

BROAD SPECIFICATION OF OXYGEN/NITROGEN PLANT CAPACITY
110 M3/Hr

Supply, Installation, Commissioning & Testing of Oxygen-cum-Nitrogen Gas Plant of 110 M3 / Hr capacity (*Oxygen production capacity of 100 M3/ hour, purity 99.50 % & above, Nitrogen Production of 130 M3 / hour, purity 99.00 % & above*) with all accessories, motor 3 Phase , 440 Volt, 50 C/S with starter & control panel, chilling plant etc.

Quantity :- 2 No.

Lot – 1

Delivery – 30-01-2008

Detailed specifications and other conditions of requirement are as per enclosed Annexure -I.

SPECIFICATION OF 110 M3 PER HOUR OXYGEN/NITROGEN PLANT

1. **Requirement**

Two no, Identical Oxygen-cum-Nitrogen Gas Plant of 110 M3/ hour (*Oxygen production capacity of 100 M3/ hour, purity 99.50 % & above, Nitrogen Production of 130 M3 / hour, purity 99.00 % & above*) based on modern and proven design conforming to latest technology and standards are required for supplying of Oxygen –cum- Nitrogen gas on continuous basis.

2. **The Offer**

The offer for Oxygen-cum-Nitrogen Gas Plant shall be furnished with complete technical information, design, technical parameters, constructional, dimensional, operational details, safety interlocks, layout plan etc. along with point to point detail reply as required in following. The offer must be in two parts, (a) Techno- Commercial bid and (b) Price bid, each sealed in separate envelope. The commercial offer must be clearly indicated item-wise breakup of price in relation to scope of supply / work.

3. **Selection Basis**

The selection of Oxygen-cum-Nitrogen Gas Plant shall be carried out on the basis of overall merit viz. Operational ease, full load & part-load efficiency, operational economics, maintenance aspects and suitability of Oxygen-cum-Nitrogen Plant for long running stretches of round the clock operation .

4. **Technical Specifications of the Oxygen – cum -Nitrogen plant detailing for scope of supply :-**

BHEL requirement is for **two numbers** Oxygen / Nitrogen Gas plants each of the capacity 110 m3 / Hr .:

<i>Oxygen gas</i>	<i>100 M3 / hr</i>	<i>purity</i>	<i>99.5 % & above</i>
<i>Nitrogen gas</i>	<i>135 M3/hr</i>	<i>purity</i>	<i>99.0 % & above</i>

- 4.1. **Suction Filter Air Intake** - M.S. Vessel consisting of perforated sheet shall be Covering with the wire Mesh is required for removing dust particle from suction path of the Air Compressor.

- 4.2. **Air Compressor**- Reciprocating multistage horizontal, positive Displacement, piston type with Inter-coolers, Electric Motor and Starter Including flywheel, Foundation Bolts, Motor Pulley, V-belts, Belt Guard, And Slide Rails for the Motor. The Compressor shall be of Ingersoll Rand (India) , Ahmedabad .
- 4.3. **After Cooler of the Air compressor** - M.S. High Pressure Cooler Consisting of M.S. High Pressure Tube Bundle which shall be submerged in cold circulating water is required for cooling of the compressed air.
- 4.4. **Moisture Separator– 2 Nos.** - This should be a cylindrical shape vessel made of M.S. duly fitted with drain valves for removal of moisture Present in the process air path.
- 4.5. **Cascade Air Cooler** - Should be designed in to a vessel consisting of High Pressure air cooling coils in two separate chambers. The process air shall be allowed to pass trough the coils of the Cooler & shall be suitably designed to cool down with water and incoming Nitrogen from the Air separation units. These coils shall be immersed in water with a water level indicators facility.
- 4.6. **Activated Carbon / Alumina Filter** - This vessel is to be constructed of Mild Steel in cylindrical shape, having activated carbon & Alumina along with sand filters. The purpose is for the absorption of Hydro-Carbons from the compressed air used for manufacturing of Oxygen and Nitrogen Gas.
- 4.7. **Molecular Battery** - The vessel is to be filled with Molecular sieve type 13 X (*Imported material*) along with controlled heaters required for regeneration. The function of Molecular battery set is for absorption of moisture, CO₂, traces of Acetylene and other hydrocarbons etc from the Process Air.
- 4.8. **Ceramic Filter** - The equipment should be of Mild Steel and in cylindrical shape. The micro ceramic filter should be needed to avoid the entry of the dust in side of the Air Separation unit of the Oxygen plant.
- 4.9. **Expansion Engine** – Shall be a vertical reciprocating machine Complete with Fly Wheel, Pressure Gauges, Motor, Motor Pulley, V-belts, starters cables etc. The Belt Guard, Inter-connecting Copper Pipes and bursting disk for safety should also be taken care.

