PRE FEASIBILITY REPORT
FOR
500 KTPA PROPANE DEHYDROGENATION UNIT INTEGRATED WITH POLYPROPYLENE UNIT AT GAIL (INDIA) LTD, USAR, MAHARASHTRA

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The matter contained in the report is confidential.
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1.0 Executive Summary

1.1 Background

GAIL (India) Limited is India’s principal Gas Transmission and Marketing Company under the Ministry of Petroleum and Natural Gas, Government of India. GAIL is also in the business of Gas Processing, Petrochemicals, LPG, Transmission and Telecommunications. The company has also extended its presence in Power, Liquefied Natural Gas regasification, City Gas Distribution and Exploration & Production through equity and joint ventures participations.

GAIL has six LPG recovery plants across various states in India. LPG recovery Plant at Usar was commissioned in 1998 with design capacity to process 5.0 MMSCMD of rich gas. Presently, LPG Usar plant is under shutdown and is in preservation mode due to non availability of rich gas.

GAIL is planning to utilize the land and other facilities existing at Usar and set up GAIL Petrochemical Complex Project’ Usar “wherein a 500 KTPA Propane Dehydrogenation unit integrated with Polypropylene unit is proposed to be set up.

M/s GAIL has entrusted Engineer's India Limited (EIL) to prepare feasibility report for the proposed project.

The proposed facilities will be set-up along with the existing facilities at USAR. The proposed project shall benefit from the land in possession of GAIL as well as coastal location of the existing facility for both Propane Import and product evacuation, nearby port facility, proximity to highways and ease of getting environmental clearance.

1.2 Objectives

The study is carried out for the Proposed PDH – PP facility at USAR, Maharashtra to establish feasibility along with following broad objectives:

- Meet the projected increase in domestic demand of petrochemicals.
- Maximize value addition and return on investment through:
Production of Petrochemicals
Utilize existing Land and infrastructure available
Proximity to port terminals for feedstock sourcing

Maximise use of Indigenous Hardware

1.2.1 Existing Facilities

GAIL has a LPG recovery plants in Usar. LPG recovery Plant at Usar was commissioned in 1998 with design capacity to process 5.0 MMSCMD of rich gas. Presently, LPG Usar plant is under shutdown and is in preservation mode due to non availability of rich gas.

Existing Offsite & Utilities System

Mounded LPG Storage : 4290 (3 MST X 1430 each) MT
Naphtha Storage Tank : 50 KL
Methanol Storage Tank : 24 KL
Diesel Storage Tank : 16 KL
Odourant dosing pot : 0.5 M3
Plant Air Receiver : 45 M3
Instrument Air Receiver : 100 M3
Nitrogen Storage Tank : 35 M3

Compressed Air System

Instrument Air Compressors : 3 X 585 Kg/Hr @ 8.5 Kg/Cm2
Plant Air : 340 NM3/Hr
Instrument Air Dryer Units : 2 X 350 NM3/Hr
Instrument Air : 340 NM3/Hr
Air (Nitrogen) Compressors : 2 X 625 Kg/Hr @ 8.5 Kg/Cm2
PSA N2 System : 200 NM3/Hr
Cooling Water System : 600 M3/Hr
Boiler : 5 TON/Hr
Flare System : 200 Tons/Hr of Hydrocarbon
LPG Road Loading Facilities : 6 + 1 (Sick Tanker Gantry)
Naphtha Road loading facilities : 1 (Loading bay) + 1 (Sick bay)
LPG Pipeline Transfer Facility : 8” Pipeline of 1.5 Km to HPCL
Raw Water Reservoirs : 2750 (R1=1100+R2=1100+Common = 550) M3

1.2.2 Key considerations for the Project

❖ **Propane Import**
  o Propane availability: Propane receipt will be through existing JNPT port. The Propane shall be stored at Uran terminal from where propane feed shall be pumped to Usar through pipeline for conversion to Propylene and Polypropylene.

❖ **Propane Storage** (Usar)
  o 9 Days storage capacity with each bullet of 4270 m3 capacity of propane storage.

❖ **Product Storage**
  o Poly Propylene product storage shall be kept on 21 Days basis.

❖ **Intermediate Propylene Storage**
  o Intermediate Propylene storage shall be provided on 3 days basis to take care of any unexpected outages in upstream or downstream process units.

❖ **Power**
  o The power requirement for the complex shall be sourced through Grid.

