Process and Specifications for Oxygen

Process

Oxygen is received from the suppliers, through a vacuum insulated transport tank and then transferred to vacuum insulated storage tanks by pump transfer system.
The storage tanks are then connected to an ambient atmospheric vaporizer to convert the liquid to warm gas for entry into pipeline.

Liquid oxygen is pale blue in colour, odourless and has a boiling point of -297^{o}F (-183^{o}C). Liquid oxygen is stored under pressure in vacuum insulated storage tanks. These tanks are equipped with valves and equipments specifically meant and designed to be used in oxygen service.
The Ambient atmospheric vaporizers are designed as per the ASME Section VIII, Div I & in consideration to Wind design & Seismic codes. The sizes are based on the flow pattern required, ie 2270Nm^{3}/hr of Oxygen at a pressure of 20 barg. The liquid from the tanks are allowed to pass through the inner tubes of the vaporizer, converting liquid to gas. Two vaporisers are selected since the duty cycle is 24 hrs continuous. A layer of ice forms on an external portion of the heat transfer surface exposed to the atmosphere where the temperature at the heat transfer surface is below the freezing temperature of water. De-icing of the vaporiser is essential to achieve the required flow & hence these vaporizers need to be manually switched over from use for every eight hours of operation. So by the time one vaporizer has an icing formation, the other can be used to cater the flow.
The gases from the vaporizers are then passed through the orifice plates. It is usually placed in a pipe in which fluid flows. As fluid flows through the pipe, it has a certain velocity and a certain pressure. When the fluid reaches the orifice plate, with the hole in the middle, the fluid is forced to converge to go through the small hole; the point of maximum convergence actually occurs shortly downstream of the physical orifice, at the so-called vena contracta point. As it does so, the velocity and the pressure changes. Beyond the vena contracta, the fluid expands and the velocity and pressure change once again. The vapours are then passed through the pressure reducing station to cater the required flow at a constant pressure.

Physical & Chemical Properties of Liquid Oxygen:

Appearance	: Pale blue cryogenic liquid
Odour	: Odourless
Physical state	: Cryogenic liquid
Freezing point @1atm	: -361.1°F (-218.4°C)
Boiling point @1atm	: -297.4°F (-183°C)

Flammability	: Non-flammable
Evaporation rate	: High
Expansion ratio	: 1 to 860.5
Vapour density @21.1°C & 1 atm	: 1.325 Kg/m^3
Specific gravity (H20=1) @ boiling point	: 1.141
Specific gravity (Air=1) @ 21.1°C & 1 atm	: 1.105
Molecular weight	: 31.9988
Molecular formula	: O_2

Storage tank Details

LIQUID OXYGEN STORAGE TANK	
Type	Vacuum Insulated Storage Tank
Water capacity	52840 Ltrs
Net capacity	50200 Ltrs
MAWP	25 Kg/cm^2 (g)
Configuration	Vertical
Design Code	EN13458 Annex C
	AD Merkblatter 2000
Operating Temperature	-196°C to +50°C
Ullage space	5%
Cleaning Duty	Oxygen
Insulation	Vacuum + Perlite

Oxygen Supply:	
Normal Flow	2,270 Nm3/hr (1)
Purity	> 99.0%

- **Nm^3/ hr is measured at a temperature of 0 deg.C, at 14.696 psia.**

Mode supply and unloading at UCIL premises

Liquid Oxygen shall be supplied on Weighment Basis by seller's Vacuum Insulated Transport Tanker (VITT) and the product will be decanted in the VIE (Storage Vessels) installed at UCIL's premises by Pressure Transfer System. The VITT will be weighed at UCIL's Weigh Bridge before and after decanting Liquid into the VIE for ascertaining the quantity of product supplied.