- 4.10. **Cold Box** - The Cold Box shall consist of Air Separation Column with Heat Exchangers for heat transfer between the incoming air and the outgoing cold Nitrogen and Oxygen. Cold Box should be equipped with expansion valves for controlling the operation of the Plant and delivery of the oxygen. Cold Box internal parts should be made of Stainless Steel duly argon welded wherever needed. The other internal parts i.e. copper piping etc should also be brazed & soldered for leak proof operation. The cold box should be insulated with perlite insulation powder. The Control Panel shall be equipped with temperature controlling system, on line oxygen gas purity analyzer, CO₂ analyzer and Nitrogen gas purity analyzer. The defrost heater should be designed along with automatic temperature controller required for defrosting of the Cold Box.
- 4.11 **Liquid Oxygen Pump** - Should be designed for single cylinder pumping facility which will fill the bone dry Oxygen into cylinders up to max 160 kg /cm² pressure. The Pump should be supplied with suitable Motor, Pulley, & V- belts, belt guards, starter & cables etc.
- 4.11 (A) **Nitrogen Compressor**: - For filling Nitrogen Gas in pressure vessel and cylinders.
- 4.12 (a) **Gas / Air Lines** - Pipelines for the Process Air, Nitrogen and Oxygen as per standard Layout should be needed.
- (b) Filling Manifolds, Gauges, Valves, Indicators, Safety Devices, and Testing Kit etc shall also be part of supply.
- 4.13. **Insulation** – The Insulation wool with wire mesh, GI sheeting for insulation of cascade Cooler, Alumina Filter, Molecular Battery, Pipelines etc shall be a part of supply.
- 4.14 **Independent Water Cooling System for both the Plants**:-Two independent Cooling towers (*one for each oxygen plant*) along with suitable capacity Two pumps for each tower with motors, starter panel, cables, suitable length and size of the pipe line, valves, NRV, temperature & pressure gauges etc required for efficient cooling for **Oxygen-cum - Nitrogen Plants each of 110 Cu. M. capacity** (*Oxygen production capacity of 100 M³/ hour of purity 99.50 % & above, Nitrogen Production of 130 M³ / hour of purity 99.00 % & above*). The water hardness of BHEL Plant is of 225 PPM, suitable water softening plant is also required as part of the supply of cooling water system.

4.15 Chilling Unit: - It should design to control the inlet air temperature before Air Separation Unit automatically in between 10 Degree C to 20 degree C.

5. Ambient Conditions at site for installation & designing of oxygen –cum- Nitrogen plants:-

- a. Temperature : 50 Degree C Max.
- b. Relative humidity : 95% max.

6. Details to be furnished by Manufacturer:-

- a. Discharge Out put of Oxygen –cum-Nitrogen plant per hours.
- b. Specific power consumption at rated per cubic meter of oxygen Gas and Nitrogen Gas production
- c. Purity of oxygen and Nitrogen Gas
- d. Lube oil consumption in compressor, expansion engine on weekly basis.
- e. Vibration level of the compressor at a distance of one meter.

7. Designing condition for Air Compressor of the oxygen –cum- Nitrogen plant:-

- 1. One Compressor on each unit is to be design for continuous services at a stretch. The compressor must be capable for round the clock uninterrupted services and the supplier must specify the minimum period between the two overhauls of the compressor.
- 2. Selection of the Compressor should be of M/s Ingersoll Rand (India) Limited, Ahmedabad.
- 3. Noise level of combined unit (compressor and drive motor) should be less than 90 dbA at a distance of one Meter from the equipment without use of sound attenuation hoods on the compressor.
- 4. Heat exchangers shall be constructed to allow their removal with minimum dismantling of piping or compressor components. Inter coolers and after coolers should be provided with automatic drain valves for removal of condensed moisture.
- 5. Over all plant must be maintenance friendly.

8. Air Flow meter and Oxygen Gas flow meter.

- (a) Air Flow meter is to be provided on each Compressor air path. It should be highly reliable and capable for continuous monitoring of the compressor performance for analyzing of the likely faults in day to day working. The installation and commissioning of the Air flow meters shall be in scope of Oxygen –cum- Nitrogen Gas Plant supplier.
- (b) Oxygen flow Meter shall also be required for, measuring the out put of the plant.

