PP/ PVDF; D: Teflon
15.	B269-475-17-44-DS-2013	1W	475-S-201	ZLD Plant Drain Sump	Effective Capacity: 18 m <sup>3</sup> L x B x D: 3.0 m X 3.0 m x 2.0 m LD + 0.2 m DVD + 0.3 m FB	RCC Epoxy Coated
16.	B269-475-17-44-DS-2014	2(1W+1S)	475-P-207 A/B	ZLD Plant Drain Transfer Pumps (Vertical Centrifugal)	Capacity: 5 m <sup>3</sup> /hr Head: 20 m	C: SDSS; I: SDSS
17.	B269-475-17-44-DS-2015	1W	475-S-202	Lime Soda Clarifier Sludge Sump (2 COMPARTMENT)	Overall Effective Capacity: 240 m <sup>3</sup> Overall size: L x B x D: 5 m X 16 m x 3 m LD + 0.2 m DVD + 0.3 m FB	RCC Epoxy Coated
18.	B269-475-17-44-DS-2016	2W	475-MX-202 A/B	Lime Soda Clarifier Sludge Sump Agitator	Diameter: 1500 mm	I: SS316L S: SS431
19.	B269-475-17-44-DS-2017	2(1W+1S)	475-P-208 A/B	Lime Soda Clarifier Sludge Transfer Pump	Capacity: 30 m <sup>3</sup> /hr Head: 25 m	C: SDSS I: SDSS
20.	B269-475-17-44-DS-2018	2W	475-T-204 A/B	Anti Foam Solution Dosing Tank (Note-5)	Effective Capacity: 2.5 m <sup>3</sup> Size: 1.8 m dia x 1 m SWD + 0.3 m FB + 0.2 m DVD	FRP
21.	B269-475-17-44-DS-2019	3(2W+1S)	475-P-209 A/B/C	Anti Foam Solution Dosing Pumps	Capacity: 100 LPH Head: 20 m	C: PP/PVDF, D:TEFLON


S. No.	DATASHEET NO.	Nos.	Equipment Tag No.	Equipment Description	Size (Each Unit)	MOC
22.	B269-475-17-44-DS-2021	1	475-T-205	Recovered Condensate Tank	Effective Capacity: 102 m3 Size: 5.7 m dia x 4 m SWD + 0.5 m FB + 0.5 m DVD	CSEP
23. 9	B269-475-17-44-DS-2022	2 (1W + 1S)	475-P-210 A/B	Recovered Condensate Transfer Pump	Capacity: 100 m3/h Head: 60 m	C: SS316L I: SS316L
24.	B269-475-17-44-DS-2023	2 (1W + 1S)	475-LZ-204 A/B	Clarifier Centrifuge	Capacity: 30 m3/h	Bowl: SDSS Shaft/Scroll: SDSS
25.	-	-	-	Tech. Structure for Evaporator Dryer Package (2-tier)	L x B: 30 m x 12 m: Ht: 15 m (to be finalized during detailed engineering)	


**NOTES:**


- All other equipments described elsewhere in the tender document (including technical & process specifications, drawings etc.), and/or as required to make the plant complete from trouble free operation & safety point of view, but not listed above shall also be deemed to have been included in the Water Block Contractor's scope of work.**
- All other works including civil, structural, mechanical, electrical, piping, instrumentation, construction, erection, testing, painting works, etc., shall be as per the tender requirements.**
- All the Sizes/Specifications as specified above in the Equipment List are Minimum Requirements (unless & until specified in the datasheet). Vendor shall confirm these sizes/specifications and shall provide adequate sizes/specifications "not less than the above" or "more as required" to make the plant complete from process & engineering point of view including trouble free safe operation of the plant.**
- SWD: Side Water Depth (excludes FB & DVD), FB: Free Board, DVD: Dead Volume Depth, LD: Liquid Depth, H: Hold, DDE: During Detail Engineering.**
- Anti Foam Solution Dosing Tanks and Pumps shall be located in the ZLD area only.**
- In case of ATFD dryer, at least two dryers for each chain to be provided. In case of Pusher Centrifuge as dryer, at least one Pusher Centrifuge for each chain to be provided.**
- The Recirculation Pumps shall be provided as minimum one pump for each stage of Multi Effect Evaporator. The no. of pumps (operating and store standby) may be increased by the contractor if recommended by the system supplier.**


HRSCC-I SLUDGE TRANSFER PUMPS					
PROJECT : PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-P-103 A/B	
SERVICE : TO TRANSFER HRSCC-I SLUDGE TO CENTRIFUGE					
TYPE : CENTRIFUGAL, HORIZONTAL					
PROPERTIES OF LIQUID					
LIQUID HANDLED				HRSCC-1 SLUDGE	
PUMPING TEMPERATURE (°C)				AMBIENT	
VISCOSITY AT PUMPING TEMPERATURE (cp)				1.0	
LIQUID DENSITY (kg/m³)				~1000	
PRESENCE OF CORROSIVE / TOXIC COMPONENTS				YES	
SOLIDS IN SUSPENSION (YES / NO)				YES	
SIZE OF SOLID PARTICLES (mm)(MAX)				NOTE-1	
OPERATING CONDITIONS					
FLOW RATE		MAX. (m3/hr)	10		
		NORMAL(m3/hr)	NOTE-1		
		MIN. (m3/hr)	NOTE-1		
SUCTION PRESSURE (kg/cm2.a)				ATM. + LD	
MAXIMUM SUCTION PRESSURE (kg/cm2.g)				NOTE-1	
DISCHARGE PRESSURE (kg/cm2.a)				3.5	
DIFFERENTIAL PRESSURE (kg/cm2.g)				2.5	
DIFFERENTIAL HEAD (m)				25	
NPSH AVAILABLE (m) MIN.				FLOODED SUCTION	
NO. OF PUMPS				2 (1W+1S)	
CAPACITY CONTROL FOR VOLUMETRIC PUMPS					
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC				NOT APPLICABLE	
TYPE					
RANGE (%)					
PRECISION AT MIN. RATE (%)					
MECHANICAL DATA					
DESIGN PRESSURE (kg/cm2.g)				5.0	
DESIGN TEMPERATURE (°C)				65	
MATERIAL CODE		CASING	CS		
		IMPELLER	SS304		
SEAL TYPE (MECHANICAL / PACKING)				PACKING	
LINE RATING IN / OUT				150# / 150#	
DRIVER				ELECTRIC MOTOR	
NOTES:					
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.				
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.				
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.				
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.				
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
1	23.11.2020	REVISED & REISSUED FOR TENDER	SC	VS	PKG
0	21.05.2020	ISSUED FOR TENDER	SC	VS	PKG
A	23.04.2020	ISSUED FOR INPUTS/ COMMENTS	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
		ENGINEERS INDIA LIMITED NEW DELHI	HRSCC-I SLUDGE TRANSFER PUMPS	PROCESS DATA SHEET B269-475-17-44-DS-1014	REV. 2

HRSCC-II SLUDGE TRANSFER PUMPS					
PROJECT : PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-P-115 A/B	
SERVICE : TO TRANSFER HRSCC-II SLUDGE TO CENTRIFUGE					
TYPE : CENTRIFUGAL, HORIZONTAL					
PROPERTIES OF LIQUID					
LIQUID HANDLED				HRSCC-II SLUDGE	
PUMPING TEMPERATURE (°C)				AMBIENT	
VISCOSITY AT PUMPING TEMPERATURE (cp)				1.0	
LIQUID DENSITY (kg/m³)				~1000	
PRESENCE OF CORROSIVE / TOXIC COMPONENTS				YES	
SOLIDS IN SUSPENSION (YES / NO)				YES	
SIZE OF SOLID PARTICLES (mm)(MAX)				NOTE-1	
OPERATING CONDITIONS					
FLOW RATE		MAX. (m3/hr)	10	2	
		NORMAL(m3/hr)	NOTE-1		
		MIN. (m3/hr)	NOTE-1		
SUCTION PRESSURE (kg/cm2.a)				ATM. + LD	
MAXIMUM SUCTION PRESSURE (kg/cm2.g)				NOTE-1	
DISCHARGE PRESSURE (kg/cm2.a)				3.5	
DIFFERENTIAL PRESSURE (kg/cm2.g)				2.5	
DIFFERENTIAL HEAD (m)				25	
NPSH AVAILABLE (m) MIN.				FLOODED SUCTION	
NO. OF PUMPS				2 (1W+1S)	
CAPACITY CONTROL FOR VOLUMETRIC PUMPS					
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC				NOT APPLICABLE	
TYPE					
RANGE (%)					
PRECISION AT MIN. RATE (%)					
MECHANICAL DATA					
DESIGN PRESSURE (kg/cm2.g)				5.0	
DESIGN TEMPERATURE (°C)				65	
MATERIAL CODE		CASING	SDSS		
		IMPELLER	SDSS		
SEAL TYPE (MECHANICAL / PACKING)				PACKING	
LINE RATING IN / OUT				150# / 150#	
DRIVER				ELECTRIC MOTOR	
NOTES:					
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.				
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.				
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.				
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.				
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
1	23.11.2020	REISSUED FOR TENDER	SC	VS	PKG
0	21.05.2020	ISSUED FOR TENDER	SC	VS	PKG
A	23.04.2020	ISSUED FOR INPUTS/ COMMENTS	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
		ENGINEERS INDIA LIMITED NEW DELHI	HRSCC-II SLUDGE TRANSFER PUMPS	PROCESS DATA SHEET B269-475-17-44-DS-1047	REV. 2


HRSCC CENTRIFUGE			
PROJECT : PANIPAT REFINERY EXPANSION		CLIENT : IOCL	JOB NO. : B269
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475	ITEM NO.: 475-LZ-102 A/B
SERVICE : DE-WATERING OF CHEMICAL SLUDGE FROM HRSCC-I & II		2	2
<b>PROCESS DATA</b>			
FLUID HANDLED		SLUDGE	
TYPE & NATURE OF SLUDGE		CHEMICAL	
<b>INFLUENT CHARACTERISTICS</b>			
INFLUENT FLOW RATE (m <sup>3</sup> /hr)		10	2
SOLID CONTENT (%wt.)		5 (MAX.)	
TEMPERATURE(°C)		AMBIENT	
PH		6.5-8.5	
DENSITY (kg/m <sup>3</sup> )		~1100	
VISCOSITY (Cp)		NOTE-1	
<b>DEWATERED SLUDGE CHARACTERISTICS</b>			
SOLID CONTENT (%wt.) (MIN.)		20	
MOISTURE CONTENT (%wt.)		80	
SOLIDS RECOVERY (%wt.)		NOTE-1	
FLOW RATE (m <sup>3</sup> /hr)		NOTE-1	
<b>CENTRATE CHARACTERISTICS</b>			
SOLID CONTENT (mg/l)		NOTE-1	
FLOW RATE (m <sup>3</sup> /hr)		NOTE-1	
<b>UNIT SPECIFICATION</b>			
NUMBER OF UNITS		2 (1W + 1S)	2
DUTY (CONTINUOUS/INTERMITTENT)		NOTE-1	
OPERATING CYCLE (hrs) PER UNIT		16 (NOTE-1)	
SEPARATION FORCE (G)(m/s <sup>2</sup> )		NOTE-1	
SETTLING TIME (sec)		NOTE-1	
BOWL LENGTH (m)		NOTE-1	
BOWL DIAMETER (m)		NOTE-1	
BOWL SPEED (rpm)(MAX/OPERATING)		NOTE-1	
SPEED CONTROL		THROUGH PULLEYS	
CONICAL ANGLE (deg.)		NOTE-1	
CONVEYER SPEED (rpm)		NOTE-1	
POLY-ELECTROLYTE DOSING REQUIRED		YES (DEWATERING POLYELECTROLYTE)	
DOSAGE REQUIREMENT (kg/Ton of Dry Solids)		3	
DOSING STRENGTH		0.10%	
MODE OF APPLICATION		BY METERING PUMP	
POINT OF APPLICATION		IN FEED SUMP / INLET OF CENTRIFUGE	
LIFTING ARRANGEMENT REQUIRED		YES	
Sheet 1 of 2			
	ENGINEERS INDIA LIMITED NEW DELHI	HRSCC CENTRIFUGE	PROCESS DATA SHEET B269-475-17-44-DS-1076
			REV 2

HRSCC CENTRIFUGE					
<b>MATERIAL OF CONSTRUCTION</b>					
BOWL				SS316	
SHAFT/SCROLL				SS316	
LINING				TUNGSTEN CARBIDE	
CASING				SS316	
GEARBOX OVERLOAD PROTECTION MECHANISM (YES/NO)				YES	
<b>NOTES:</b>					
1	TO BE FURNISHED BY THE CONTRACTOR DURING DETAIL ENGINEERING.				
2	SEPARATION FORCE VALUE TO BE FURNISHED BY THE CENTRIFUGE SUPPLIER.				
3	DOSING RATE TO BE ESTABLISHED BY THE CENTRIFUGE SUPPLIER.				
4	EIL APPROVED VENDOR LIST FOR CENTRIFUGE TO BE FOLLOWED.				
5	DELETED				
6	DELETED				
2	02.05.2022	REVISED & ISSUED WITH TA- 03	SC	VS	PKG
1	24.05.2021	REVISED & REISSUED FOR TENDER	SC	VS	PKG
0	21.05.2020	ISSUED FOR TENDER	SC	VS	PKG
A	23.04.2020	ISSUED FOR INPUTS/ COMMENTS	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
<b>SHEET 2 OF 2</b>					
	ENGINEERS INDIA LIMITED NEW DELHI		HRSCC CENTRIFUGE	PROCESS DATA SHEET B269-475-17-44-DS-1076	REV. 2