❖ **Utilities**
  o All utilities shall be captively generated.
1.2.3 Plant Capacity

500 KTA Propane Dehydrogenation Unit.
500 KTA Poly Propylene Unit

1.2.4 On-Stream Hours

8000 hrs/annum.

1.2.5 Product Specifications

Petrochemical products – Polypropylene shall be industrial/polymer grade. The plant shall be capable of producing six grades of homopolymer Polypropylene.

Table 1: Product Distribution Share

<table>
<thead>
<tr>
<th>Sr</th>
<th>End Use</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TQ Film</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Woven sacks</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>Fiber &amp; Filaments</td>
<td>05</td>
</tr>
<tr>
<td>4</td>
<td>BOPP Films</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Injection Molding</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Extrusion / Thermoforming</td>
<td>05</td>
</tr>
</tbody>
</table>

The desired properties for the products are tabulated below. The values are indicative and wide range values for properties are given.

Table 2: Polypropylene Specifications

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method*</th>
<th>Unit</th>
<th>Homo Polymer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melt flow rate (MFR) 230 °C / 2.16kg</td>
<td>D-1238L</td>
<td>g/10min</td>
<td>0.3-75**</td>
</tr>
<tr>
<td>Xylene Insolubles</td>
<td>By LICENSOR</td>
<td>% wt</td>
<td>95-98.5</td>
</tr>
<tr>
<td>Total ash (as oxides)</td>
<td>By LICENSOR</td>
<td>ppmw max</td>
<td>130 - 150</td>
</tr>
<tr>
<td>Chlorine</td>
<td>By LICENSOR</td>
<td>ppm wt</td>
<td>35 - 50</td>
</tr>
<tr>
<td>Property</td>
<td>Method</td>
<td>Unit</td>
<td>Value</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>-----------</td>
</tr>
<tr>
<td>Water absorption</td>
<td>D-570</td>
<td>%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>D738</td>
<td>MPa</td>
<td>32-38</td>
</tr>
<tr>
<td>Elongation at Break</td>
<td>D-638</td>
<td>%</td>
<td>8-12</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>D-790A</td>
<td>MPa</td>
<td>1250-1800</td>
</tr>
<tr>
<td>Hardness, Rockwell</td>
<td>D-785</td>
<td>R Scale</td>
<td>70-105</td>
</tr>
<tr>
<td>Izod Impact Strength, 23°C</td>
<td>D-256</td>
<td>KJ/m²</td>
<td>2.5-4.0</td>
</tr>
<tr>
<td>Gloss</td>
<td>D-523</td>
<td>%</td>
<td>90-105</td>
</tr>
<tr>
<td>Haze</td>
<td>D-1003</td>
<td>%</td>
<td>Licensor to indicate</td>
</tr>
<tr>
<td>Vicat. Softening point</td>
<td>D-1525</td>
<td>°C</td>
<td>150-156</td>
</tr>
<tr>
<td>SECR***</td>
<td>D-1693</td>
<td>LICENSOR</td>
<td>Licensor to indicate</td>
</tr>
<tr>
<td>Thermal Expansion</td>
<td>D-696</td>
<td>$10^5$ cm/cm° C</td>
<td>14-15</td>
</tr>
<tr>
<td>C2 Content</td>
<td>By LICENSOR</td>
<td>% wt</td>
<td>NA</td>
</tr>
<tr>
<td>EPR Content</td>
<td>By LICENSOR</td>
<td>% wt</td>
<td>NA</td>
</tr>
</tbody>
</table>
1.2.5.1 Applications and Market coverage

Homopolymer - Injection molding, Blow molding, thermoforming, sheet Tape / (Raffia), Fiber, Cas. / TQPP & BOPP films, profile extrusion etc.

1.3 Project Configuration

The proposed complex shall consist of a Propane De-Hydrogenation Unit (PDH) which utilizes propane as feedstock for conversion into propylene through De-Hydrogenation route. The generated propylene from the PDH unit will be used in a downstream Polypropylene unit to convert to Polypropylene unit.

A basic schematic of the configuration is as under:

1.4 Material Balance

Material balance for selected case is given in Table below:

<table>
<thead>
<tr>
<th>Description</th>
<th>000’Tons / Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEEDSTOCK PURCHASES</td>
<td></td>
</tr>
<tr>
<td>PROPANE (90% purity)</td>
<td>686</td>
</tr>
</tbody>
</table>
### Utilities & Offsites

#### Utilities

The total utility consumption of new units in the complex for the selected case are estimated based on EIL in-house data and are tabulated below.