9. Electrical and Control Panel with switchgear and protection, indication, fuse unit volt meter ammeter etc for operation of individual Oxygen –cum- Nitrogen Plant:

- i) All electrical equipment should be designed for in door installation.
- ii) Compressor and main motor drive should be suitable for 440 V, 3 Phase, wire with neutral, frequency of 50 +/- 5%, Hz power supply variation.
- iii) Main motor shall be squirrel cage induction CACA type with IP 55 protection and designed as per IS-325 or equivalent international standard. It shall have class 'F' insulation with class 'B' temperature rise at an ambient of 45 Degree C. Bearing and winding temperature RTD should be provided and their values should appear on control panel.
- iv) Motor rating should be based on the rated shaft power drawn by the compressor plus 10% margin over the rated shaft power.
- v) All the motors should be of reputed make like Siemens / Crompton /AEI / Kirloskar/ and shall be supplied with the starting panel.
- vi) Starting panel of main motor should have following features:-
 - a. Starter should be star delta fully automatic suitable for 440 power supply. This should be of L&T, Siemens, cutler Hammer etc.
 - b. On, off and Trip indication & remote control switching arrangement should be available,
 - c. Digital motor protection relay for complete safety of motor.
 - d. Starting interlock with panel isolator,
 - e. Door interlock with 440 Volt power supply.

vii) All the electrical interconnecting cables and wiring should be Multi strand copper, insulated and to be supplied with the compressors. Both end of wiring should be provided with crimped terminals and numbered ferrules. The same numbers should appear on electrical diagrams.

viii) Control panel :

- a.. Control system should be microprocessor based with automatic control providing complete integration of compressor, motor and auxiliaries.
- b. The controller should be allowed complete adjustment of all parameters. Alarm limits and trip set points from the data input device provided on the panel. It should have self-diagnostic feature.
- c. The Controller shall have all motor protection functions and shall automatically record the energy consumption.
- d. Alarms and Trips facility

The controller should continuously monitor the following Parameters (even when compressor is not running) and alert the Operator when fault occurs.

Parameters	Alarm	Trip
- Low cooling water flow	x	x
- Low bearing oil pressure	x	x
- Low bearing oil temp.	x	-
- High bearing oil temp.	x	x
- High air discharge Temp.	x	x
- Microprocessor fault	-	x
- Faulty Transmitters	-	x

10. Connecting pipelines and accessories;

All the connecting pipelines, isolation valves, regulating valves, control valves, drain valves, non return valves etc. are to be provided along with the compressors and all the valves should be of reputed make. The make of the offered valves shall be mentioned with details, in the offer. All other instruments, pressure gauges, safety valves, inter locks, vent valves, temperature gauge etc. shall also be provided as per design and requirement of smooth operation of the Oxygen-cum- Nitrogen Plant.

11. Essential requirements of the offer;

Following detailed information is required for the technical evaluation of the offer:

- a). Full technical information design and technical parameters, constructional / dimensional details safety devices details, Electrical and control panel wiring diagrams etc.
- b) Complete layout of the Oxygen Plant and accessories with foundation details and drawing.
- c) Total requirement of power, water, consumables and other utilities.
- e) Item wise breakup of complete scope of supply including details like make, supplier and other technical information. The price breakup in relation to above should be mentioned in price bid.
- f) List of customers to whom the identical / similar Oxygen Plant had been supplied in recent years along with details like model, date of supply and commissioning and full address of the contact person of the customer.
- g) Supplier should also mention in detail, the total number of Oxygen Plant supplied so far and their market share.
- h.) Details of works are not included in the scope of supply to are to be mentioned by vendor.

12. Inspection and Testing:

Both the Oxygen-cum- Nitrogen Plant units, complete in all respects, shall be offered for witnessing, for inspection and testing. Dispatch of both the units will be done after submission of test result / documents and their approval. Vital equipment / accessories like electrical motor, control panel and other bought out items will also be inspected for ensuring good quality and workmanship at the works of Oxygen-cum-Nitrogen Plant. Modifications, if found necessary during inspection, will have to be carried out, free of charge, by the supplier of Oxygen –cum- Nitrogen Plant.

Four copies of the testing documents and inspection certificate for all the components should be furnished along with the dispatch of material. In case the inspection and testing is required to be carried out at OEM's Works, the cost of the same shall be included in the offer.

13. Erection commissioning and job proving:

- Both the Oxygen-Cum- Nitrogen Plant with all accessories must reach the site in one lot. The Oxygen Plant must be supplied with all the foundation bolts, leveling, aligning, anchoring and other material required for erection of complete Oxygen-cum-Nitrogen Plants. The supplier shall assist in finalisation of layout plan, electrical plan etc., in line with BHEL's requirements.
- The supplier shall furnish activity bar chart, civil drawings, foundation design details, loading details, layout plan etc, immediately after receipt of LOI.
- Other activities, manpower, material, instruments etc., required for satisfactory installation, erection, commissioning testing and job proving of both the oxygen-cum-Nitrogen plants shall be the responsibility of the supplier.
- Related Civil work shall be carried out by BHEL as per supplier's drawings under their supervision and guidance.
- First fill of lubricants and other required consumables for commissioning shall be arranged by the supplier.
- The offer must be on turnkey basis including the charges for complete erection and commissioning of both the oxygen-cum-Nitrogen Plant. This shall be completed and handed over with in the committed time bound period.
- The supplier shall also operate the oxygen-cum-Nitrogen Plant for the desired performance and efficiency to the BHEL's entire satisfaction level at the site. The oxygen-cum-Nitrogen Plant shall be operated for 72 hrs continuously one-by-one & / or both at full load parameters. For measuring the parameters during job proving such as energy per meter cube, Capacity per hour, pressure, purity of gas etc Supplier shall also bring all the required instruments / devices.