LIME SOLUTION DOSING TANK						
PROJECT : PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269		
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-T-119 A/B		
SERVICE : STORAGE OF LIME SOLUTION						
PROCESS DATA						
LIQUID HANDLED			15% LIME			
NOMINAL CAPACITY OF EACH TANK (m <sup>3</sup> )			6			
EFFECTIVE LIQUID HOLD UP OF EACH TANK (m <sup>3</sup> )			4			
NATURE OF LIQUID (TOXIC/CORROSIVE)			CORROSIVE			
STORAGE TEMPERATURE (°C)			AMBIENT TO 45			
DESIGN TEMPERATURE (°C)			65			
STORAGE PRESSURE (kg/cm <sup>2</sup> abs.)			ATM.+ LIQUID COULMN			
DESIGN POSITIVE PRESSURE (kg/cm <sup>2</sup> abs.)			ATM.+ FULL OF LIQUID			
DESIGN VACUUM PRESSURE			NA			
PURITY OF COMMERCIALY AVAILABLE CHEMICAL			NOTE 1			
HOLDING PERIOD OF EACH TANK (hrs) (MIN)			NOTE-2			
UNIT SPECIFICATION						
NO. OF TANKS			2			
TYPE			SQUARE WITH REMOVABLE LIDS			
DIAMETER (m) / DIMENSIONS (m x m)			4 X 1			
EFFECTIVE LIQUID DEPTH (m)			1			
FREE BOARD (m) +DVD (m) (minimum)			0.3 + 0.2			
TOTAL HEIGHT (m)			1.5			
SLOPE FOR TANK BOTTOM			AS PER ENGG. SPECS.			
BOTTOM DRAIN (YES / NO)			YES			
OVERFLOW CONNECTION			YES			
SERVICE WATER / TREATED EFFLUENT CONNECTION			YES			
DOSING ARRANGEMENT			THROUGH CENTRIFUGAL PUMPS			
AGITATOR REQUIRED			YES			
BAFFLE ARRANGEMENT			4 NOS. DIAMETRICALLY OPPOSITE			
SIZE OF BAFFLES			10% OF TANK DIAMETER ALONG ITS HEIGHT			
HEATING COIL (YES / NO)			NO			
INSULATION (YES/NO)			NO			
VENT			YES			
FUME ABSROBER/ CO2 ABSORBER/ BREATHER VALVE/ FLAME ARRESTOR			NO			
GAUGING AND SAMPLING HATCH (YES/NO)			NO			
LEVEL INDICATOR (YES / NO)			YES			
LEVEL TRANSMITTER (YES / NO)			YES			
LEVEL TRANSMITTER PLATFORM (YES / NO)			YES			
CALIBRATION OF TANK (YES/NO)			NOTE-1			
MATERIAL OF CONSTRUCTION						
TANK			RCC			
INTERNAL LINING			NIL			
CORROSION ALLOWANCE (mm)			NONE			
STAIRS / HANDRAILINGS / OPERATING PLATFORM			AS PER ENGG. SPECS.			
NOTES:						
1	To be furnished/ confirmed by the Contractor.					
2	Tank sizes indicated are minimum requirements. Higher tank sizes (equivalent to 12 hours requirement in RODM PLANT) to be provided if required.					
2	02.05.2022	REVISED & ISSUED WITH TA- 03	SC	VS	PKG	
1	24.05.2021	REVISED & REISSUED FOR TENDER	SC	VS	PKG	
0	21.05.2020	ISSUED FOR TENDER	SC	VS	PKG	
A	23.04.2020	ISSUED FOR INPUT / COMMENTS	SC	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
		ENGINEERS INDIA LIMITED NEW DELHI	LIME SOLUTION DOSING TANK	PROCESS DATA SHEET B269-475-17-44-DS-1087		REV. 2


LIME SOLUTION DOSING TANK AGITATOR						
PROJECT : PANIPAT REFINERY EXPANSION			CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT			UNIT NO.: 475		ITEM NO.: 475-MX-109 A/B	
SERVICE : LIME SOLUTION PREPARATION						
PROCESS DATA						
PURPOSE				MIXING		
OPERATION (BATCH/CONTINUOUS)				CONTINUOUS		
AGITATED VOLUME (m <sup>3</sup> )				4 <span style="float: right;">2</span>		
OPERATING PRESSURE (kg/cm <sup>2</sup> abs.)				ATM.		
OPERATING TEMPERATURE (°C)				AMBIENT		
SOLIDS PRESENT (YES/NO, TYPE & SIZE)				YES		
FOAM TENDENCY (YES/NO)				NO		
SOLUBILITY (HIGH / MEDIUM / LOW / NIL)				LOW		
ABRASION (HIGH / MEDIUM / LOW / NIL)				MEDIUM		
SETTLING (HIGH / MEDIUM / LOW / NIL)				HIGH		
DEGREE OF AGITATION (MILD / MEDIUM / VIOLENT)				MEDIUM TO VIOLENT		
CORROSIVE PRODUCTS ( YES / NO, TYPE)				YES		
PROCESS LIMITATION (NONE / HP / TIP SPEED / SPACE)				TIP SPEED		
S. NO.	COMPONENT	PERCENT COMPOSITION		VISCOSITY (Cs)	SP. GRAVITY	
		BY VOLUME	BY WEIGHT			
1	LIME		15%	NOTE-1	NOTE-1	
2	WATER		NOTE-1	NOTE-1	NOTE-1	
AVERAGE PROPERTIES OF MIXTURE				NOTE-1	NOTE-1	
UNIT SPECIFICATION						
IMPELLER		TYPE (TURBINE / PROPELLER)		NOTE-1		
		NUMBER		1 (EACH TANK) <span style="float: right;">2</span>		
		DIAMETER (mm)		300		
		SPEED (RPM)		NOTE-1		
		M.O.C.		SS-316L		
BLADES		TYPE (TURBINE / PROPELLER)		NOTE-1		
		NUMBER		3		
		PITCH		NOTE-1		
		WIDTH (mm)		NOTE-1		
		M.O.C.		SS-316L		
SHAFT		M.O.C.		SS-431		
MOUNTING SPACE AVAILABLE (AMPLE/RESTRICTED)				AMPLE		
MIXER ENTRY (TOP / SIDE /BOTTOM / PORTABLE)				TOP		
MOUNTING (CLAMPED / FLANGED, MOUNTING ANGLE)				FLANGED, 90°		
SHAFT SEAL (MECH. / STUFFING BOX / LABYRINTH / VAPOUR SEAL)				N.A.		
DRIVE TYPE				ELECTRICAL MOTOR		
DRIVE UNIT TRANSMISSION TYPE (GEAR / BELT / DIRECT)				GEAR		
NOTES						
1	To be furnished/confirmed by the Contractor.					
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
1	24.05.2021	REVISED & REISSUED FOR TENDER	SC	VS	PKG	
0	21.05.2020	ISSUED FOR TENDER	SC	VS	PKG	
A	23.04.2020	ISSUED FOR INPUT / COMMENTS	SC	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SOLUTION DOSING TANK AGITATOR	PROCESS DATA SHEET		REV.
				B269-475-17-44-DS-1088		2





HRSCC CENTRATE SUMP					
PROJECT : PANIPAT REFINERY		CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-S-107	
SERVICE : TO HOLD CENTRATE OF HRSCC-I & II SLUDGE					
PROCESS DATA					
FLUID HANDLED				HRSCC-I & II SLUDGE CENTRATE	
INFLUENT FLOW (m3/hr) (DESIGN)				10	
INFLUENT TEMPERATURE (°C)				AMBIENT	
PRESENCE OF CORROSIVE/TOXIC COMPONENTS				YES	
NOMINAL CAPACITY OF SUMP (m3) (OVERALL VOLUME)				50	
EFFECTIVE LIQUID STORAGE VOLUME (m3)				40	
ANY BAFFLE ARRANGEMENT REQUIRED (YES/NO)				NO	
TYPE OF SUMP (ABOVE/UNDER GROUND)				ABOVE GROUND	
COVER (YES/NO)				NO	
UNIT SPECIFICATION					
WET SUMP					
SHAPE				RECTANGLE	
NO. OF COMPARTMENTS				1	
DIMENSIONS OF EACH COMPARTMENT(LXB) (mXm)				4 X 5	
EFFECTIVE LIQUID DEPTH (m) + FREE BOARD (m) (MIN.)				2.0 + 0.5	
OVERALL DIMENSIONS (L x B x H) (m x m x m)				4 X 5 X 2.5	
RESIDENCE TIME (hrs) (@DESIGN FLOW) (MINIMUM)				NOTE-1	
SLOPE FOR SUMP BOTTOM				1:100	
PUMP PIT REQUIRED				NO	
SIZE OF PUMP PIT (L X B X D) (m x m x m)				NA	
SLOPE IN PUMP PIT				NA	
SIZE OF SUCTION CHANNEL(m x m)				NOTE-1	
SLOPE IN SUCTION CHANNEL				NOTE-1	
VENT (NOS. AND DIA)				NO	
LEVEL INDICATOR (YES / NO)				YES	
LEVEL TRANSMITTER (YES / NO)				YES	
LEVEL TRANSMITTER PLATFORM (YES/NO)				YES	
MATERIAL OF CONSTRUCTION					
WET SUMP				RCC	
INTERNAL PAINTING/COATING/LINING				EPOXY SCREED	
DRY SUMP (BELOW FGL/ABOVE FGL)				NA	
STAIRS/HANDRAILS				AS PER EIL SPECS.	
RUNGS				MSEP	
NOTES:					
1	DATA TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.				
2	THE SUMP SHALL BE PROVIDED WITH HANDRAILING ALL AROUND.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	26.05.2020	ISSUED FOR TENDER	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		HRSCC CENTRATE SUMP		PROCESS DATA SHEET
					B269-475-17-44-DS-1124
					REV
					1


HRSCC CENTRATE TRANSFER PUMP					
PROJECT : PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-P-152 A/B	
SERVICE : TO TRANSFER CENTRATE TO BD COLLECTION TANK					
TYPE : CENTRIFUGAL, VERTICAL					
PROPERTIES OF LIQUID					
LIQUID HANDLED				HRSCC-I & II SLUDGE CENTRATE	
PUMPING TEMPERATURE (°C)				AMBIENT	
VISCOSITY AT PUMPING TEMPERATURE (cp)				1.0	
LIQUID DENSITY (kg/m³)				~1000	
PRESENCE OF CORROSIVE / TOXIC COMPONENTS				YES	
SOLIDS IN SUSPENSION (YES / NO)				YES	
SIZE OF SOLID PARTICLES (mm)(MAX)				NOTE-1	
OPERATING CONDITIONS					
FLOW RATE		MAX. (m³/hr)	10	2	
		NORMAL(m³/hr)	NOTE-1		
		MIN. (m³/hr)	NOTE-1		
SUCTION PRESSURE (kg/cm².a)				ATM. + LD	
MAXIMUM SUCTION PRESSURE (kg/cm².g)				NOTE-1	
DISCHARGE PRESSURE (kg/cm².a)				4	
DIFFERENTIAL PRESSURE (kg/cm².g)				3	
DIFFERENTIAL HEAD (m)				30	
NPSH AVAILABLE (m) MIN.				FLOODED SUCTION	
NO. OF PUMPS				2 (1W+1S)	
CAPACITY CONTROL FOR VOLUMETRIC PUMPS					
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC				N.A.	
TYPE				N.A.	
RANGE (%)				N.A.	
PRECISION AT MIN. RATE (%)				N.A.	
MECHANICAL DATA					
DESIGN PRESSURE (kg/cm².g)				5.0	
DESIGN TEMPERATURE (°C)				65	
MATERIAL CODE		CASING	SDSS		
		IMPELLER	SDSS		
SEAL TYPE (MECHANICAL / PACKING)				PACKING	
LINE RATING IN / OUT				150# / 150#	
DRIVER				ELECTRIC MOTOR	
NOTES:					
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.				
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.				
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.				
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.				
5	THE PUMPS SHALL BE SELECTED FOR PARALLEL OPERATION.				
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
1	23.11.2020	REISSUED FOR TENDER	SC	VS	PKG
0	26.05.2020	ISSUED FOR TENDER	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
		ENGINEERS INDIA LIMITED NEW DELHI	HRSCC CENTRATE TRANSFER PUMP	PROCESS DATA SHEET B269-475-17-44-DS-1125	REV. 2


