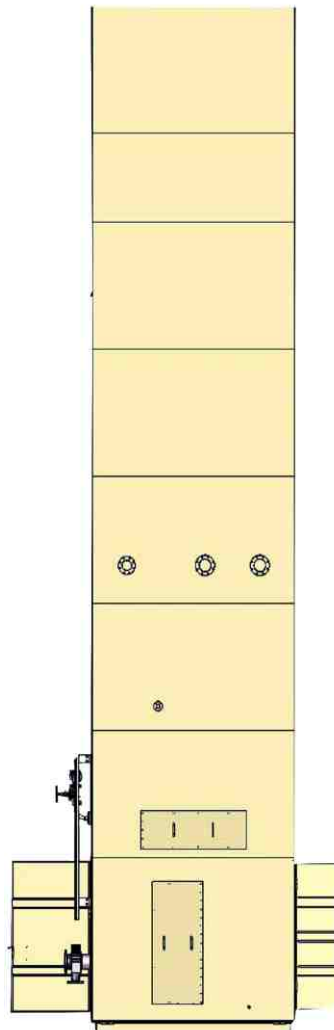
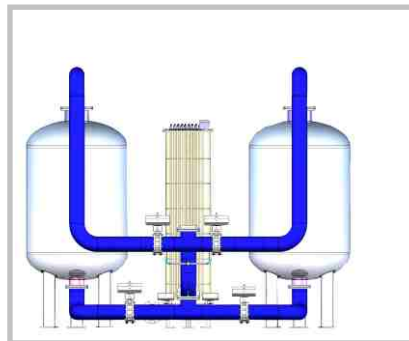


IMPIANTI LIQUEFAZION E PRODUZIONE GAS TECNICI  
**23 years of Excellence**

# LIQUID OXYGEN NITROGEN PLANTS AIR SEPARATION PLANTS

Low Operating Pressure(5-7Bar)  
20M<sup>3</sup>/h To 1,000M<sup>3</sup>/h



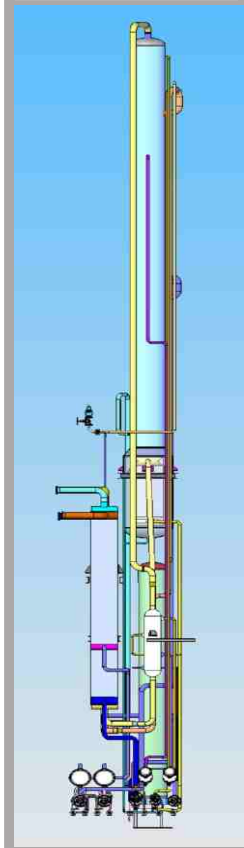
IN TECHNICAL COLLABORATION WITH

**ING L & A BOSCHI OF ITALY**

[www.oxygenplants.com](http://www.oxygenplants.com)



Air Compressor



Rectification Column



Air Purification System

1. Air Compressor:

Rotary air compressor screw type can be used for smaller size plants upto 500m<sup>3</sup>/hr & 1000m<sup>3</sup>/hr. Upto 40000m<sup>3</sup>/hr. Centrifugal compressor can be used for higher size plants.

2. Air pre cooling system:

Air separation plants adopts chilling system in all air pre-cooling systems.

3. Air purification system:

This system beds of molecular sieve are used in the air purification system, it remove the Co<sub>2</sub> & moisture for the process air at low-Pressure.

4. Rectification column:

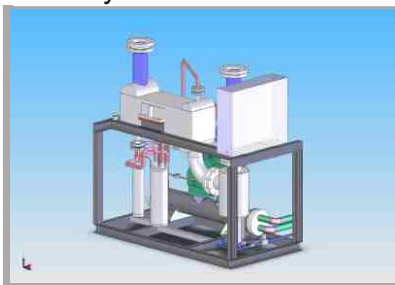
The unit in cold box are all low pressure technology. This unit employs the latest state of the art plate & fin exchanger, condensor and sub-coolers. The column is supplied as a packed unit complete with all the control systems including digital flow-meters, temperature, pressure available with high purity upto 2-3 ppm nitrogen as a second product without loss in oxygen Production.