<table>
<thead>
<tr>
<th>Utilities &amp; Offsites</th>
<th>Capacity</th>
</tr>
</thead>
</table>
| Steam & Power Generation | • Gas based steam Boiler (130 TPH) (1+1) x 350Deg C @ 105 kg/cm2a  
• ~ 37 MW Power Import from Grid. |
| Compressed Air System | • Nitrogen Plant – 2500 Nm3/hr  
• Plant Air – 750 Nm3/hr  
• Instrument Air – 750 Nm3/hr |
| Cooling Water | Total Requirement – 24000 m3/hr  
(6 + 1) Cells of 4000 m3 each |
| Raw Water System | Raw Water rate– 700 m3/hr  
Treated Water Storage - based on 3 day storage. |
| RO Based DM Plant | 350 M3/hr (feed basis) |
| Condensate Polishing Unit | 100 m3/hr |
| Effluent Treatment Plant | 50 m3/hr |
1.5.2 Offsites

Based on the unit capacities and operating requirements following are the storages and pipelines considered for the proposed project.

<table>
<thead>
<tr>
<th>Utilities &amp; Offsites</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storages</td>
<td>Propane – 9 Mounded Bullets</td>
</tr>
<tr>
<td></td>
<td>Propylene - 3 Mounded Bullets</td>
</tr>
<tr>
<td></td>
<td>Treated Water – 3 Tanks</td>
</tr>
<tr>
<td></td>
<td>Hydrogen Storage</td>
</tr>
<tr>
<td></td>
<td>Polypropylene Warehouse</td>
</tr>
<tr>
<td></td>
<td>Fire water reservoir</td>
</tr>
<tr>
<td>Onshore Pipelines</td>
<td>Propane Pipeline - 12”</td>
</tr>
<tr>
<td></td>
<td>Raw Water - 20”</td>
</tr>
<tr>
<td></td>
<td>Effluent Pipeline – 6” (part)</td>
</tr>
<tr>
<td>Offshore Pipelines</td>
<td>Effluent Pipeline – 6” (shall be routed to nearest sea at appropriate discharge location)</td>
</tr>
</tbody>
</table>

1.6 Land Requirement

At present GAIL is in possession of 321 Acres of land at Usar, Maharashtra. The land requirement for the Proposed Project is estimated as below:

**Overall land requirement**

- Total Complex Area : 321 Acres /130 Hectares
- Plant Area : 215 Acres / 87 Hectares
- Green Belt Provided : 106 Acres / 43 Hectares
- Green Belt Requirement (33%) : 106 Acres / 42.9 Hectares

As per the above no additional land area is to be purchased by GAIL, the proposed complex can be accommodated within the existing plot area.
1.7 Existing Location Map

[Map images showing the location of various facilities such as Mounded Storage Area, LPG Loading Area, Naphtha Storage Area, and others including JNPT, NHAVA SHEVA and GPU USAR.]
1.8 Project Economics

The total estimated cost of PDH & PP Complex including pipeline & Propane terminal is around Rs.7750 Crores.

PART -2 REFRIGERATED LIQUID PROPANE IMPORT TERMINAL AT URAN, MAHARASHTRA

2.0 PROPANE IMPORT

To meet the Propane feedstock requirement for Propane Dehydrogenation unit integrated with Polypropylene unit, it is proposes to set up a refrigerated liquid propane import terminal at Uran, Maharashtra.

Refrigerated liquid propane will be imported via jetty at JNPT utilizing marine unloading arms & will be transferred to onshore Import Terminal via 02 no’s of pipelines of 12”(H) size each. Liquid Propane will be dispatched via cross country pipeline from Uran, Import terminal to Usar, Maharashtra.

This document covers the brief process for Unloading, Storage, heating and dispatch facilities under the Uran, Import Terminal. The import facilities are consist of following major part:

1. Jetty facilities.
2. Unloading Cross country pipeline.
3. Onshore terminal facilities (including Storage, heating and product dispatch section)

2.1 FEED AND PRODUCT SPECIFICATION

2.2 FEED DESIGNATION

Refrigerated liquid propane (i.e. imported and unloaded from Ship tanker in refrigerated form)
2.3 PRODUCT DESIGNATION

Pressurized liquid propane (i.e. dispatched through cross country pipeline)