CLARIFIER CENTRATE SUMP					
PROJECT : PANIPAT REFINERY		CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT		UNIT NO.: 475		ITEM NO.: 475-S-108	
SERVICE : TO HOLD CENTRATE OF LIME SODA CLARIFIER SLUDGE					
PROCESS DATA					
FLUID HANDLED			LIME SODA CLARIFIER SLUDGE CENTRATE		
INFLUENT FLOW (m3/hr) (DESIGN)			30		
INFLUENT TEMPERATURE (°C)			AMBIENT		
PRESENCE OF CORROSIVE/TOXIC COMPONENTS			YES		
NOMINAL CAPACITY OF SUMP (m3) (OVERALL VOLUME)			50		
EFFECTIVE LIQUID STORAGE VOLUME (m3)			40		
ANY BAFFLE ARRANGEMENT REQUIRED (YES/NO)			NO		
TYPE OF SUMP (ABOVE/UNDER GROUND)			ABOVE GROUND		
COVER (YES/NO)			NO		
UNIT SPECIFICATION					
WET SUMP					
SHAPE			RECTANGLE		
NO. OF COMPARTMENTS			1		
DIMENSIONS OF EACH COMPARTMENT(LXB) (mXm)			4 X 5		
EFFECTIVE LIQUID DEPTH (m) + FREE BOARD (m) (MIN.)			2.0 + 0.5		
OVERALL DIMENSIONS (L x B x H) (m x m x m)			4 X 5 X 2.5		
RESIDENCE TIME (hrs) (@DESIGN FLOW) (MINIMUM)			NOTE-1		
SLOPE FOR SUMP BOTTOM			1:100		
PUMP PIT REQUIRED			NO		
SIZE OF PUMP PIT (L X B X D) (m x m x m)			NA		
SLOPE IN PUMP PIT			NA		
SIZE OF SUCTION CHANNEL(m x m)			NOTE-1		
SLOPE IN SUCTION CHANNEL			NOTE-1		
VENT (NOS. AND DIA)			NO		
LEVEL INDICATOR (YES / NO)			YES		
LEVEL TRANSMITTER (YES / NO)			YES		
LEVEL TRANSMITTER PLATFORM (YES/NO)			YES		
MATERIAL OF CONSTRUCTION					
WET SUMP			RCC		
INTERNAL PAINTING/COATING/LINING			EPOXY SCREED LINING		
DRY SUMP (BELOW FGL/ABOVE FGL)			NA		
STAIRS/HANDRAILS			AS PER EIL SPECS.		
RUNGS			MSEP		
NOTES:					
1	DATA TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.				
2	THE SUMP SHALL BE PROVIDED WITH HANDRAILING ALL AROUND.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	26.05.2020	ISSUED FOR TENDER	SC	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		CLARIFIER CENTRATE SUMP	PROCESS DATA SHEET B269-475-17-44-DS-1126	REV 1

CLARIFIER CENTRATE TRANSFER PUMP						
PROJECT : PANIPAT REFINERY EXPANSION			CLIENT : IOCL		JOB NO. : B269	
UNIT : RO-MB BASED DM PLANT			UNIT NO.: 475		ITEM NO.: 475-P-153 A/B	
SERVICE : TO TRANSFER CENTRATE TO ZLD FEED TANK						
TYPE : CENTRIFUGAL, VERTICAL						
PROPERTIES OF LIQUID						
LIQUID HANDLED				LIME SODA CLARIFIER SLUDGE CENTRATE		
PUMPING TEMPERATURE ( $^{\circ}$ C)				AMBIENT		
VISCOSITY AT PUMPING TEMPERATURE (cp)				1.0		
LIQUID DENSITY (kg/m <sup>3</sup> )				~1000		
PRESENCE OF CORROSIVE / TOXIC COMPONENTS				YES		
SOLIDS IN SUSPENSION (YES / NO)				YES		
SIZE OF SOLID PARTICLES (mm)(MAX)				NOTE-1		
OPERATING CONDITIONS						
FLOW RATE			MAX. (m3/hr)		30	
			NORMAL(m3/hr)		NOTE-1	
			MIN. (m3/hr)		NOTE-1	
SUCTION PRESSURE (kg/cm2.a)				ATM. + LD		
MAXIMUM SUCTION PRESSURE (kg/cm2.g)				NOTE-1		
DISCHARGE PRESSURE (kg/cm2.a)				4		
DIFFERENTIAL PRESSURE (kg/cm2.g)				3		
DIFFERENTIAL HEAD (m)				30		
NPSH AVAILABLE (m) MIN.				FLOODED SUCTION		
NO. OF PUMPS				2 (1W+1S)		
CAPACITY CONTROL FOR VOLUMETRIC PUMPS						
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC				N.A.		
TYPE				N.A.		
RANGE (%)				N.A.		
PRECISION AT MIN. RATE (%)				N.A.		
MECHANICAL DATA						
DESIGN PRESSURE (kg/cm2.g)				5.0		
DESIGN TEMPERATURE ( $^{\circ}$ C)				65		
MATERIAL CODE			CASING		SDSS	
			IMPELLER		SDSS	
SEAL TYPE (MECHANICAL / PACKING)				PACKING		
LINE RATING IN / OUT				150# / 150#		
DRIVER				ELECTRIC MOTOR		
NOTES:						
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.					
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.					
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.					
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.					
5	THE PUMPS SHALL BE SELECTED FOR PARALLEL OPERATION.					
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
1	23.11.2020	REISSUED FOR TENDER	SC	VS	PKG	
0	26.05.2020	ISSUED FOR TENDER	SC	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
 <b>ENGINEERS INDIA LIMITED</b> <b>NEW DELHI</b>			<b>CLARIFIER CENTRATE</b> <b>TRANSFER PUMP</b>		<b>PROCESS DATA SHEET</b> <b>B269-475-17-44-DS-1127</b>	
					<b>REV.</b> <b>2</b>	


ZLD FEED TANK						
PROJECT : IOCL- PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269		
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO.: 475-T-201		
SERVICE : TO STORE ZLD PLANT FEED WATER						
PROCESS DATA						
DESIGN FLOW (m <sup>3</sup> /hr)			75	1		
NOMINAL CAPACITY (m <sup>3</sup> )			2154			
EFFECTIVE LIQUID HOLD UP (m <sup>3</sup> )			1846			
STORAGE TEMPERATURE (°C)			AMBIENT			
DESIGN TEMPERATURE (°C)			65			
SP. GR. OF LIQUID AT STORAGE TEMPERATURE (°C)			1.0			
VISCOSITY AT STORAGE TEMPERATURE (Cp)			~1			
STORAGE PRESSURE (kg/cm <sup>2</sup> abs.)			ATM. + LIQUID COULMN			
DESIGN PRESSURE (kg/cm <sup>2</sup> abs.)			ATM. + FULL OF LIQUID			
DESIGN PRESSURE (VACUUM.)			N.A.			
BLANKETING GAS			N.A.			
UNIT DESCRIPTION						
NO. OF TANKS			1			
TYPE			CIRCULAR, FIXED CONE ROOF			
DIAMETER OF EACH TANK (m)			14.0	1		
EFFECTIVE LIQUID DEPTH			12.0			
DVD (m)+FREE BOARD ABOVE TWL (m)			0.5 + 1.0			
TOTAL HEIGHT (m)			13.5			
RESIDENCE TIME (hrs) (@ DESIGN FLOW) (MINIMUM)			24.0			
SLOPE FOR TANK BOTTOM			AS PER ENGG. SPECS.			
OVERFLOW ARRANGEMENT REQUIRED (YES / NO)			YES			
BOTTOM DRAIN REQUIRED (YES / NO)			YES			
ANY BAFFLE ARRANGEMENT REQUIRED (YES / NO)			NO			
FLAME ARRESTOR REQUIRED			NO			
LEVEL INDICATION REQUIRED (YES / NO)			YES			
LEVEL TRANSMITTER (YES / NO)			YES			
LEVEL SWITCHES (YES / NO)			NO			
LEVEL TRANSMITTER / SWITCH PLATFORM (YES / NO)			YES			
LEVEL ALARM (YES/NO)			YES			
VENT			YES			
MATERIAL OF CONSTRUCTION						
TANK			CS			
PAINTING/LINING			GLASS FLAKED VINYL ESTER LINING			
CORROSION ALLOWANCE (SHELL/BOTTOM/ROOF)			3.0/3.0/1.5			
STAIRS / HANDRAILINGS / OPERATING PLATFORM			AS PER ENGG. SPECS.			
DESIGN CODE			API 650 (LATEST EDITION)			
NOTES:						
1	02.05.2022	REVISED & ISSUED WITH TA- 03	SC	VS	PKG	
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG	
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
	ENGINEERS INDIA LIMITED NEW DELHI		ZLD FEED TANK	PROCESS DATA SHEET		REV.
				B269-475-17-44-DS-2001		1


LIME SODA CLARIFIER FEED PUMPS					
PROJECT : IOCL-PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-P-201 A/B	
SERVICE : TO TRANSFER RO-IV REJECT AND CENTRIFUGE CENTRATE WATER TO LIME SODA CLARIFIER					
TYPE : CENTRIFUGAL, HORIZONTAL					
PROPERTIES OF LIQUID					
LIQUID HANDLED			RO-IV REJECT & CENTRATE WATER		
PUMPING TEMPERATURE ( <sup>0</sup> C)			AMBIENT		
VISCOSITY AT PUMPING TEMPERATURE (cp)			1.0		
LIQUID DENSITY (kg/m <sup>3</sup> )			~1000		
PRESENCE OF CORROSIVE / TOXIC COMPONENTS			YES		
SOLIDS IN SUSPENSION (YES / NO)			NO		
SIZE OF SOLID PARTICLES (mm)(MAX)			NA		
OPERATING CONDITIONS					
FLOW RATE		MAX. (m3/hr)	75	1	
		NORMAL(m3/hr)	NOTE-1		
		MIN. (m3/hr)	NOTE-1		
SUCTION PRESSURE (kg/cm2.a)			ATM. + LD		
DISCHARGE PRESSURE (kg/cm2.a)			2.5		
DIFFERENTIAL PRESSURE (kg/cm2.g)			1.5		
DIFFERENTIAL HEAD (m)			15		
NPSH AVAILABLE (m) MIN.			FLOODED SUCTION		
NO. OF PUMPS			2 (1W+1S)		
CAPACITY CONTROL FOR VOLUMETRIC PUMPS					
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC			N.A.		
TYPE			N.A.		
RANGE (%)			N.A.		
PRECISION AT MIN. RATE (%)			N.A.		
MECHANICAL DATA					
DESIGN PRESSURE (kg/cm2.g)			3.5		
DESIGN TEMPERATURE ( <sup>0</sup> C)			65		
MATERIAL CODE		CASING	SDSS		
		IMPELLER	SDSS		
SEAL TYPE (MECHANICAL / PACKING)			PACKING		
LINE RATING IN / OUT			150# / 150#		
DRIVER			ELECTRIC MOTOR		
NOTES:					
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.				
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.				
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.				
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SODA CLARIFIER FEED PUMPS	PROCESS DATA SHEET	REV.
				B269-475-17-44-DS-2002	1

LIME SODA CLARIFIER				
PROJECT : IOCL-PANIPAT REFINERY EXPANSION		CLIENT : IOCL	JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475	ITEM NO.: 475-CL-201	
SERVICE : SOFTENING OF RO-IV REJECT WATER				
INFLUENT CHARACTERISTICS				
TEMPERATURE (°C)		AMBIENT		
SPECIFIC GRAVITY		~1.0		
CALCIUM AS CaCO3 (mg/l)		NOTE-1		
SILICA AS SiO2 (mg/l)		NOTE-1		
FLOW RATE				
INFLUENT FLOW PER UNIT (m³/hr)		75	1	
OVERFLOW PER UNIT (m³/hr)		NOTE-1		
UNDERFLOW PER UNIT (PEAK) (m³/hr)		NOTE-1		
OUTLET CHARACTERISTICS				
CALCIUM AS CaCO3 (mg/l)		NOTE-1		
SILICA AS SiO2 (mg/l)		NOTE-1		
DESIGN CRITERIA				
SURFACE LOADING CLARIFIER (m³/m²/day)		24 (MAXIMUM)		
FLOCCULATION (minutes)		20 (MINIMUM)		
SOLIDS LOADING (Kg/m²/hr)		NOTE-1		
WEIR LOADING (m³/m/day) (MAX/NOR)		300 (MAXIMUM)		
TOTAL DETENTION TIME (minutes)		150 (MINIMUM)		
UNIT SPECIFICATION				
NO. OF UNITS		1		
MODE OF FEED		CENTRAL FEED		
DIA. OF CLARIFIER (m)		10.0	1	
HEIGHT (S.W.D + F.B) (m)		4.5 + 0.5	1	
HOLD UP VOLUME (m³)		353	1	
BOTTOM SLOPE		1 : 12 (NOTE-1)		
TYPE OF INLET ARRANGEMENT		SUBMERGED, SIDE ENTRY		
FEED WELL DIAMETER (m)		NOTE-1		
FEED WELL DEPTH (m)		NOTE-1		
TYPE OF OVER FLOW ARRANGEMENT		NOTE-1		
SIZE OF OVER FLOW WEIR		NOTE-1		
OVER FLOW LAUNDER FREE BOARD		NOTE-1		
SIZE OF EFFLUENT LAUNDER (mxm)		NOTE-1		
SLOPE OF EFFLUENT LAUNDER		1 : 5000		
SLUDGE SCRAPPING MECHANISMTYPE/RPH		CENTRALLY DRIVEN TRUSSED RAKE/0.75-1.5 (NOTE-1)		
SHEET 1 OF 2				
	ENGINEERS INDIA LIMITED NEW DELHI	LIME SODA CLARIFIER	PROCESS DATA SHEET	REV.
			B269-475-17-44-DS-2003	1