5. Turbo-expander:

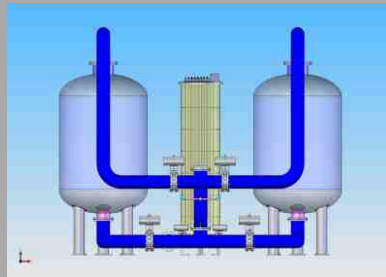
Turbo-expander is used for giving cooling to the air for the liquefaction process and braked by booster, so as to reduce the expanded air volume, stabilize the upper columns working condition and reduce power consumption. The turbine expanders have complete trouble free working and long life and reliability.

6. Computer control:

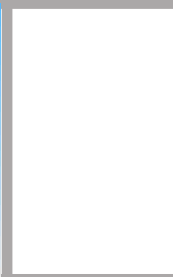
All the plants can be configured for automatic operation through a pc this will use a out switching valves of German or Japanese and motorized cryogenic valves on cold box.



Air Pre-Cooling System



Purifier



Liquid Tank



AIR COMPRESSOR



PRE-COOLER+PURIFICATION UNIT



AIR SEPARATION UNIT



TURBO-EXPANDER



CONTROL PANEL

## TECHNICAL SPECIFICATION AIR- SEPARATION LIQUID OXYGEN / NITROGEN PLANTS

### SMALL CAPACITY PLANTS (20 Nm<sup>3</sup>/hr TO 1,000 Nm<sup>3</sup>/hr)

Model(O <sub>2</sub> /N <sub>2</sub> */Ar)	LOX Capacity Nm <sup>3</sup> / h	LOX Capacity L/Hr	GO <sub>2</sub> Purity %O <sub>2</sub>	GN <sub>2</sub> Capacity Nm <sup>3</sup> / h	LIN Capacity Nm <sup>3</sup> / h	GN <sub>2</sub> Purity X 10 <sup>-6</sup> O <sub>2</sub>	Operating Air Pressure Bar (Mpa)	Argon Capacity Nm <sup>3</sup> / h	Argon Purity % AIR
UBTL-20/20	20	24	99.60%	20	20	99.9%-99.9% 3PPM	10(1)	N/A	N/A
UBTL-30/30	30	36	99.60%	30	30	99.9%-99.9% 3PPM	10(1)	N/A	N/A
UBTL-40/50	40	48	99.60%	50	40	99.9%-99.9% 3PPM	10(1)	N/A	N/A
UBTL-60/80	60	72	99.6%	80	60	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-80/100	80	96	99.6%	100	80	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-100/150	100	120	99.6%	150	100	99.9%-99.9% 3PPM	7(0.7)	**3	99.90%
UBTL-120/150	120	144	99.6%	150	120	99.9%-99.9% 3PPM	7(0.7)		N/A
UBTL-150/200	150	180	99.6%	200	150	99.9%-99.9% 3PPM	7(0.7)		N/A
UBTL-170/200	170	204	99.6%	200	170	99.9%-99.9% 3PPM	7(0.7)	**3	99.90%
UBTL-200/220	200	240	99.6%	220	200	99.9%-99.9% 3PPM	7(0.7)	**6	99.90%
UBTL-220/220	220	264	99.6%	220	220	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-250/250	250	300	99.6%	250	250	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-300/300	300	360	99.6%	300	300	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-LOX/350LIN/350GAN	350	420	99.6%		350	99.9%-99.9% 3PPM		N/A	N/A
UBTL-350/350	350	420	99.6%	350	350	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-400/400	400	480	99.6%	400	400	99.9%-99.9% 3PPM	7(0.7)		N/A
UBTL-500/500	500	600	99.6%	500	500	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-600/600	600	720	99.6%	600	600	99.9%-99.9% 3PPM	7(0.7)	N/A	N/A
UBTL-800/800	800	960	99.6%	800	800	99.9%-99.9% 3PPM	6(0.6)	N/A	N/A
UBTL-1000(LOX/LIN)1000	1000	1200	99.6%		1000	99.9%-99.9% 3PPM	9(0.9)	N/A	N/A
UBTL-1000(LOX)/1000(LIN)	1000	1200	99.6%		1000	99.9%-99.9% 3PPM	10(1)	N/A	N/A
LOX/450GOX/100LIN/1000GAN/LAR70	450	540	99.6%	1000	100	99.9%-99.9% 3PPM		80	