2.4 DESIGN COMPOSITION

<table>
<thead>
<tr>
<th>COMPOSITION</th>
<th>PROPAINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>NIL</td>
</tr>
<tr>
<td>C2</td>
<td>1.5 (Max.)</td>
</tr>
<tr>
<td>C3</td>
<td>95 (Min.)</td>
</tr>
<tr>
<td>C4</td>
<td>4.0 (Max.)</td>
</tr>
<tr>
<td>C5 &amp; heavier</td>
<td>0.2 (Max.)</td>
</tr>
<tr>
<td>N2</td>
<td>Traces (0 – 0.1)</td>
</tr>
</tbody>
</table>

2.5 BATTERY LIMIT CONDITIONS

<table>
<thead>
<tr>
<th>STATION</th>
<th>OPERATING CONDITIONS</th>
<th>MECHANICAL DESIGN</th>
<th>SOURCE/DESTINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pressure [Kg/cm2g]</td>
<td>Temp. [°C]</td>
<td>Pressure [Kg/cm2g]</td>
</tr>
<tr>
<td>FEED AT JETTY</td>
<td>Propane</td>
<td>128 MLC at Unloading arm flange (6.67 kg/cm2g)</td>
<td>(-) 41</td>
</tr>
<tr>
<td>PRODUCTS FROM IMPORT TERMINAL</td>
<td>Propane</td>
<td>8-14.5</td>
<td>Atm.</td>
</tr>
</tbody>
</table>

2.6 IMPORT TERMINAL MODES OF OPERATION

Following operational cases can occur as a result of the configuration of the storage facilities:

a. **Mode 1**: Tank Pressure Holding mode.
b. **Mode 2**: Receipt of Propane from Ship.
c. **Mode 3**: Pre-cooling of Unloading pipeline.
2.6.1 MODE 1: TANK PRESSURE HOLDING MODE

Propane storage tanks are provided with insulation to minimize heat leak from atmosphere and also prevent condensation of atmospheric moisture on the external surface. Nevertheless, there is heat ingress through the insulation into the tanks which may fluctuate depending on the ambient temperature. When no propane transfer from ship is taking place, the time taken for a certain increase in tank pressure depends on the filled level. Due to heat leak into the tanks, propane evaporates and thereby tends to increase the tank pressure. To keep the pressure of Storage Tanks as constant as possible, the Boil-off Compressor system is used.

2.6.2 MODE 2: RECEIPT OF PROPANE FROM SHIP

Refrigerated liquid propane received from Ship at jetty is transferred to the Storage Tank through two 12" (H) pipelines. Flash Compressor system is used to keep the pressure of Storage Tanks as constant as possible. The evaporated gas (produced in the Storage Tanks) will be drawn and pressurized by running Flash Compressors. The pressurized gas from Compressors will be condensed in Flash Condensers.

2.6.3 MODE 3: PRECOOLING OF UNLOADING PIPELINE

The refrigerated liquid remained in the unloading pipelines slowly warms up between two ship unloading operations to a higher temperature by heat leak from the atmosphere through the insulation. If the next ship unloading is started under this condition, sudden cooling of the pipeline will develop undesirable stresses in the piping. Further such operation would result in the generation of large quantity of Propane vapor in the storage tanks and this vapor will be required to be flared to maintain the tank pressure. Hence, before commencing each ship unloading operation, it is necessary to pre-cool the unloading line gradually.
2.7 PROCESS DESCRIPTION

2.8 UNLOADING & HANDLING FACILITIES AT JNPT JETTY

Each consignment of 15000 MT refrigerated liquid propane at -41°C (min.) is proposed to be unloaded from ship at a rate of 600 MT/hr. (max.) with the help of ship unloading pumps having discharge pressure of 7.0 kg/cm² g through a marine unloading arm & is transferred to proposed atmospheric double wall storage tanks at GAIL Propane import terminal through both 12” (H) (Transfer line & Pre cooling Line simultaneously). 12” line is estimated considering 15000 MT of consignment and a pumping rate of 600 MT/hr.

As Propane has been received from refrigerated ship at -41°C (min.), it is necessary to pre cool these pipelines to this level before unloading takes place.

For pre-cooling of ship unloading line, liquid propane from tank is pumped through 12” (H) pre-cooling line up to jetty and returned through 12” (H) ship unloading line to propane Tank. If the ROW for two 12” line is not available then a smaller recirculation line can be considered.