LIME SODA CLARIFIER					
PROJECT : IOCL-PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO.: 475-CL-201	
TYPE OF BRIDGE & WALKWAY		FULL DIA. FIXED BRIDGE / WALK WAY UP TO CENTER			
APPROACH TO BRIDGE		BY STAIRS			
WIDTH OF WALKWAY		1.0 m			
SLUDGE WITHDRAWAL ARRANGEMENT		OUTLET PIPE FROM BOTTOM			
SLUDGE HOPPER VOLUME (m <sup>3</sup> ) (MIN.)		NOTE-1			
SCUM REMOVAL ARRANGEMENT (YES/ NO)		NO			
<b>DRIVE UNIT FOR SLUDGE SCRAPPING MECHANISM</b>					
TYPE		ELECTRIC MOTOR			
MOUNTING		CENTRAL			
NO. OF MOTORS		TWO			
DRIVE HP/RPM (REACTOR/SCRAPPER) TURBINE		NOTE-1			
SPEED REDUCTION GEAR BOX		YES			
REDUCTION RATIO		NOTE-1			
<b>MATERIAL OF CONSTRUCTION</b>					
TANK		RCC EPOXY SCREED			
FEED WELL		MS FRP COATED			
RAKE ARM		MS FRP COATED			
OVER FLOW WEIR		MS FRP COATED			
PEDESTAL		RCC			
SCRAPPER RAKE		MS FRP COATED			
SQUEEZERS		NEOPRENE			
DESLUDGING VALVE & PIPE		AS PER ENGG. SPECS.			
SCUM BAFFLE		AS PER ENGG. SPECS.			
SCUM TROUGH		AS PER ENGG. SPECS.			
WALKWAY BRIDGE		MS			
HANDRAILINGS		AS PER ENGG. SPECS.			
ACCESS STAIR		AS PER ENGG. SPECS.			
PAINTING/ COATING		AS PER ENGG. SPECS.			
INTERNAL SURFACE		AS PER ENGG. SPECS.			
EXTERNAL SURFACE		AS PER ENGG. SPECS.			
<b>NOTES:</b>					
1	DATA TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR				
2	ACCESS SHALL BE PROVIDED FROM ONE SIDE TO ATTEND TO CENTRALLY LOCATED SCRAPPING / CLARIFYING MECHANISM MOTOR.				
3	TOP LEVEL OF ORIFICE SHALL BE MINIMUM 40 MM BELOW TWL.				
4	AN MS/RCC PLATFORM SHALL BE PROVIDED ACROSS THE DIAMETER OF THE CLARIFIER UP TO CENTRE.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG
<b>SHEET 2 OF 2</b>					
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SODA CLARIFIER		PROCESS DATA SHEET
					B269-475-17-44-DS-2003
					REV. 1





EVAPORATOR FEED TANK					
PROJECT : IOCL- PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO.: 475-T-202	
SERVICE : TO HOLD AND TRANSFER LIME SODA CLARIFIER OUTLET WATER					
<b>PROCESS DATA</b>					
LIQUID HANDLED			LIME SODA CLARIFIER OUTLET WATER		
VISCOSITY OF LIQUID (cs)			1		
LIQUID DENSITY (kg/m <sup>3</sup> )			1000		
OPERATING TEMPERATURE (°C)			AMBIENT		
OPERATING PRESSURE (kg/cm <sup>2</sup> )			ATM. + LIQUID DEPTH		
HOLDING PERIOD OF TANK (MINUTES)			~60		
<b>MECHANICAL DATA</b>					
NO. OF TANKS			1		
TYPE			OPEN, RECTANGULAR		
DIMENSION (mxm)			5.0 x 5.0		
LIQUID DEPTH (m)			3.5		
DEAD VOLUME DEPTH (m)			0.5		
FREE BOARD (m)			0.5		
TOTAL HEIGHT (m)			NOTE-1		
EFFECTIVE CAPACITY OF EACH TANK (m <sup>3</sup> )			80		
TOTAL CAPACITY OF EACH TANK (m <sup>3</sup> )			NOTE-1		
LEVEL INDICATOR			YES		
TYPE OF LEVEL INDICATOR			LEVEL TRANSMITTER		
SERVICE WATER CONNECTION			NO		
OVERFLOW CONNECTION			YES		
DRAINING ARRANGEMENT			YES		
WITHDRAWING ARRANGEMENT			THROUGH CENTRIFUGAL PUMPS		
AGITATOR REQUIRED			NA		
BAFFLE ARRANGEMENT			NA		
SIZE OF BAFFLES			NA		
CORROSION ALLOWANCE (mm)			NA		
HEATING COIL			NO		
INSULATION (YES/NO)			NO		
BREATHING VALVE (YES/NO)			NO		
VENT (YES/NO)			NO		
FLAME ARRESTOR (YES/NO)			NO		
CALIBRATION OF TANK (YES/NO)			NO		
<b>MATERIAL OF CONSTRUCTION</b>					
TANK			RCC		
COATING /PAINTING			EPOXY SCREED		
COVER			NA		
<b>NOTES:</b>					
1	ELEVATION OF THE TANK SHALL ENSURE FLOODED SUCTION TO THE DOWNSTREAM TRANSFER PUMPS				
2	HANDRAILING SHALL BE PROVIDED ALL AROUND THE TANK				
3	ALL INSTRUMENTS SHALL BE MOUNTED ON THE TANK WITH PROPER APPROACH.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS / COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	D	CHECKED	APPROVED
		ENGINEERS INDIA LIMITED NEW DELHI	EVAPORATOR FEED TANK	PROCESS DATA SHEET B269-475-17-44-DS-2004	REV. 1


EVAPORATOR FEED PUMPS						
PROJECT : IOCL-PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269		
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-P-202 A/B/C		
SERVICE : TO TRANSFER LIME SODA CLARIFIER OUTLET WATER TO EVAPORATOR- DRYER SYSTEM						
TYPE : CENTRIFUGAL, HORIZONTAL						
PROPERTIES OF LIQUID						
LIQUID HANDLED			LIME SODA CLARIFER OUTLET WATER			
PUMPING TEMPERATURE ( <sup>0</sup> C)			AMBIENT			
VISCOSITY AT PUMPING TEMPERATURE (cp)			1.0			
LIQUID DENSITY (kg/m <sup>3</sup> )			~1000			
PRESENCE OF CORROSIVE / TOXIC COMPONENTS			NO			
SOLIDS IN SUSPENSION (YES / NO)			NO			
SIZE OF SOLID PARTICLES (mm)(MAX)			NA			
OPERATING CONDITIONS						
FLOW RATE		MAX. (m3/hr)	30	<div><div></div><div>3</div></div>		
		NORMAL(m3/hr)	NOTE-1			
		MIN. (m3/hr)	NOTE-1			
SUCTION PRESSURE (kg/cm2.a)			ATM. + LD			
MAXIMUM SUCTION PRESSURE (kg/cm2.g)			NOTE-1			
DISCHARGE PRESSURE (kg/cm2.a)			4.0			
DIFFERENTIAL PRESSURE (kg/cm2.g)			3.0			
DIFFERENTIAL HEAD (m)			30			
NPSH AVAILABLE (m) MIN.			FLOODED SUCTION			
NO. OF PUMPS			3 (2W+1S)			
CAPACITY CONTROL FOR VOLUMETRIC PUMPS						
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC			N.A.			
TYPE			N.A.			
RANGE (%)			N.A.			
PRECISION AT MIN. RATE (%)			N.A.			
MECHANICAL DATA						
DESIGN PRESSURE (kg/cm2.g)			5.0			
DESIGN TEMPERATURE ( <sup>0</sup> C)			65			
MATERIAL CODE		CASING	SDSS			
		IMPELLER	SDSS			
SEAL TYPE (MECHANICAL / PACKING)			PACKING			
LINE RATING IN / OUT			150# / 150#			
DRIVER			ELECTRIC MOTOR			
NOTES:						
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.					
2	THE PUMP MOTOR SHALL BE DESIGNED FOR OPEN DISCHARGE CONDITION.					
3	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.					
4	THE PUMPS SHALL BE ABLE TO MEET REQUIRED PLANT T/D FLOW REQUIREMENTS.					
3	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
2	27.05.2021	REVISED & REISSUED FOR TENDER	SC	VS	PKG	
1	23.11.2020	REISSUED FOR TENDER	SC	VS	PKG	
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG	
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
	ENGINEERS INDIA LIMITED		EVAPORATOR FEED PUMPS		PROCESS DATA SHEET	REV.
	NEW DELHI				B269-475-17-44-DS-2005	3


ZERO LIQUID DISCHARGE PACKAGE				
PROJECT : IOCL-PANIPAT REFINERY EXPANSION		CLIENT : IOCL	JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475	ITEM NO. : 475-LZ-202 A/B/C	
SERVICE : RO-IV REJECT EFFLUENT TREATMENT FOR ACHIEVING ZERO LIQUID DISCHARGE				
TYPE : MULTIEFFECT EVAPORATOR WITH DRYER				
LOCATION			RODMP BLOCK	
FEED WATER			LIME SODA CLARIFIER OUTLET WATER	
NO. OF UNITS			3 (2W + 1 SB)	
DESIGN CAPACITY (m3/hr)			30 PER CHAIN 2	
FLOW/ FEED TO EVAPORATOR (m3/hr) (DESIGN)			NOTE-1	
FEED WATER AT EVAPORATOR-DRYER PACKAGE BATTERY LIMIT INLET				
OPERATING TEMPERATURE (deg C)			AMBIENT	
DESIGN TEMPERATURE (deg C)			65	
OPERATING PRESSURE (kg/cm2.g)			2.5	
DESIGN PRESSURE (kg/cm2.g)			3.5	
INFLUENT CHARACTERISTICS (AS PER PROCESS DESIGN BASIS DOCUMENT NO. B269-475-17-44-DB-1001)				
TREATED EFFLUENT QUALITY				
DISTILLATE/ CONDENSATE WATER QUALITY				
TDS (mg/L)(MAX.)			300	
TSS (mg/L)(MAX.)			1	
EVAPORATOR UNIT OUTLET				
DISSOLVED SOLIDS IN CONCENTRATED LIQUOR			30% (MINIMUM)	
SOLIDS AT DRYER UNIT OUTLET				
MOISTURE CONTENT			10% (MAXIMUM)	
EVAPORATOR DESIGN DATA (NOTE-2,3,4,5,6)				
TYPE			NOTE-2	
TYPE BASED ON NO. OF STAGES			MULTI-EFFECT EVAPORATOR	
NO. OF STAGES			4 (MIN.) (NOTE-3)	
FEED RATE (kg/hr)			NOTE-1	
EVAPORATION RATE (kg/hr)			NOTE-1	
CONCENTRATE OUTLET RATE (kg/hr)			NOTE-1	
INITIAL CONCENTRATION (w/w%)			~ 3-4 (AS PER RO PROJECTIONS) 2	
OUTLET CONCENTRATION (w/w%)			30 % MINIMUM	
DRYER DESIGN DATA (NOTE-7)				
TYPE			NOTE-17	
NO. OF UNITS			2 (1W + 1 SB)	
DESIGN CAPACITY (m3/hr)			5 PER CHAIN (NOTE-18) 2	
FEED RATE (kg/hr)			NOTE-1	
EVAPORATION RATE (kg/hr)			NOTE-1	
INITIAL CONCENTRATION (w/w%)			NOTE-1	
CONDENSATE OUTLET RATE (kg/hr)			NOTE-1	
CONDENSATE PRESSURE AT THE B/L OF EVAPORATOR-DRYER PACKAGE (kg/cm2.g)			2.0	
DRIED SOLIDS OUTLET RATE (kg/hr)			NOTE-1	
MOISTURE CONTENT IN DRIED SOLIDS			10 % (Max)	
DESIGN CONSIDERATIONS				
FOAMING TENDENCY (YES/NO)			NOTE-1	
SCALING/ FOULING TENDENCY (YES/NO)			NOTE-1	
CRYSTALLIZING TENDENCY (YES/NO)			NOTE-1	
SHEET 1 OF 3				
	ENGINEERS INDIA LIMITED NEW DELHI	ZERO LIQUID DISCHARGE PACKAGE	PROCESS DATA SHEET	REV.
			B269-475-17-44-DS-2006	2

ZERO LIQUID DISCHARGE PACKAGE				
UTILITIES				
STEAM CONDITIONS AT B/L AVAILAIBLE	MP STEAM (NOTE-7)			
MP STEAM PRESSURE (kg/cm2.g) (Min./Nor./Max)	NOTE- 1,7			
STEAM TEMPERATURE (deg C) (Min./Nor./Max)	NOTE- 1,7			
DRY SATURATED STEAM REQUIREMENT (kg/hr)	NOTE- 1			
COOLING WATER CIRCULATION RATE (m3/hr)	NOTE- 1			
COMPRESSED AIR REQUIREMENT (Nm3/hr)	NOTE- 1			
POWER REQUIREMENT FOR EVAPORATOR UNIT (KWH)	NOTE- 1			
POWER REQUIREMENT FOR DRYER UNIT (KWH)	NOTE- 1			
CLEANING CYCLE (NOTE-11)				
OPERATING CYCLE (hrs/day)	NOTE- 1			
CLEANING CYCLE (hrs/day)	NOTE- 1			
CIP SYSTEM REQUIRED (YES/NO)	NOTE- 1			
CHEMICALS REQUIRED	NOTE- 1			
MATERIAL OF CONSTRUCTION				
EVAPORATOR UNIT	NOTE- 12			
DRYER UNIT	NOTE- 13			
NOTES				
1	DETAILS TO BE CONFIRMED BY THE EVAPORATOR AND DRYER SYSTEM SUPPLIER.			
2	TYPE OF EVAPORATOR (FALLING FILM, NATURAL CIRCULATION AND/OR FORCED CIRCULATION ETC.) SHALL BE SELECTED SUITABLY SO AS TO MAINTAIN GOOD HEAT TRANSFER COEFFICIENTS AND TO REDUCE THE TENDENCY OF CRYSTALLIZING/SCALING IN THE TUBES)			
3	MINIMUM 4 EFFECTS/STAGES SHALL BE PROVIDED FOR GOOD STEAM ECONOMY AND CONDENSATE RECOVERY IN THE			
4	THE EVAPORATOR SYSTEM SHALL BE PROVIDED ALONG WITH VAPOR SEPARATORS (ONE FOR EACH EFFECT) AND CONCENTRATE / RE-CIRCULATING / TRANSFER PUMPS.			
5	THERMAL VAPOR RECOMPRESSION (TVR) / ADIABATIC EVAPORATOR SYSTEM, PRE-HEATERS, DEAERATOR, FLASH VESSELS, SURFACE CONDENSER, VACUUM PUMPS/EJECTOR (WITH MINIMUM 1 STANDBY), VAPOR DUCTING, CONDENSATE/DISTILLATE STORAGE AND PUMPING, CONCENTRATED LIQUOR STORAGE AND PUMPING TO DRYER UNIT ETC. SHALL BE PROVIDED AS PER THE SYSTEM SUPPLIER DESIGN REQUIREMENTS.			
6	ALL FACILITIES AS REQUIRED FOR THE EVACUATION OF THE SOLIDS FROM THE DRYER UNIT SHALL BE PROVIDED SO AS TO ENSURE THAT THE SOLIDS ARE COLLECTED CONTINUOUSLY AND STORED FOR DISPOSAL.			
7	ADEQUATE PRESSURE REDUCTION & DE-SUPERHEATING SYSTEM (PRDS) SHALL BE PROVIDED FOR GETTING THE REQUIRED INLET CONDITIONS OF STEAM AS ENVISAGED BY THE EVAPORATOR AND DRYER PACKAGE SYSTEM SUPPLIER.			
8	ALL CONTROLS AND INSTRUMENTATION AS REQUIRED FOR THE SMOOTH OPERATION OF THE EVAPORATOR AND DRYER PACKAGE AS PER THE TENDER SPECIFICATIONS AND AS RECOMMENDED BY THE SYSTEM SUPPLIER SHALL BE PROVIDED.			
9	CHEMICAL CLEANING SYSTEM FOR THE EVAPORATOR AND DRYER UNIT AS RECOMMENDED BY THE PACKAGE SUPPLIER SHALL BE PROVIDED WITH NECESSARY PIPING AND ISOLATION FACILTIES.			
10	REFER TECHNICAL SPECIFICATIONS (DOC NO. B269-475-17-44-SS-1001 & B269-475-17-44-SS-1002) AND DESIGN BASIS (DOC. NO. B269-475-17-44-DB-1001).			
11	THE PROCESS DATASHEETS OF THE INDIVIDUAL EQUIPMENTS/ UNITS IN THE EVAPORATOR & DRYER UNITS INCLUDING PRETREATMENT SECTION & CHEMICAL CLEANING FACILITIES SHALL BE PREPARED & SUBMITTED FOR EIL/ IOCL REVIEW/ APPROVAL.			
SHEET 2 OF 3				
	ENGINEERS INDIA LIMITED NEW DELHI	ZERO LIQUID DISCHARGE PACKAGE	PROCESS DATA SHEET	REV.
			B269-475-17-44-DS-2006	2