**AIR COMPRESSOR**

**PURIFICATION UNIT**

**AIR SEPARATION UNIT**

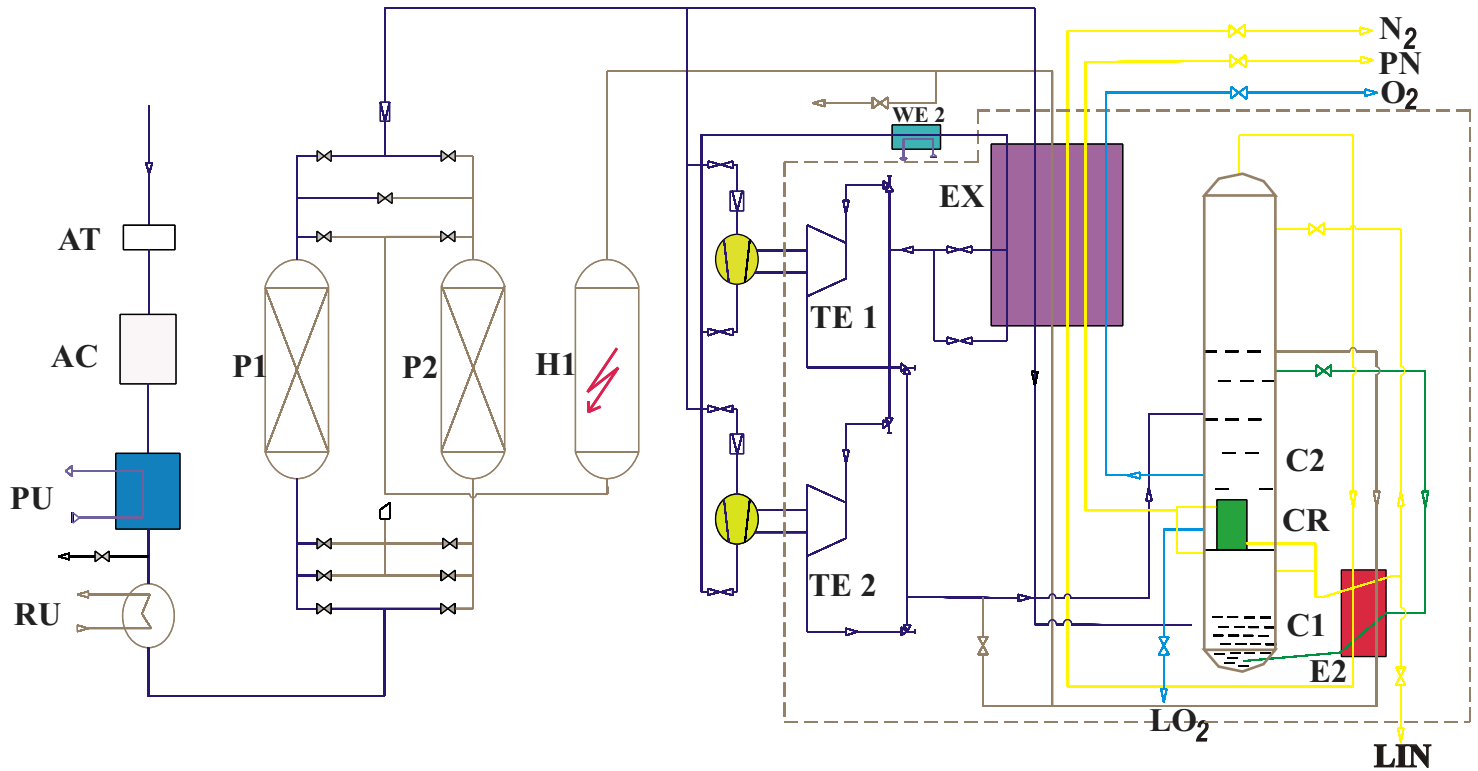
**CONTROL PANEL**

It will give both LOX & LIN simultaneously as per the capacity mentioned.

It will give either LOX or LIN.