During idling of pipelines when no ship unloading is taking place, pipelines shall be isolated at both end i.e. jetty and terminal. Pipelines shall be allowed to raise the temperature through ambient heating. Pipelines shall remain in isolated condition till preparation for next ship unloading, is made.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Size of tanker</td>
<td>15000 MT</td>
</tr>
<tr>
<td>2</td>
<td>Product unloading rate</td>
<td>600 MT/HR</td>
</tr>
<tr>
<td>3</td>
<td>Unloading Arms</td>
<td>2 No’s 12” marine unloading arm</td>
</tr>
<tr>
<td>4</td>
<td>Minimum Ship unloading pump discharge pressure @ ship manifold</td>
<td>128 MLC (equivalent)</td>
</tr>
</tbody>
</table>
2.9 REFRIGERATED LIQUID PIPELINE TRANSFER FACILITIES

Both the 12" (H) lines shall be employed for transfer operation of propane from Ship. Two mass flow meters, one at jetty end & one at terminal end is provided for mass measurement & input to leak detection system.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>DESCRIPTION</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Products to be Transported</td>
<td>Propane</td>
</tr>
<tr>
<td>2</td>
<td>No of pipeline</td>
<td>2 Nos. 12&quot; Each</td>
</tr>
<tr>
<td>3</td>
<td>Approx. Length of Pipe</td>
<td>5.6 Kms</td>
</tr>
<tr>
<td>4</td>
<td>Insulation Details</td>
<td>Material – PUF@150 mm, for above ground section.</td>
</tr>
<tr>
<td>5</td>
<td>Maximum Unloading rate</td>
<td>600 MT/Hr. (Max. through both the line)</td>
</tr>
<tr>
<td>6</td>
<td>Unloading Temperature</td>
<td>(-) 41°C</td>
</tr>
<tr>
<td>7</td>
<td>Unloading line heat leak rate</td>
<td>30 w/m²</td>
</tr>
<tr>
<td>8</td>
<td>Design Codes</td>
<td>ASME B31.3 and OISD 236 will be followed as applicable. However, in case of contradictory stipulations, the more stringent of the above code requirements will prevail.</td>
</tr>
<tr>
<td>9</td>
<td>Material of Construction</td>
<td>LTCS</td>
</tr>
<tr>
<td>10</td>
<td>Maximum Operating Pressure (MOP)</td>
<td>Actual pressure</td>
</tr>
<tr>
<td>11</td>
<td>Maximum Allowable Operating Pressure (MAOP)</td>
<td>110% of maximum surge pressure in pipeline considering closer of tank inlet valve.</td>
</tr>
<tr>
<td>12</td>
<td>Design Pressure</td>
<td>35 kg/cm² g</td>
</tr>
<tr>
<td>13</td>
<td>Design temperature</td>
<td>Above ground : 65°C/(-) 47°C</td>
</tr>
</tbody>
</table>

2.10 ONSHORE TERMINAL FACILITIES

2.10.1 CRYOGENIC STORAGE TANKS

Two numbers of cryogenic full containment Double Wall Storage Tanks (DWST) shall be provided for storing propane. The tank capacity shall be 15000 - 18000 MT each, both the tanks shall be designed to handle propane @ (-) 43°C.
### STORAGE TANK

<table>
<thead>
<tr>
<th>Quantity</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Capacity</td>
<td>15000 – 18000 MT (each)</td>
</tr>
<tr>
<td>Diameter</td>
<td>43 m (Inner Tank); 45 m (Outer Tank) [approx.]</td>
</tr>
<tr>
<td>Height</td>
<td>19.5 m (Inner Tank); 21 m (Outer Tank) [approx.]</td>
</tr>
<tr>
<td>Design tank boil-off</td>
<td>0.06 wt.% per day at LAH (pure propane basis)</td>
</tr>
</tbody>
</table>
| Temperature (°C) | Operating: -41 to -43 (Propane)  
                                              Design: -48 /+65 |
| Pressure (mmWCg) | Operating Range: 400 to 1000  
                                              Design: 2000 mmWCg /65 mmWC vacuum |

The density of propane in the tanker relative to the propane stored in the onshore Tanks shall decide mode of filling (top/bottom) in the tanks. This implies that if the propane is heavy, top filling shall be used and vice versa. This is to facilitate the mixing of propane in the tanks to prevent the stratification in the tanks that can cause “Roll over phenomenon” thereby generating large amount of BOG. Online density meter provided at onshore to monitor the product density.

DWST Tanks shall be operated according to the liquid level, pressure level and temperature configurations described below. It shall also be equipped with a leak detection system and Level–Density-Temperature / Level-Temperature In-tank measurement system.