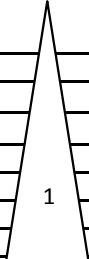




ZERO LIQUID DISCHARGE PACKAGE						
NOTES:						
12	MATERIAL OF CONSTRUCTION FOR THE EVAPORATOR UNIT SHALL BE AS INIDCATED BELOW AS A MINIMUM					
I	CALENDRIAS					
a	TUBES	TITANIUM GRADE-II				
b	TUBE SHEET	SS316 + Ti CLADDING				
c	SHELL	SS304				
d	DISHED ENDS	SDSS				
II	PRE- HEATERS					
a	TUBES	TITANIUM GRADE-II				
b	TUBE SHEET	SS316 + Ti CLADDING				
c	SHELL	SS304				
d	DISHED ENDS	SDSS				
III	SURFACE CONDENSORS					
a	TUBES	SS304				
b	TUBE SHEET	SS304				
c	SHELL	SS304				
d	DISHED ENDS	SS304				
IV	TANKS AND VESSELS					
a	FEED TANK AND VAPOR SEPARATORS	SDSS				
b	CONDENSATE VESSEL	SS304				
V	FEED AND CIRCULATION PUMPS					
VI	CONDENSATE PUMPS					
VII	VACCUM PUMPS					
VIII	TVR					
SUPERIOR METALLURGY IF RECOMMENDED BY THE EVAPORATOR UNIT SUPPLIER SHALL BE PROVIDED						
13	MATERIAL OF CONSTRUCTION FOR THE DRYER UNIT SHALL BE AS INIDCATED BELOW AS A MINIMUM					
I	ATFD	SDSS (JACKET - CS)				
II	SURFACE CONDENSORS					
a	TUBES	SS304				
b	TUBE SHEET	SS304				
c	SHELL	SS304				
d	DISHED ENDS	SS304				
III	PUMPS					
IV	TANKS AND VESSELS					
a	FEED TANK	SDSS				
b	CONDENSATE TANK	SS304				
c	CYCLONE SEPARATOR	SS304				
SUPERIOR METALLURGY IF RECOMMENDED BY THE DRYER UNIT SUPPLIER SHALL BE PROVIDED						
14	PREFERRED TUBE OD AND THICKNESS FOR EVAPORATOR (CALENDRIA), PREHEATER, CONDENSERS AND OTHER EXCHANGERS IS TO BE SPECIFIED AS MENTIONED BELOW					
		TUBE METALLURGY	25 mm OD	20 mm OD		
		CS/ LAS	2.5	2.0		
		SS/ HAS/ ADMIRALTY/ Cu-Ni	2.0	1.6		
		TITANIUM	1.2	0.9		
		IBR SERVICE				
		CS/ LAS	2.5	2.1		
		SS/ HAS	2.1	2.1		
15	COMPLETE PROCESS & THERMAL DESIGN CALCULATIONS/ DETAILS OF THE ZERO LIQUID DISCHARGE PACKAGE SHALL BE SUBMITTED DURING DETAIL ENGINEERING FOR EIL/ IOCL REVIEW/ APPROVAL AS PER THE VENDOR DATA REQUIREMENTS (Doc. No. B269-475-17-44-VDR-1001).					
16	THE CONTRACTOR SHALL TAKE BACK TO BACK GUARANTEES FOR 30% OUTLET TDS CONCENTRATION IN THE EVAPORATOR UNIT AND FINAL MOISTURE CONTENT OF 10% IN THE DRYER OUTLET FROM THE EVAPORATOR & DRYER UNITS SUPPLIER(S).					
17	SELECTION OF DRYER UNIT, EITHER AGITATED THIN FILM DYER OR PUSHER CENTRIFUGE SHALL BE DONE BASED ON SUPLIER EXPERIENCE OF ACHIEVING DESIRED MOISTURE CONTENT IN DRYER OUTLET.					
18	THIS IS MINIMUM DRYER CAPACITY REQUIREMENT. HIGHER CAPACITY OF DRYER UNIT SHALL BE PROVIDED BY THE SUPPLIER AS PER SYSTEM REQUIRMENTS.					
2	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23		SC	VS	PKG
1	25.05.2021	REVISED & ISSUED FOR TENDER		SC/DB	VS	PKG
0	05.05.2020	ISSUED FOR TENDER		DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS		DB	VS	PKG
NO.	DATE	REVISION		PREPARED	CHECKED	APPROVED
		ENGINEERS INDIA LIMITED NEW DELHI		ZERO LIQUID DISCHARGE PACKAGE	PROCESS DATA SHEET B269-475-17-44-DS-2006	REV. 2


LIME SOLUTION DOSING TANKS					
PROJECT : IOCL- PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-T-203 A/B	
SERVICE : PREPARATION OF 15% LIME SOLUTION					
PROCESS DATA					
LIQUID HANDLED				15 % LIME SOLN.	
VISCOSITY OF LIQUID (cs)				NOTE-1	
LIQUID DENSITY (kg/m3)				NOTE-1	
OPERATING TEMPERATURE (°C)				AMBIENT	
OPERATING PRESSURE (kg/cm2.a)				ATM. + LIQUID COLUMN	
NATURE OF LIQUID (TOXIC/CORROSIVE)				CORROSIVE	
LIME (100%) REQUIRED FOR ZLD AT DESIGN FLOW RATE (kg/day)				~6670 (NOTE-1)	
PURITY OF COMMERCIALY AVAILABLE CHEMICAL				65%	
HOLDING PERIOD OF EACH TANK (hrs)				12	
MECHANICAL DATA					
NO. OF TANKS				2	
TYPE				RECTANGULAR, OPEN	
DIMENSION (mxm)				4.0 x 4.0	
LIQUID DEPTH (m)				2	
DEAD VOLUME DEPTH (m)				0.2	
FREE BOARD (m)				0.3	
TOTAL HEIGHT (m)				2.5	
EFFECTIVE CAPACITY OF EACH TANK (m³)				32	
TOTAL CAPACITY OF EACH TANK (m³)				40	
LEVEL INDICATOR				YES	
TYPE OF LEVEL INDICATOR				LEVEL TRANSMITTER	
SERVICE WATER CONNECTION				YES	
OVERFLOW CONNECTION				YES	
DRAINING ARRANGEMENT				YES	
WITHDRAWING ARRANGEMENT				THROUGH CENTRIFUGAL PUMPS	
AGITATOR REQUIRED				YES (ONE/ TANK)	
BAFFLE ARRANGEMENT				NO	
SIZE OF BAFFLES				NA	
CORROSION ALLOWANCE (mm)				NA	
HEATING COIL				NO	
INSULATION (YES/NO)				NO	
BREATHING VALVE (YES/NO)				NO	
VENT (YES/NO)				NO	
FLAME ARRESTOR (YES/NO)				NO	
CALIBRATION OF TANK (YES/NO)				NO	
MATERIAL OF CONSTRUCTION					
TANK				RCC	
LINING /PAINTING				ACID/ ALKALI RESISTANT PROOF TILING	
COVER				OPEN TANK	
NOTES:					
1	TO BE FURNISHED BY THE CONTRACTOR DURING DETAIL ENGINEERING.				
2	TANKS SHALL BE PROVIDED WITH TEMPERATURE INDICATION.				
3	FOR OTHER REQUIREMENTS REFER GENERAL ENGG. SPEC.				
4	ALL INSTRUMENTS ON THE TANKS SHALL BE MOUNTED ON A RCC PLATFORM WITH PROPER APPROACH.				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SOLUTION DOSING TANKS	PROCESS DATA SHEET B269-475-17-44-DS-2009	REV. 1


LIME SOLUTION DOSING TANK AGITATOR					
PROJECT : IOCL- PANIPAT REFINERY		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-MX-201 A/B	
SERVICE : 15% LIME SOLUTION PREPARATION					
PROCESS DATA					
PURPOSE			MIXING		
OPERATION (BATCH/CONTINUOUS)			BATCH		
AGITATED VOLUME (m <sup>3</sup> )			35.2 <span style="float: right;">1</span>		
OPERATING PRESSURE (kg/cm <sup>2</sup> abs.)			ATM. + L.D.		
OPERATING TEMPERATURE (°C)			AMBIENT		
SOLIDS PRESENT (YES/NO, TYPE & SIZE)			YES		
FOAM TENDENCY (YES/NO)			NO		
SOLUBILITY (HIGH / MEDIUM / LOW / NIL)			MEDIUM		
ABRASION (HIGH / MEDIUM / LOW / NIL)			LOW		
SETTLING (HIGH / MEDIUM / LOW / NIL)			NIL		
DEGREE OF AGITATION (MILD / MEDIUM / VIOLENT)			MILD		
CORROSIVE PRODUCTS ( YES / NO, TYPE)			YES		
PROCESS LIMITATION (NONE / HP / TIP SPEED / SPACE)			TIP SPEED		
S. NO.	COMPONENT	PERCENT COMPOSITION BY WEIGHT	VISCOSITY (Cs)	SP. GRAVITY	
1	LIME	15%	NOTE-1	NOTE-1	
2	WATER	85%	1.00	1.00	
AVERAGE PROPERTIES OF MIXTURE			NOTE-1	NOTE-1	
MECHANICAL DATA					
IMPELLER		TYPE (TURBINE / PROPELLER)	NOTE-1		
		NUMBER	2 (ONE/ TANK) <span style="float: right;">1</span>		
		DIAMETER (mm)	1200		
		SPEED (RPM)	NOTE-1		
BLADES		M.O.C.	SS-316L		
		TYPE (TURBINE / PROPELLER)	NOTE-1		
		NUMBER	3 (NOTE-1)		
		PITCH	NOTE-1		
SHAFT		WIDTH (mm)	NOTE-1		
		M.O.C.	SS-316L		
		M.O.C.	SS-431		
MOUNTING SPACE AVAILABLE (AMPLE/RESTRICTED)			AMPLE		
MIXER ENTRY (TOP / SIDE /BOTTOM / PORTABLE)			TOP		
MOUNTING (CLAMPED / FLANGED, MOUNTING ANGLE)			FLANGED, 90°		
SHAFT SEAL (MECAHNICAL / STUFFING BOX / LABYRITGH SEAL / VAPOUR SEAL)			N.A.		
DRIVE TYPE			ELECTRICAL MOTOR		
DRIVE UNIT TRANSMISSION TYPE (GEAR / BELT / DIRECT)			NOTE-1		
NOTES					
1	TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.				
2	SUSPENDED SOLIDS PRESENT IN THE EFFLUENT.				
1	02.05.2022	REISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SOLUTION DOSING TANK AGITATOR	PROCESS DATA SHEET	REV.
				B269-475-17-44-DS-2010	1