1. The above data is only indicative to enable the buyer to select the model and detailed offer shall be given with the order.
2. The oxygen booster/ LO Pump depending on model is used for filling oxygen gas in cylinders at 150 bar pressure.
3. Argon can be produced in all plants above 500m<sup>3</sup>/hr.
4. Pure nitrogen gas upto 3ppm is available as a second product without loss of oxygen production.
5. All capacities are as per design suction conditions.
6. Liquid Nitrogen LIN output can be taken as optional along with liquid oxygen as per requirement.
7. Liquid Oxygen is collected in a liquid tank and can be gasified to get gox by additional liquid oxygen pump, vaporiser.
8. Voltage 380-415 & 50/60 Hz as Specified. Also Voltage & Frequency count HT motors above 400 KW of 10/11KV
9. Nm<sup>3</sup>/hr means the volume flow at 0.1013 mpa (a) and 0 deg centigrade.
10. The liquid has been converted into gas volume flow at 0.1013 mpa (a) and 0 deg centigrade.

AIR SEPARATION PLANT FLOW CHART WITH MOLECULAR SIEVE PURIFIER AND BOOSTER AIR EXPANSION

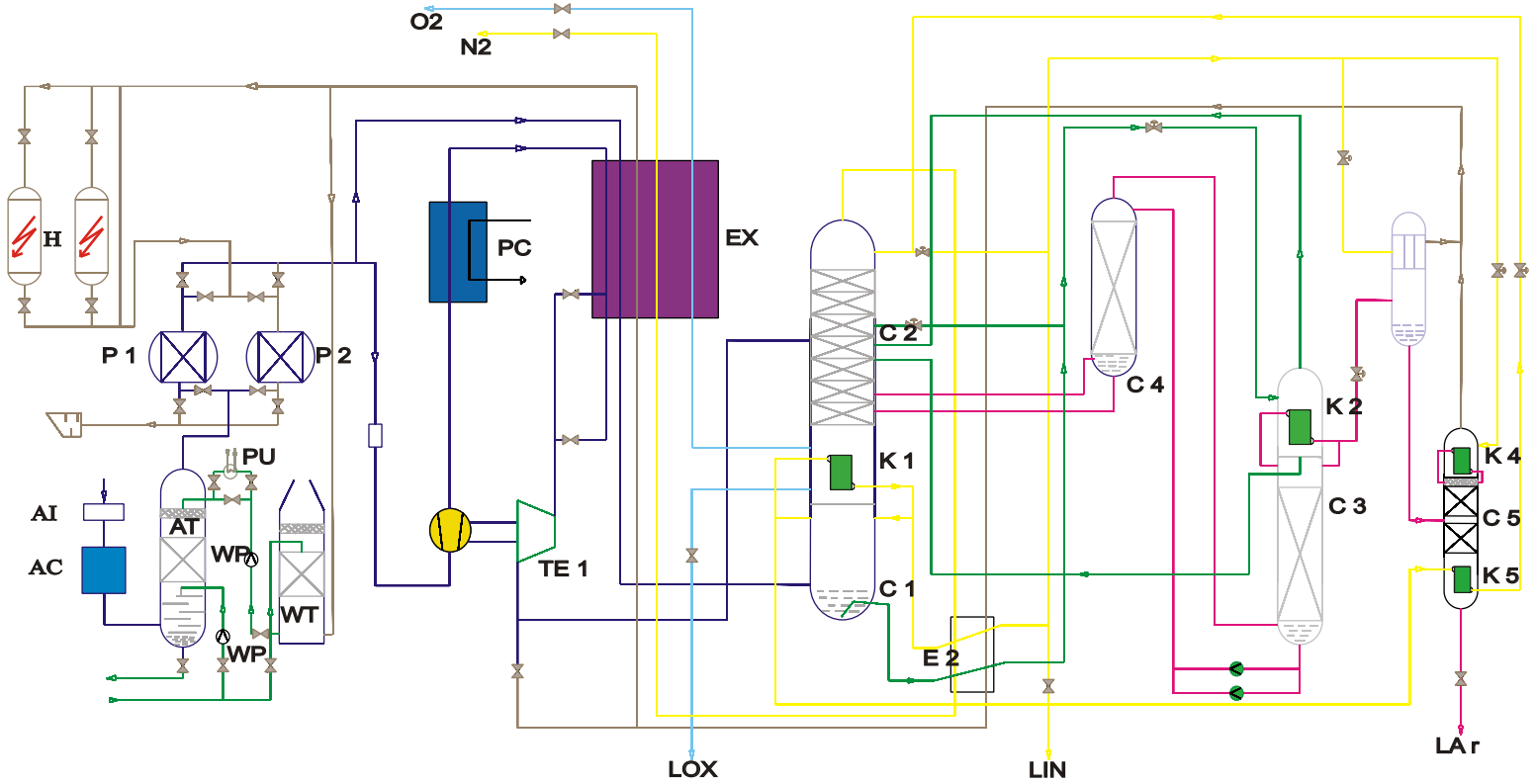


AI	AIR FILTER	H	HEATER	CR	CONDENSOR REBOILER
AC	AIR COMPRESSOR	EX	MAIN HEAT EXCHANGER	C2	LOW PRESSURE COLUMN
PC	PRE-COOLING UNIT	TE 1/2	TURBO EXPANDER		
PU	PURIFICATION UNIT	E2	SUB COOLER		
P1/2	TOWER1/TOWER 2	C1	COLUMN		

