TENDER DOCUMENT

FOR

SUPPLY INSTALLATION, TESTING AND COMMISSIONING OF MEDICAL GAS PIPE LINE SYSTEM AT THE OLD OPD & CAUSALITY BLOCK AT MEDICAL COLLEGE TRIVANDRUM

PART-III
PRICE BID

TENDER NO. HLL / ID / 13 / 71

September 2013

HLL LIFECARE LIMITED.
INFRASTRUCTURE DEVELOPMENT DIVISION

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1. COMMERCIAL CONDITIONS

1.1 The tendered rate shall inter alia be deemed to include for the provision of all materials , process, operation and special requirements detailed in the particular specification irrespective of whether these are mentioned in the description of equipment schedule and Bill of quantities or not. It is an express condition of the contract that the tendered rates for various items in the Bill of Quantities shall be deemed to include for the full, entire and final condition of the contractor respective items of the works in accordance with the provision of the contract.

1.2 The tendered rate shall include for all taxes, duties, etc. as applicable and shall be quoted on the works contract basis for the Supply Installation, Testing and Commissioning of Medical gas pipe line system at the old OPD & Causality block at Medical college Trivandrum..

1.3 The tendered rate shall remain firm and free from variation due to rise in the cost of materials/equipment labour or any other reasons whatsoever during the contract period and valid extension.

1.4 The quantum of excise duty included in the tendered price, the rate at which they were assumed etc. shall be indicated in the tender.

2. UNIT RATES

2.1 Only approved work will be measured on completion and priced as per rates quoted against the respective items.

3. BRIEF DESCRIPTION OF PRICING

3.1 The tenderer shall furnish duly certified breakup of material and labour separately for each item of work. The same shall be attached separately along with the price bid.

3.2 The quoted price shall be inclusive of all taxes and duties whether payable by the contractor or to be deducted at source. This shall include those applicable among VAT, Sales Tax, Income Tax, Customs Duty, Excise Duty, Turnover Tax, Service Tax, Work Contract Tax, Octroi, Labour Welfare Cess or any other Taxes and Duties prevailing in respect of this contract. ANY BID STATING THAT TAXES ARE EXTRA WILL BE SUMMARILY REJECTED.

4. PRO-RATA VALUE

The detailed break up of prices for various items of equipments and materials of the full system should be provided by successful tenderers within fifteen days from the date of letter of intent to facilitate the Employer for assessment and verification and to certify payment.

5. INCOME TAX

Any payment to the contractor as per contract, will be made after deducting income tax as per the rules and regulations.

6. SALES TAX AND EXCISE DUTY

The tenderer shall clearly indicate sales tax, Excise and works contract tax and other duties as applicable in his offer for carrying out this work.

7. SUBMISSION OF BILL

7.1 The contractor shall from time to time prepare and submit interim bills of the work executed and on completion of the contract, he shall prepare and submit the final bill. The measurements sheets in support of the interim and final bills shall be prepared by the contractor on the basis of measurements taken by him jointly with the project engineer and the said measurement sheets shall be submitted by him with the relevant bill.

8. EXTRA ITEMS

The contractor is bound to carry out any items of work necessary for the completion of the job even though such items may not have been included in the schedule of probable quantities or rates, such items being necessary or essential for completing the job. Variation order in respect of such additional items and their quantities will be issued in writing by the Employer.

All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of work and on completion including that of the sub-contractors and special tradesman and all materials condemned by the project engineer shall be cleared and removed from the site by the contractor without any extra charge.

All measuring steel taps, scaffolding, ladders instruments and tools that may be required for taking measurements shall be supplied by the contractor.

9.OVER TIME WORK

If the contractor is required to work night or on holidays in order to maintain the time schedule he shall take prior approval from the Employer. He should also provide and maintain at his own cost sufficient lights as may be necessary to enable the work to proceed satisfactorily during the night.