SODA ASH SOLUTION DOSING PUMPS FOR LIME SODA CLARIFIER					
PROJECT : IOCL- PANIPAT REFINERY EXPANSION		CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-P-206 A/B	
SERVICE : DOSING OF 30% SODA ASH SOLUTION AT INLET OF LIME SODA CLARIFIER					
TYPE : POSITIVE DISPLACEMENT, DIAPHRAGM					
PROPERTIES OF LIQUID					
LIQUID HANDLED			30% SODA ASH SOLUTION		
PUMPING TEMPERATURE ( <sup>0</sup> C)			AMBIENT		
VISCOSITY AT PUMPING TEMPERATURE (cp)			~1.0		
VAPOUR PRESSURE AT PUMPING TEMPERATURE (kg/cm2.a)			NOTE-1		
LIQUID DENSITY (kg/m <sup>3</sup> )			NOTE-1		
PRESENCE OF CORROSIVE / TOXIC COMPONENTS			CORROSIVE		
SOLIDS IN SUSPENSION (YES / NO)			NO		
SIZE OF SOLID PARTICLES (mm)(MAX)			NA		
OPERATING CONDITIONS					
FLOW RATE		MAX. (LPH)	5000	1	
		NORMAL(LPH)	NOTE-1		
		MIN. (LPH)	NOTE-1		
SUCTION PRESSURE (kg/cm2.a)			ATM		
DISCHARGE PRESSURE (kg/cm2.a)			3.0		
DIFFERENTIAL PRESSURE (kg/cm2.g)			2.0		
DIFFERENTIAL HEAD (m)			20		
NPSH AVAILABLE (m) MIN.			FLOODED SUCTION		
NO. OF PUMPS			2 (1W + 1S)		
CAPACITY CONTROL FOR VOLUMETRIC PUMPS					
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC			MANUAL		
TYPE			STROKE ADJUSTMENT		
RANGE (%)			10-100		
PRECISION AT MIN. RATE (%)			NOTE-1		
MECHANICAL DATA					
DESIGN PRESSURE (kg/cm2.g)			4.0		
DESIGN TEMPERATURE ( <sup>0</sup> C)			65		
MATERIAL CODE		CASING	PP/PVDF		
		DIAPHRAGM	TEFLON		
SEAL TYPE (MECHANICAL / PACKING)			GLANDLESS (NOTE-1)		
LINE RATING IN / OUT			150# / 150#		
DRIVER			ELECTRIC MOTOR		
NOTES:					
1	TO BE FURNISHED/ CONFIRMED BY THE CONTRACTOR.				
2	PULSATION DAMPENER TO BE PROVIDED ON EACH PUMP DISCHARGE LINE.				
3	SOLUTION STRENGTH SHALL BE CONFIRMED BY THE VENDOR				
4	PUMPS SHALL HAVE AN EXTERNAL PRESSURE SAFETY RELIEF VALVE. (IN CASE NOT PROVIDED INTERNALLY)				
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG
A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED
	ENGINEERS INDIA LIMITED NEW DELHI		SODA ASH SOLUTION DOSING PUMPS FOR LIME SODA CLARIFIER	PROCESS DATA SHEET	REV.
				B269-475-17-44-DS-2012	1





LIME SODA CLARIFIER SLUDGE SUMP						
PROJECT : IOCL- PANIPAT REFINERY EXPANSION			CLIENT : IOCL		JOB NO. : B269	
UNIT : ZERO LIQUID DISCHARGE PLANT			UNIT NO.: 475		ITEM NO. : 475-S-202	
SERVICE : TO HOLD & TRANSFER SLUDGE FROM LIME SODA CLARIFIER						
PROCESS DATA						
FLUID HANDLED			SLUDGE			
INFLUENT TEMPERATURE (0C)			AMBIENT 			
INFLUENT FLOW (m3/hr) (DESIGN)			18.5 			
PRESENCE OF CORROSIVE/TOXIC COMPONENTS			YES			
NOMINAL CAPACITY OF SUMP (m3) (OVERALL VOLUME)			280			
EFFECTIVE LIQUID STORAGE VOLUME (m3) (OVERALL VOLUME)			240			
RESIDENCE TIME (HOURS.)			8 			
ANY BAFFLE ARRANGEMENT REQUIRED (YES/NO)			NO			
TYPE OF SUMP (OPEN/COVERED)			OPEN			
UNIT SPECIFICATION						
WET SUMP						
SHAPE			RECTANGULAR TWIN COMPARTMENT 			
OVERALL SIZE (LXB) (mXm)			16 X 5.0			
NO. OF COMPARTMENTS			2			
EACH COMAPRTMENT SIZE (LXB) (mXm)			8.0 X 5.0			
LIQUID DEPTH (m)			3			
FREE BOARD (m) + DVD (m) (MINIMUM)			0.3 + 0.2			
TOTAL DEPTH (m)			3.5			
EFFECTIVE LIQUID STORAGE VOLUME EACH COMPARTMENT (m3)			120			
SLOPE FOR SUMP BOTTOM			NOTE-1			
PUMP PIT REQUIRED			NO			
SIZE OF SUCTION CHANNEL (mxm)			NOTE-1			
SLOPE IN SUCTION CHANNEL			NOTE-1			
HYDRO INSULATION (YES/NO)			NO			
TYPE OF HYDRO INSULATION			N.A.			
LEVEL INDICATION REQUIRED (YES / NO)			YES			
LEVEL TRANSMITTER (YES / NO)			YES			
LEVEL SWITCHES (YES / NO)			NO			
LEVEL TRANSMITTER / SWITCH PLATFORM (YES/NO)			YES			
LEVEL ALARM (YES/NO)			YES			
LEVEL ALARM (YES/NO)			YES			
MATERIAL OF CONSTRUCTION						
WET SUMP			RCC 			
PAINTING/COATING/LINING			EPOXY SCREED 			
DRY SUMP (BELOW FGL/ABOVE FGL)			NOTE-5			
STAIRS/HANDRAILS			AS PER EIL SPECS.			
RUNGS			MSEP			
1	DATA TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.					
2	TOP OF SUMP SHALL BE RAISED AT LEAST 300 MM ABOVE FINISHED GROUND/ PAVEMENT LEVEL TO AVOID RAIN WATER INGRESS.					
3	THE SUMP SHALL BE PROVIDED WITH HANDRAILING ALL AROUND 					
4	DELETED					
5	THE LIME SODA CLARIFIER SLUDGE SUMP SHALL BE PROVIDED WITH A PUMP HOUSE FOR ENSURING FLOODED SUCTION TO LIME SODA CLARIFIER SLUDGE TRANSFER PUMPS.					
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG	
A	17.04.2020	ISSUED FOR INPUTS / COMMENTS	DB	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SODA CLARIFIER SLUDGE SUMP	PROCESS DATA SHEET		Rev
				B269-475-17-44-DS-2015		1

LIME SODA CLARIFIER SLUDGE SUMP AGITATOR																														
PROJECT : IOCL- PANIPAT REFINERY			CLIENT : IOCL		JOB NO. : B269																									
UNIT : ZERO LIQUID DISCHARGE PLANT			UNIT NO.: 475		ITEM NO. : 475-MX-202 A/B																									
SERVICE : AGITATION OF UNIT CONTENTS																														
PROCESS DATA																														
PURPOSE				KEEPING SOLIDS IN SUSPENSION																										
OPERATION (BATCH/CONTINUOUS)				CONTINUOUS																										
AGITATED VOLUME (m <sup>3</sup> )				256 <span style="float: right;">1</span>																										
OPERATING PRESSURE (kg/cm <sup>2</sup> abs.)				ATM.																										
OPERATING TEMPERATURE (°C)				AMBIENT																										
SOLIDS PRESENT (YES/NO, TYPE & SIZE)				YES																										
FOAM TENDENCY (YES/NO)				NO																										
SOLUBILITY (HIGH / MEDIUM / LOW / NIL)				NA																										
ABRASION (HIGH / MEDIUM / LOW / NIL)				HIGH																										
SETTLING (HIGH / MEDIUM / LOW / NIL)				HIGH																										
DEGREE OF AGITATION (MILD / MEDIUM / VIOLENT)				MILD TO MEDIUM																										
CORROSIVE PRODUCTS ( YES / NO, TYPE)				YES, CHEM. SLUDGE																										
PROCESS LIMITATION (NONE / HP / TIP SPEED / SPACE)				TIP SPEED																										
S. NO.	COMPONENT		PERCENT BY WEIGHT	VISCOSITY (Cs)	SP. GRAVITY																									
1	CHEM. SLUDGE FROM LIME SODA CLARIFIER <span style="float: right;">1</span>		3-5	NOTE-1	NOTE-1																									
2	WATER		BALANCE	1.00	1.00																									
AVERAGE PROPERTIES OF MIXTURE				NOTE-1	~1.05																									
MECHANICAL DATA																														
IMPELLER			TYPE (TURBINE / PROPELLER)	NOTE-1																										
			NUMBER	2 <span style="float: right;">1</span>																										
			DIAMETER (mm)	1500 <span style="float: right;">1</span>																										
			SPEED (RPM)	NOTE-1																										
			M.O.C.	SS-316L																										
BLADES			TYPE (TURBINE / PROPELLER)	NOTE-1																										
			NUMBER	3 (NOTE-1)																										
			PITCH	NOTE-1																										
			WIDTH (mm)	NOTE-1																										
			M.O.C.	SS-316L																										
SHAFT			M.O.C.	SS431																										
MOUNTING SPACE AVAILABLE (AMPLE/RESTRICTED)				AMPLE																										
MIXER ENTRY (TOP / SIDE / BOTTOM / PORTABLE)				TOP																										
MOUNTING (CLAMPED / FLANGED, MOUNTING ANGLE)				FLANGED, 90°																										
SHAFT SEAL (MECAHNICAL / STUFFING BOX / LABYRITGH SEAL / VAPOUR SEAL)				N.A.																										
DRIVE TYPE				ELECTRICAL MOTOR																										
DRIVE UNIT TRANSMISSION TYPE (GEAR / BELT / DIRECT)				NOTE-1																										
NOTES																														
1	TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.																													
2	SUSPENDED SOLIDS PRESENT IN THE EFFLUENT.																													
<table border="1"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>REVISION</th> <th>PREPARED</th> <th>CHECKED</th> <th>APPROVED</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>02.05.2022</td> <td>REVISED &amp; ISSUED WITH TA- 03 OF T-8701/23</td> <td>SC</td> <td>VS</td> <td>PKG</td> </tr> <tr> <td>0</td> <td>05.05.2020</td> <td>ISSUED FOR TENDER</td> <td>DB</td> <td>VS</td> <td>PKG</td> </tr> <tr> <td>A</td> <td>17.04.2020</td> <td>ISSUED FOR INPUTS/ COMMENTS</td> <td>DB</td> <td>VS</td> <td>PKG</td> </tr> </tbody> </table>							NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG	A	17.04.2020	ISSUED FOR INPUTS/ COMMENTS	DB	VS	PKG
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED																									
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	ENGINEERS INDIA LIMITED NEW DELHI		LIME SODA CLARIFIER SLUDGE SUMP AGITATOR		PROCESS DATA SHEET	REV.																								
					B269-475-17-44-DS-2016	1																								