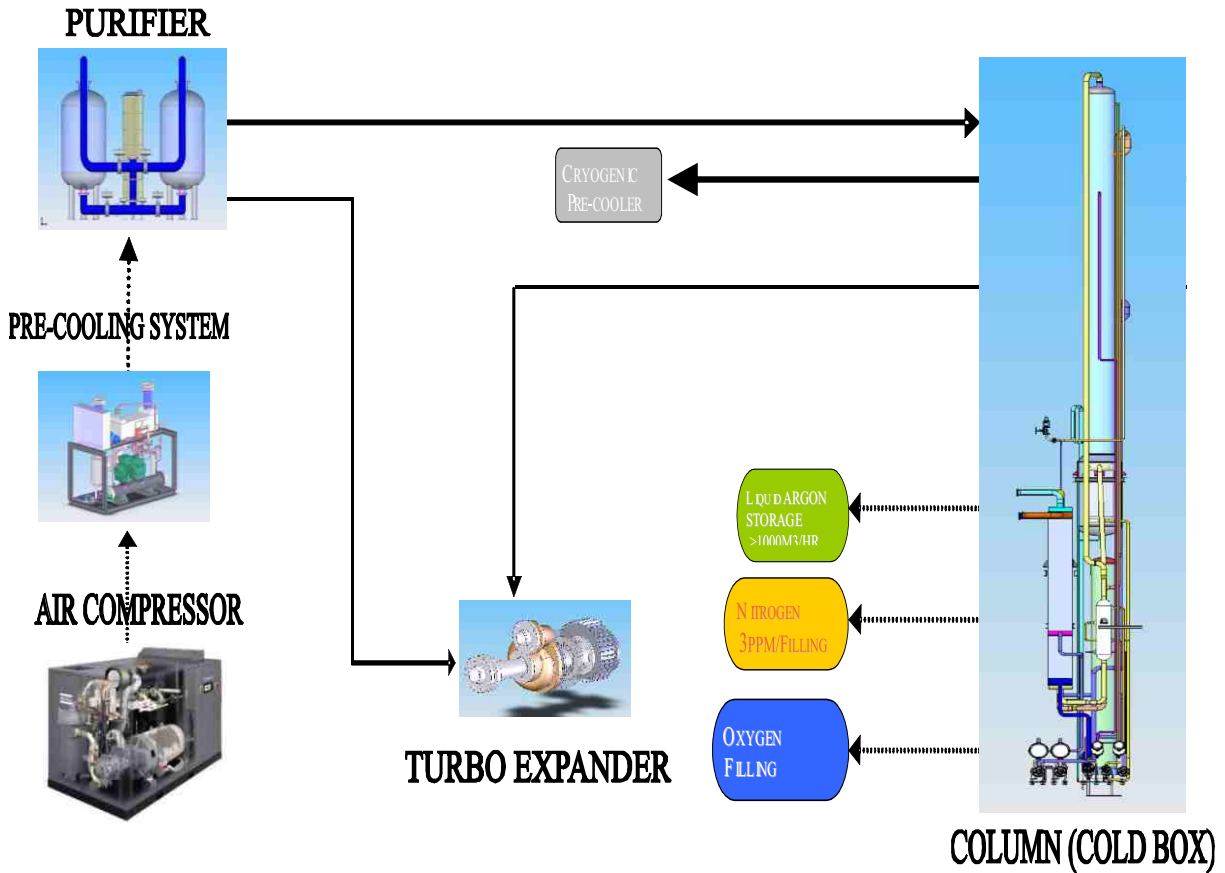
Technical Data

Production	Oxygen	Nitrogen	Argon
Purity	99.6%	99.9%-99.99% or 3ppm	99.5% or 5ppm
Air Pressure	0.7Mpa/7Bar		
Normal operating pressure of plant	0.6 To 0.7Mpa	0.6 To 0.7Mpa	0.6 To 0.7Mpa
Power Consumption for oxygen	0.5 To 0.8 KWh/m	Nil	Negligible

AIR SEPARATION PLANT FLOW CHART WITH MOLECULAR SIEVE PURIFIER AND BOOSTER AIR EXPANSION & FULL RECTIFYING ARGON RECOVERY



AI	AIR FILTER	E 2	SUBCOOLER	K4	PURE ARGON CONDENSER
AC	AIR COMPRESSOR	C 1	COLUMN	K5	PURE ARGON REBOILER
PC	PRE-COOLING UNIT	K 1	CONDENSOR REBOILER		
PU	PURIFICATION UNIT	C2	LOW PRESSURE COLUMN		
P 1/2	MOLECULAR SIEVE ADSORBER	C3/4	ARGON COLUMN		
H	ELECTRIC HEATER	C5	PURE ARGON COLUMN		
TE	TURBO EXPANDER	AP	LIQUID ARGON PUMP		
EX	MAIN HEAT EXCHANGER	K2	CRUDE ARGON CONDENSER		
		K3	CRUDE ARGON LIQUEFIER		



# PROCESS FLOW DIAGRAM

## Basic Principle

The air separation plant is a plant recovering oxygen and nitrogen from air simultaneously. It advances low pressure technology process of Boschi Italy using Rotary screw compressor (or low oil free piston compressor) and turbo expanders.

The feed air entering the Molecular Sieve purification system is employed to remove the moisture and CO<sub>2</sub> from the process air. The air is liquefied by cryogenic cooling using latest plate and fin high efficiency heat exchangers and turbo expanders. The liquid air separates into oxygen, nitrogen, and inert gases in the air separation column.



## PROCESS DESCRIPTION

### 1. AIR COMPRESSOR-LOW PRESSURE

Air is compressed at a low pressure of 5-7 bar (0.5-0.7mpa). Air can be compressed at such low pressure by trouble free rotary compressor (Screw / Centrifugal Type advanced technology is employed in lieu of old bulky piston compressor).