### 2.10.2 VAPOR HANDLING SYSTEM

The vapor handling section will include:

- Flash gas compressor
- Boil off gas compressor
- Condenser
- Receiver
Concentrate Pump

Buffer bullet

The heat leak into the various systems (e.g. unloading pipeline, cryogenic piping, DWST etc.) and a part of pumping work adds up to the boil-off gas from the tanks. Consequently, the cryogenic storage tank pressure is primarily controlled by controlling the flow of boil off gases to the BOG compressors during holding mode and Flash gas Compressor during unloading operation.

Flash Gas Section
During unloading operation of the ship tanker into the storage tanks, the vapors displaced from the storage tanks, as well as the vapors generated from the heat coming from ship unloading pumps and import pipelines due to atmospheric heat gain will be re-liquefied in the Re-Liquefaction section including boil-off load and stored in two nos. of buffer bullets. The propane unloading at a rate of 600 MT/hr. is considered for flash load.

The detail of flash gas section are as follows:

Compressor
Number of compressor : 1 working +1 standby
Type of compressor : Screw
Capacity : 12 t/hr. (each)

Flash gas condenser
Number of condenser : 1 working +1 standby
Duty of condenser : 1395 KW (each)

Boil Off Gas Section
During holding mode (not receiving mode) propane boil-off vapors from the DWST are compressed in Boil-off gas compressor section. The boil off vapors will be liquefied in condensers. The liquid product will be collected in receivers. From receivers the condensate will be pumped to buffer bullet.
The detail of boil-off gas section are as follows:

**Compressor**
Number of compressor : 1 working +1 standby  
Type of compressor : Screw  
Capacity : 2.5 t/hr. (each)  

**Flash gas condenser**
Number of condenser : 1 working +1 standby  
Duty of condenser : 290 KW (each)  

2.10.3 PROPALE HEATING SECTION

Liquid propane at (-) 41°C from propane storage tank shall be pumped through  
in-tank transfer pump through propane air pre heater to heat liquid propane  
from (-) 41°C to 0°C (min.). Two numbers of In-tank pump of 220 m3/hr. rated  
capacity shall be provided in each Storage tank.

The propane shall be heated using draft of air fans, the outlet temperature shall  
be controlled by VFD on the fan motor through temperature indication control.

The characteristics of In-Tank Pumps are given below:  
Number of pump : 2 working + 1 standby (per tank)  
Type : Centrifugal, vertical, with submerged motor  
Max. Flow rate : 120 m3/hr.  
Differential head : 350 Meters  

The detail of heating section is as follows:

Number of heating train : 1 working +1 standby  
Heating medium : Air  
Duty : 4490 KW (each)
2.10.4 DISPATCH OF PRODUCTS
Refrigerated liquid propane from storage tanks pump through in-tank pump and heated in heating section. Heated propane liquid after heating section further pressurized through “Mainline high pressure HP pumps” and dispatch via 52 km (approx.) cross country pipeline from Uran Import terminal to Usar complex.

The characteristics of Mainline High pressure HP Pumps are given below:

Number of pump : 1 working + 1 standby
Type : Centrifugal
Max. Flow rate : 200 m³/hr.
Differential head : 330 Meters

2.10.5 PIPELINE PARAMETERS
Products to be transported : Propane
Pipeline Length : 52.0 kms (approx.)
No. of Pipeline : 01
Main line Diameter : 12” (size derived from simulation)

Pipeline roughness : 45 micron for line sizes 12” and below

Material of Construction for Pipeline : Carbon Steel
Pipeline Corrosion Allowance : 0.5 mm

Pigging Facilities : Pigging facilities suitable for “Intelligent Pigging” shall be provided.
Subsoil temperature : 20-30 deg C throughout the entire length of the pipeline (1m below ground)
Design Pressure : 49.0 kg/cm²
### Design temperature
- 0 °C to 60 °C for all buried sections
- 0 °C to 65 °C for above ground portion

### Pipeline laying
- **Buried**

### Burial Depth (pipeline cover)
- Minimum 1.2 m (other than crossings)

### Ground profile
- As per route survey

### Pipeline corrosion protection system
- Pipeline shall be protected from external corrosion by suitable external coating and cathodic protection.

### Corrosion Monitoring System
- Corrosion monitoring system for internal corrosion shall not be provided.

### Sectionalizing valves
- Sectionalizing valves will be provided as per ASME B 31.8.