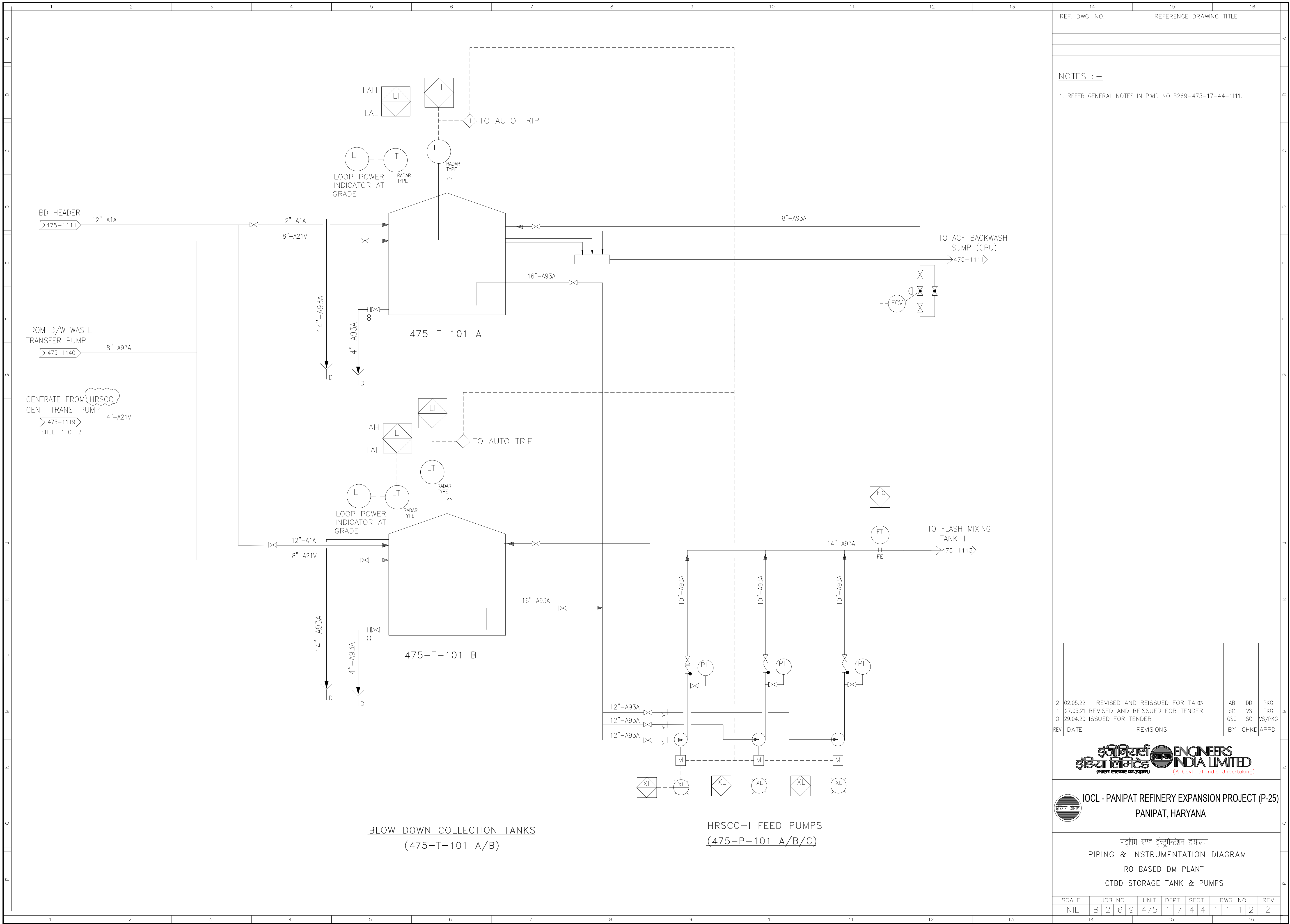
LIME SODA CLARIFIER SLUDGE TRANSFER PUMPS						
PROJECT : IOCL- PANIPAT REFINERY		CLIENT : IOCL		JOB NO. : B269		
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475		ITEM NO. : 475-P-208 A/B		
SERVICE : TO TRANSFER LIME SODA CLARIFIER SLUDGE TO CENTRIFUGE UNIT						
TYPE : HORIZONTAL CENTRIFUGAL (NOTE-3)						
PROPERTIES OF LIQUID						
LIQUID HANDLED			CHEMICAL SLUDGE			
PUMPING TEMPERATURE ( $^{\circ}\text{C}$ )			AMBIENT			
VISCOSITY AT PUMPING TEMPERATURE (cp)			NOTE-1			
LIQUID DENSITY ( $\text{kg/m}^3$ )			NOTE-1			
PRESENCE OF CORROSIVE / TOXIC COMPONENTS			YES			
SOLIDS IN SUSPENSION (YES / NO)			YES, 3-5% BY WT.			
SIZE OF SOLID PARTICLES (mm)(MAX)			NOTE-1			
OPERATING CONDITIONS						
FLOW RATE		MAX. ( $\text{m}^3/\text{hr}$ )	30	1		
		NORMAL( $\text{m}^3/\text{hr}$ )	NOTE-1			
		MIN. ( $\text{m}^3/\text{hr}$ )	NOTE-1			
SUCTION PRESSURE ( $\text{kg/cm}^2.\text{a}$ )			ATM.			
DISCHARGE PRESSURE ( $\text{kg/cm}^2.\text{a}$ )			3.5			
DIFFERENTIAL PRESSURE ( $\text{kg/cm}^2.\text{g}$ )			2.5			
DIFFERENTIAL HEAD (m)			25			
NPSH AVAILABLE (m) MIN.			FLOODED SUCTION			
NO. OF PUMPS			2 (1W+1S)			
CAPACITY CONTROL FOR VOLUMETRIC PUMPS						
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC			NOT APPLICABLE			
TYPE						
RANGE (%)						
PRECISION AT MIN. RATE (%)						
MECHANICAL DATA						
DESIGN PRESSURE ( $\text{kg/cm}^2.\text{g}$ )			4.5			
DESIGN TEMPERATURE ( $^{\circ}\text{C}$ )			65			
MATERIAL CODE		CASING	SDSS	1		
		IMPELLER	SDSS			
SEAL TYPE (MECHANICAL / PACKING)			NOTE-1			
LINE RATING IN / OUT			150# / 150#			
DRIVER			ELECTRIC MOTOR			
NOTES:						
1	TO BE FURNISHED/CONFIRMED BY THE CONTRACTOR.					
2	THE PUMP SHALL BE CAPABLE OF AUTO START / STOP OPERATION.					
3	PUMPS SHALL BE LOCATED IN AN UNDERGROUND PUMPHOUSE.					
1	02.05.2022	REVISED & ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
0	05.05.2020	ISSUED FOR TENDER	DB	VS	PKG	
A	17.04.2020	ISSUED FOR INPUTS/COMMENTS	DB	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
	ENGINEERS INDIA LIMITED NEW DELHI		LIME SODA CLARIFIER SLUDGE TRANSFER PUMPS		PROCESS DATA SHEET	REV.
					B269-475-17-44-DS-2017	1

PROJECT UNIT	P-25 PANIPAT REFINERY EXPANSION ZLD PLANT		CLIENT IOCL PANIPAT REFINERY JOBNO.B269      UNITNO. 475		
ITEM NO.	475-LZ-201		SERVICE	MP-LP PRESSURE REDUCER AND DESUPERHEATER	
STEAM INLET LINE NO.		BY VENDOR (NOTE-4)			
STEAM OUTLET LINE NO.		BY VENDOR (NOTE-4)			
MP BFW LINE NO.		BY VENDOR (NOTE-4)			
FLOW RATE		MINIMUM		NORMAL	MAXIMUM
MP BFW@DESUPERHEATERINLET	KG/HR	NOTE6		NOTE6	
STEAM @ DESUPERHEATER OUTLET	KG/HR	-		30000	BY VENDOR
INLET STEAM CONDITIONS		MINIMUM	NORMAL	MAXIMUM	MECH.DESIGN
PRESSURE	KG/CM2 G	12	14	15	18
TEMPERATURE	DEG C	210	260	305	350
OULET STEAM CONDITIONS					
PRESSURE	KG/CM2 G	6		BY VENDOR	BY VENDOR
TEMPERATURE	DEG C	165		BY VENDOR	BY VENDOR
MP BFW WATER CONDITIONS					
PRESSURE	KG/CM2 G	25	28	35	40
TEMPERATURE	DEG C	100	100-105	110	150
MAX.ALLOWABLE PRESSURE DROP					
ON WATER SIDE	KG/CM2	BY VENDOR (NOTE-4)			
ON STEAM SIDE	KG/CM2	BY VENDOR (NOTE-4)			
IBR CERTIFICATION REQUIRED		NO			
FOR DETAILS REFER P&ID NO.		B269-475-17-44-1145			
NOTES:					
1.VENDOR TO SUPPLY THE FOLLOWING ITEMS AS A PART OF THE PRDS SYSTEM:					
a) PRESSURE REDUCER AND DESUPERHEATER.					
b) STRAINER IN BFW LINE (1+1)					
c) BFW INJECTION CONTROL VALVE					
d) 1 + 1 PSV SHALL BE PROVIDED IN BFW LINE.					
e) FLOW CONTROL VALVES & TEMPRATURE CONTROL VALVES ALONG WITH ALL NECESSARY ACCESSORIES					
2. VENDOR TO FURNISH THE MAXIMUM FLOW THROUGH CONTROL VALVE FULL OPEN CONDITION.					
3. ALLOWABLE TEMPERATURE VARIATION IN DESUPERHEATER OUTLET STEAM TO BE +5 DEG C(MAX).					
4. VENDOR TO ENSURE THE OUTLET CONDITIONS FOR STEAM (AT PRDS BLOCK B/L) FOR ALL STEAM INLET OPERATING CONDITIONS.					
5. VENDOR TO ENSURE COMPLETE VAPORISATION OF BFW					
6. DESUPERHEATER VENDOR TO INDICATE THE BFW REQUIREMENT.					
7. VENDOR TO CONSIDER THE REQUIREMENT, IF ANY, FOR THE DISTANCE OF THERMOWELL FROM PRDS OUTLET AND STRAIGHT LENGTH REQUIREMENT BEFORE ANY BEND DOWNSTREAM OF THE PRDS.					
8. FAILURE POSITION OF BFW AND STEAM VALVE SHALL BE FC TYPE.					
9. PRDS SHALL BE SUITABLY PROVIDED WITH FLOW CONTROL VALVES, PRESSURE CONTROL VALVE & TEMPRATURE CONTROL VALVE ALONG WITH ALL NECESSARY ACCESSORIES					
10. ADDITIONAL CAPACITY OF PRDS SYSTEM, IF REQUIRED BASED OF LP STEAM REQUIREMENT IN ZLDP SHALL BE PROVIDED DURING DETAIL ENGINEERING.					

CLARIFIER CENTRIFUGE			
PROJECT : IOCL- PANIPAT REFINERY EXPANSION		CLIENT : IOCL	JOB NO. : B269
UNIT : ZERO LIQUID DISCHARGE PLANT		UNIT NO.: 475	ITEM NO. : 475-LZ-204 A/B
SERVICE : DE-WATERING OF CHEMICAL SLUDGE FROM ZLD CLARIFIER			
PROCESS DATA			
FLUID HANDLED		SLUDGE	
TYPE & NATURE OF SLUDGE		CHEMICAL	
INFLUENT CHARACTERISTICS			
INFLUENT FLOW RATE (m <sup>3</sup> /hr)		30	
SOLID CONTENT (%wt.)		5 (MAX.)	
TEMPERATURE(°C)		AMBIENT	
PH		6.5-8.5	
DENSITY (kg/m <sup>3</sup> )		~1100	
VISCOSITY (Cp)		NOTE-1	
DEWATERED SLUDGE CHARACTERISTICS			
SOLID CONTENT (%wt.) (MIN.)		20	
MOISTURE CONTENT (%wt.)		80	
SOLIDS RECOVERY (%wt.)		NOTE-1	
FLOW RATE (m <sup>3</sup> /hr)		NOTE-1	
CENTRATE CAHRACTERISTICS			
SOLID CONTENT (mg/l)		NOTE-1	
FLOW RATE (m <sup>3</sup> /hr)		NOTE-1	
UNIT SPECIFICATION			
NUMBER OF UNITS		2 (1W + 1S)	
DUTY (CONTINUOUS/INTERMITTENT)		NOTE-1	
OPERATING CYCLE (hrs) PER UNIT		16 (NOTE-1)	
SEPARATION FORCE (G)(m/s <sup>2</sup> )		NOTE-1	
SETTLING TIME (sec)		NOTE-1	
BOWL LENGTH (m)		NOTE-1	
BOWL DIAMETER (m)		NOTE-1	
BOWL SPEED (rpm)(MAX/OPERATING)		NOTE-1	
SPEED CONTROL		THROUGH PULLEYS	
CONICAL ANGLE (deg.)		NOTE-1	
CONVEYER SPEED (rpm)		NOTE-1	
POLY-ELECTROLYTE DOSING REQUIRED		YES (DEWATERING POLYELECTROLYTE)	
DOSAGE REQUIREMENT (kg/Ton of Dry Solids)		3	
DOSING STRENGTH		0.10%	
MODE OF APPLICATION		BY METERING PUMP	
POINT OF APPLICATION		IN FEED SUMP / INLET OF CENTRIFUGE	
LIFTING ARRANGEMENT REQUIRED		YES	
Sheet 1 of 2			
	ENGINEERS INDIA LIMITED NEW DELHI	CLARIFIER CENTRIFUGE	PROCESS DATA SHEET B269-475-17-44-DS-1076
		REV	0

CLARIFIER CENTRIFUGE						
<b>MATERIAL OF CONSTRUCTION</b>						
BOWL				SDSS		
SHAFT/SCROLL				SDSS		
LINING				TUNGSTEN CARBIDE		
CASING				CS/SDSS		
GEARBOX OVERLOAD PROTECTION MECHANISM (YES/NO)				YES		
<b>NOTES:</b>						
1	TO BE FURNISHED BY THE CONTRACTOR DURING DETAIL ENGINEERING.					
2	SEPARATION FORCE VALUE TO BE FURNISHED BY THE CENTRIFUGE SUPPLIER.					
3	DOSING RATE TO BE ESTABLISHED BY THE CENTRIFUGE SUPPLIER.					
4	EIL APPROVED VENDOR LIST FOR CENTRIFUGE TO BE FOLLOWED.					
0	02.05.2022	ISSUED WITH TA- 03 OF T-8701/23	SC	VS	PKG	
NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED	
SHEET 2 OF 2						
	ENGINEERS INDIA LIMITED NEW DELHI		CLARIFIER CENTRIFUGE		PROCESS DATA SHEET	REV.
					B269-475-17-44-DS-1076	0

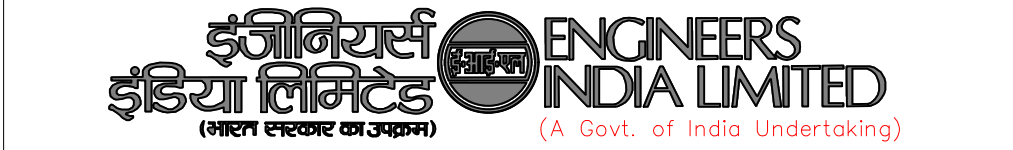
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NOTES :-

1. REFER GENERAL NOTES IN P&ID NO B269-475-17-44-1111.

2	02.05.22	REVISED AND REISSUED FOR TA 03	AB	DD	PKG
1	27.05.21	REVISED AND REISSUED FOR TENDER	SC	VS	PKG
0	29.04.20	ISSUED FOR TENDER	GSC	SC	VS/PKG
REV.	DATE	REVISIONS	BY	CHKD	APPD