### 2. PRE COOLING SYSTEM

The second stage of the process uses a low pressure refrigerant for pre-cooling the processed air to temperature around 12 deg C before it enters the purifier.

### 3. PURIFICATION OF AIR BY PURIFIER

The air enters a purifier consisting of twin Molecular Sieve driers, working alternatively. The Molecular Sieves remove the Carbon dioxide & moisture from the process air before the air enters Air Separation Unit.

### 4. CRYOGENIC COOLING OF AIR BY TURBO (EXPANDER)

The air has to be cooled to sub zero temperatures for liquification & the cryogenic refrigeration & the cooling is provided by highly efficient turbo expander, which cools the air to temperature almost below -165 to-170 deg C .

### 5. SEPARATION IF LIQUID AIR INTO OXYGEN AND NITROGEN BY AIR SEPARATION COLUMN

Oil free, moisture free and Carbon Dioxide free air enters into low pressure plate fin type Heat exchanger where the air is cooled below sub zero temp. by air expansion process in the turbo expander. Due to the excellent thermal efficiency we can achieve a temperature difference delta t as low as 2 deg c at the warm end of these exchangers .

Air gets liquefied when it enters the air separation column & gets separated into oxygen & nitrogen by the process of rectification.

Liquid Oxygen is available at the outlet of the ASU at a purity of 99.6%.

Liquid Nitrogen is also available at the outlet as a alternate product at purity of 99.99%( upto 3ppm as required). Nitrogen gas will be available as a by product.