14. Guarantees:

The manufacture shall cover for all items erected & commissioned in both the oxygen-cum-Nitrogen Plant in respect to design, material, construction, performance, Operation and against any manufacturing defects for a period of not less 18 months from date of commissioning & handing over. The

Manufacturer should provide free after sales service and free replacement of defective parts during the guarantee period.

15. Maintenance:

All the equipment & parts of the oxygen-cum-Nitrogen Plant should have easy accessibility for Inspection, repair, replacement and other maintenance jobs. The material of construction and dimensional details for every part, assembly detail and other details required for Mechanical, Electrical and Electronics etc should be clearly shown in the drawings.

16. Spares for minimum period of Two years:

List of the recommended spares along with price shall also be quoted essential for a period of two years (*round the clock operation of the oxygen-cum-Nitrogen Plant including accessories*) shall be supplied with the units offer. The order for spares shall be placed with a separately. The supplier shall bring the necessary commissioning spares if required.

17. Training of personnel

Free of charge training to our engineers, supervisor & working staff shall be provided at the supplier works in all respects of operation, maintenance (mechanical, electrical and electronics) and for related safety procedures.

18. Documents

The manufacture / supplier of the oxygen-cum-Nitrogen Plant should furnish four sets of following Documents in English language: -

- a. General layout plan for complete supply of oxygen-cum-Nitrogen Plant with dimensional details and floor space required.
- b. Civil foundation plan for both the oxygen-cum-Nitrogen Plant with foundation details, loading details and dimensional details.
- c. General constructional and arrangement drawings for the oxygen-cum-Nitrogen Plant installation, operation and maintenance (Mechanical, Electrical and Electronics) manuals for complete Plant including bought out items.
- d. Preventive maintenance schedule and recommendations.

19. MAINTENANCE OF UNITARY OXYGEN PLANT AND AUXILIARY EQUIPMENT

1. The bidders shall quote separately for comprehensive maintenance service for the unitary oxygen-cum-Nitrogen Plant and auxiliary equipment installed at BHEL, Haridwar for a period of Two-years starting after completion of Guarantee/ Warrantee period. During this period the successful bidder is supposed to provide preventive, routine and breakdown maintenance and shall repair and /or replace anything or everything defective and /or not operating correctly. He shall indicate the charges on item rate basis to be paid on raising the invoice duly certified by the Engineer after successful execution of the job.

2. Maintenance will consist of inspection and preventive maintenance at regular intervals. The same will include the following but not limited to:

- a. Check the unit for any unusual heating of motors winding and bearing, leakages in the oxygen-cum-Nitrogen Plant.
- b. Will check the out put of oxygen-cum-Nitrogen Plant,
- c. Inspect the unit's piping heat exchangers for any visible signs of leaks etc.
- d. Inspect the unit for objectionable noise, vibrations etc.
- e. Check system operating pressure and temperature.
- f. Inspect and keep a logging of all test readings in reference to original standards,
- g. Inspect and adjust all safety controls.
- h. Report to the owners in writing related to all defect, deficiencies and repairs carried out during the inspection.

3. Servicing of unit shall include but not limited to:

- 3.1 Cleaning of air filter.
 - 3.2 Cleaning of oil filters and replacement of lubricant as required.
 - 3.3 Checking of electrical parts and dressing of the wires.
 - 3.4 Checking of equipment and controls for proper functioning.
 - 3.5 Checking of capacitor, contacts, and stabilizer and unit terminals. Check connections and tighten motor terminal and control circuit terminals.
4. The contractor shall keep a minimum staff of one skilled worker who should be mobile to attend to any complaint within the complex within a reasonable time. The contractor shall confirm attending to all the problems reported to him within four working hours of

information and they should rectify within reasonable time as specified hereunder on seven day a week basis.

Bidder shall indicate downtime in case of disagreement

5. Preventive Maintenance:

At the beginning of the contract every year checking and servicing all the unitary equipment shall be done to ensure satisfactory performance of the equipment involved in the contract.

6. Break Down Calls:

Contractor shall ensure that all complaints are attended promptly and equipment made operative within the stipulated time period.

7. Stand by equipment:

Contractor shall ensure operability of standby equipment to ensure steady operation of the equipment.

(Prepared by)

(Approved by)