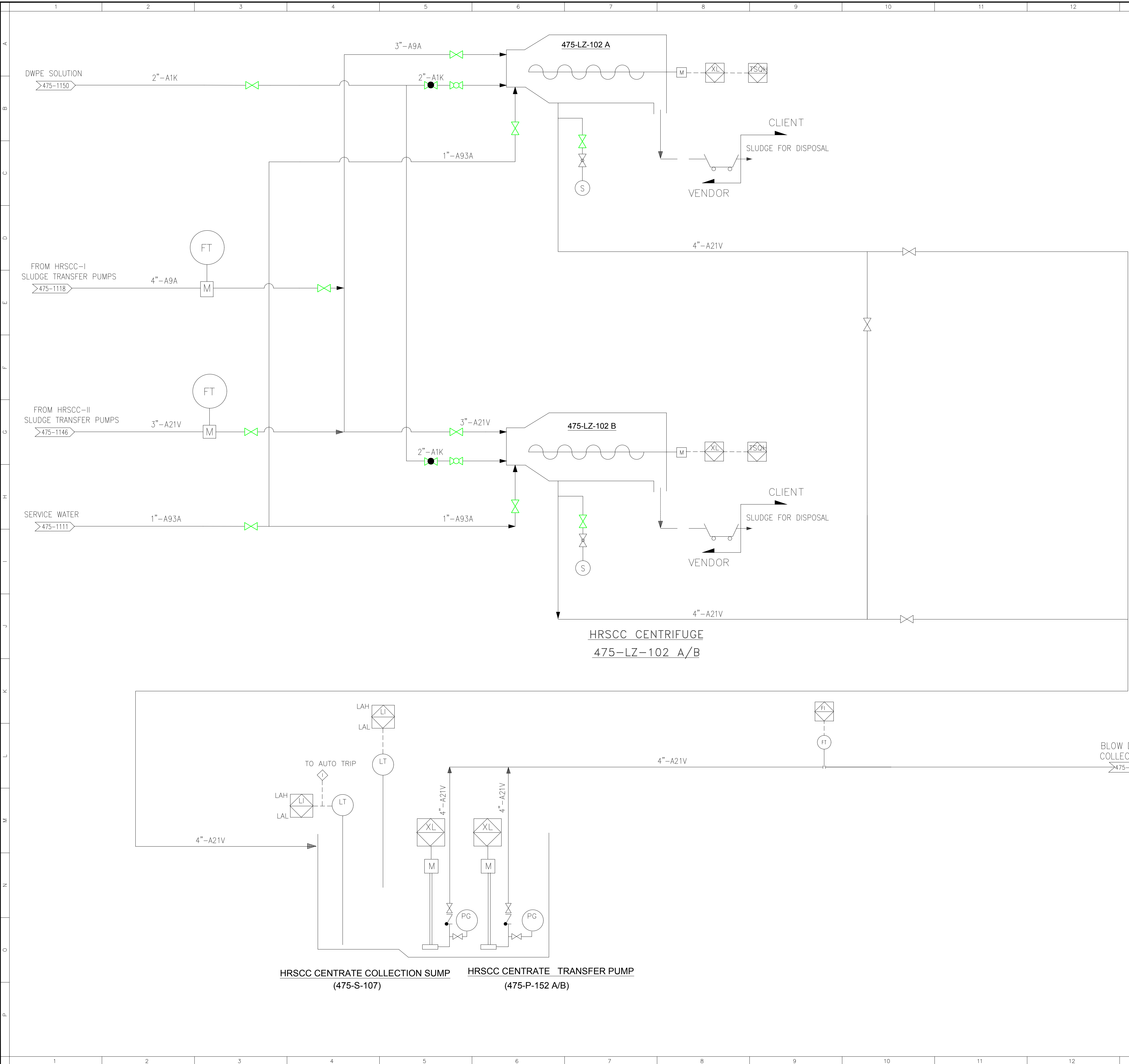
IOCL - PANIPAT REFINERY EXPANSION PROJECT (P-25)  
PANIPAT, HARYANA

पाइपिंग एवं इंस्ट्रुमेंटेशन डायग्राम  
PIPING & INSTRUMENTATION DIAGRAM  
RO BASED DM PLANT  
CTBD STORAGE TANK & PUMPS

SCALE	JOB NO.	UNIT	DEPT.	SECT.	DWG. NO.	REV.
NIL	B 2 6 9	475	1	7 4 4	1 1 1 2	2



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14	15	16
REF. DWG. NO.	REFERENCE DRAWING TITLE	

NOTES : —

1. REFER GENERAL NOTES IN P&ID NO B269-475-17-44-1111.

REV.	DATE	REVISIONS	BY	CHKD	APPD
2	02.05.22	REVISED AND REISSUED FOR TA 03	SC	VS	PKG
1	27.05.21	REVISED AND REISSUED FOR TENDER	SC	VS	PKG
0	29.04.20	ISSUED FOR TENDER	GSC	SC	VS/PKG

ENGINEERS  
INDIA LIMITED

(भारत सरकार का उपक्रम) (A Govt. of India Undertaking)

IOCL - PANIPAT REFINERY EXPANSION PROJECT (P-25)

PANIPAT, HARYANA

पाइपिंग एवं इंस्ट्रुमेंटेशन डायग्राम

PIPING & INSTRUMENTATION DIAGRAM

RO BASED DM PLANT

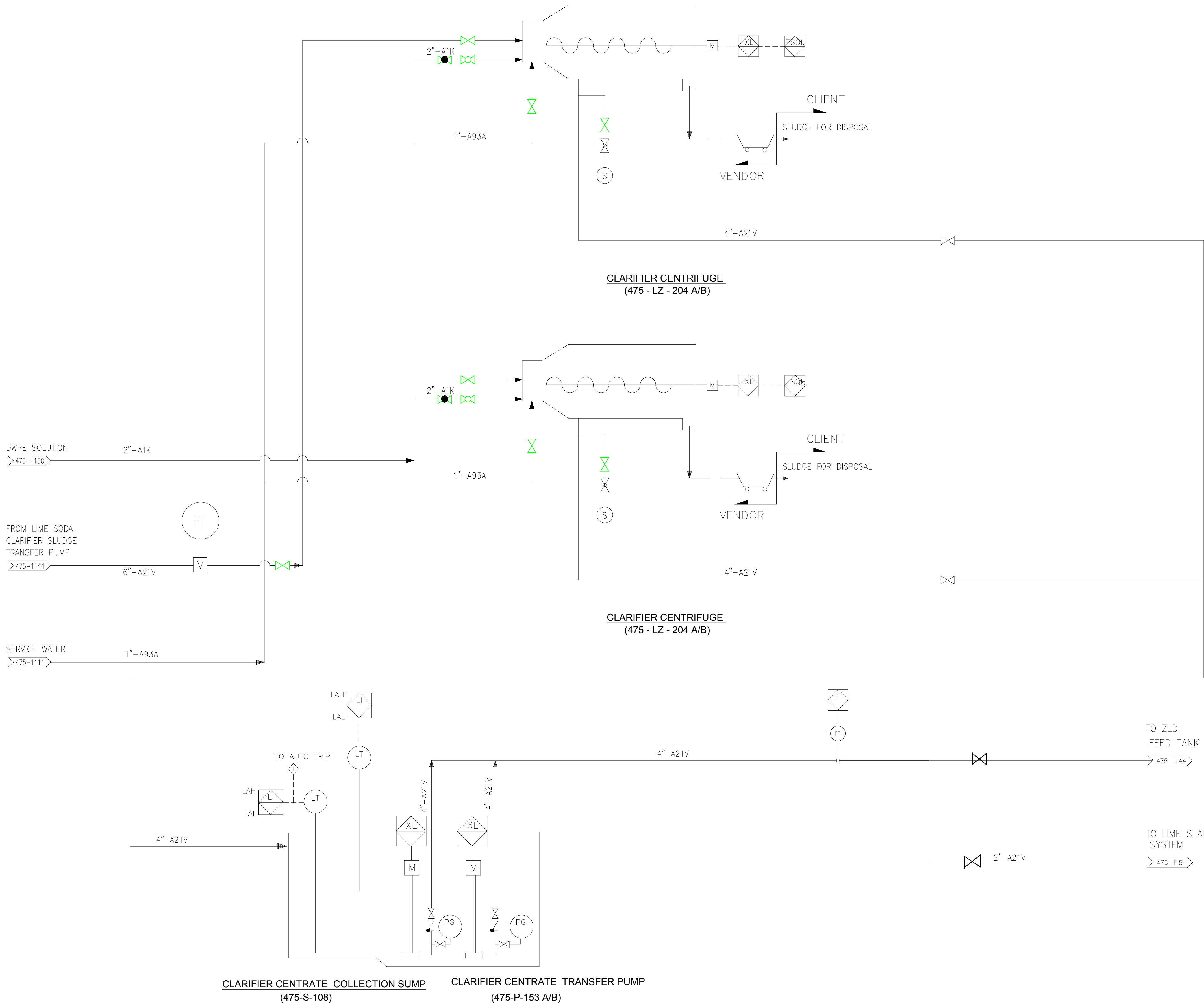
CENTRIFUGE SYSTEM

SCALE	JOB NO.	UNIT	DEPT.	SECT.	DWG. NO.	REV.
NIL	B 2 6 9	475	1 7	4 4	1 1 1 9	2

SHEET 1 OF 2



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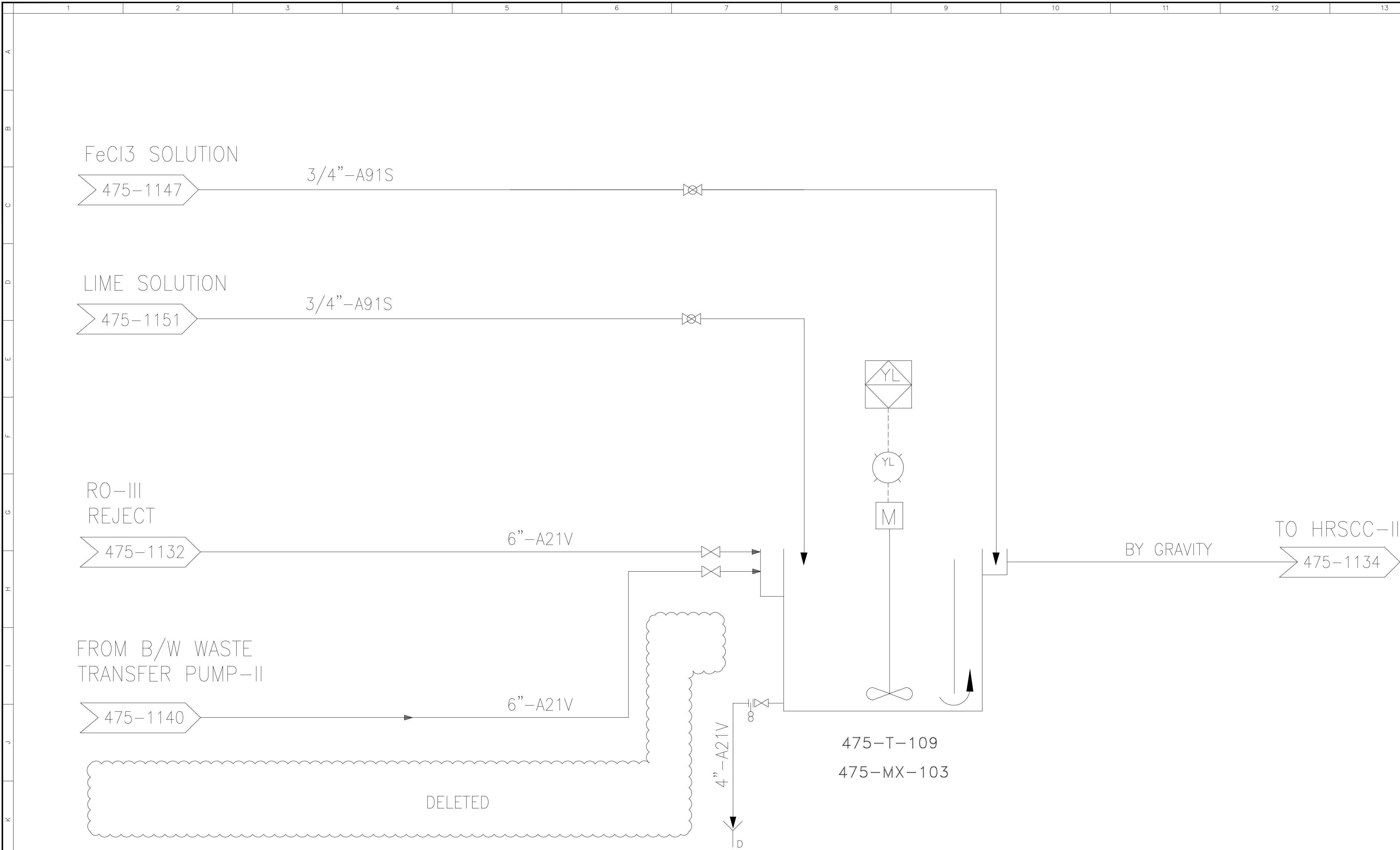
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PANIPAT, HARYANA

पाइपिंग एवं इंस्ट्रुमेंटेशन डायग्राम  
PIPING & INSTRUMENTATION DIAGRAM  
RO BASED DM PLANT  
CENTRIFUGE SYSTEM

SHEET 2 OF 2

SCALE	JOB NO.	UNIT	DEPT.	SECT.	DWG. NO.	REV.
NIL	B 2 6 9	475	1	7	4 4	1 1 1 9 2

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FLASH MIXING TANK –II  
(475–T–109)

FLASH MIXER –II  
(475–MX–103)

NOTES : –

1. REFER GENERAL NOTES IN P&ID NO B269–475–17–44–1111.

2	02.05.22	REVISED & REISSUED FOR TA 03	AB	DD	VS/PKG
1	20.07.21	REVISED & REISSUED FOR TENDER	UJ	SC	VS/PKG
0	29.04.20	ISSUED FOR TENDER	GSC	SC	VS/PKG
REV.	DATE	REVISIONS	BY	CHKD	APPD



IOCL - PANIPAT REFINERY EXPANSION PROJECT (P-25)  
PANIPAT, HARYANA

पाइपिंग एवं इंस्ट्रुमेंटेशन डायग्राम  
PIPING & INSTRUMENTATION DIAGRAM  
RO BASED DM PLANT  
FLASH MIXING TANK–II

SCALE	JOB NO.	UNIT	DEPT.	SECT.	DWG. NO.	REV.
NIL	B 2 6 9	475	1 7	4 4	1 1 3 3	2