9.2 The contractor shall give full facilities to all other contractors working on site. He shall also arrange his programme of work so as not hinder the progress of other trades. The decision of the Employers on any point of dispute between the various parties shall be final and binding.

9.3 It is specifically pointed out that the contractor shall not be entitled to any compensation whatsoever on account of delay in procurement or supply of controlled materials and the rates quoted in the contract are fixed till the completion of the contract.

9.4 The contractor shall co-operate with other agencies appointed by the Employer for the work to proceed smoothly with the least possible delay and to the satisfaction.

9.5 The owners shall provide a source for power supply at one convenient point at site. The contractor shall at his own cost install a separate meter at the said source and lay additional cables from the said source also at his own cost. For the electricity consumed by the contractor he shall pay the owner the actual cost at the rate charged by the local authority for power for constructional purposes. The contractor shall also obtain the necessary permit for utilizing power for constructional purposes.

10. TERMS OF PAYMENT

10.1 For equipments delivered and sorted at the site for the installation, the payment will be made by the HLL in accordance of this contract.

10.2 The rate of payment for the contract value under this contract shall be regulated and detailed below:

a. 70% of the contract value on pro-rata basis against open delivery of material at site and stored as directed by the HLL and after initial inspection.

b. 20% of the contract value on satisfactory installation of the complete system.

c. 10% of the contract value will be paid after testing, commissioning trial run & handing over to HLL.

11. SPECIAL CONDITIONS

11.1 EXECUTION WORK

11.1.1 The whole of the work as described in the contract (including bills of materials, specification and all drawings pertaining thereto) and as advised by the Owners/Employers from time is to be carried out and completed in all parts to the entire satisfaction of the Owners/Employers. Any minor details of construction which are obviously and fairly intended, or which may not have been definitely referred to in this contract, but which are usual construction practice and essential to the work, shall be included in this contact.

11.2 MAINTENANCE & TRAINNING FOR PERSONNEL

11.2.1 The contractor shall without any extra cost carry out for a period of 12 months after the installation is taken over by the owners, all routine and special maintenance and attend to any difficulties and defects that may arise in the operation of the system.

11.2.2 The contractor shall associate with the Employers' staff during erection and the maintenance period, in the maintenance/operation of the system..

11.2.3 If required, by the Employers, the contractor shall also train members of the Employers' staff at their works/service station without any extra charge.

11.3 CERTIFICATE OF COMPLETION

11.3.1 The contractor shall intimate to HLL in writing as and when the works are completed and put into beneficial use in order to enable HLL to check certify to the Employer to take over the plants.

11.3.2 The work shall not be considered as completed and put into beneficial use until HLL have certified in writing that the same has been completed and put into beneficial use.

11.3.3 The defects liability period of one year shall commence from date of such completion or any specific date mentioned therein.

11.4 OPERATIONAL AND MAINTENANCE MANUALS

11.4.1 The contractor shall also furnish the prints of all up-dated handing over along with required set of operating/maintenance manuals/instructions.

11.5 STATUTARY APPROVALS

All statuary approvals pertaining to the installations including electrical inspector approvals shall be in the scope of the supplier.

Supply, Installation, Testing, Commissiong of Medical Gas Pipe Line System on turnkey basis	
I	**OXYGEN SYSTEM**
1	**Oxygen Manifold - 2X 10**
1.1	**10 + 10** Size Oxygen Manifold should be configured with **2 x 10** nos. of class J Cylinders and should be suitable to withstand working pressure of 145 Kg/cm2, along with 20 nos. of high-pressure copper annealed tail pipes with end brass adapter suitable for oxygen cylinders and manifold. 10 cylinder manifold bank as left side and 10 cylinder manifold bank as right side complete with 20 nos. of pig tail pipes and 20 nos. of non-return valves.
1.2	Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. The manifold must be tested (hydraulically) at 150 bar and necessary test certificates should accompany along with the supply.
1.3	The manifold system should conform to IS 12827 standard
2	**Fully Automatic Oxygen Control Panel**
2.1	The Manifold control panel should be digital/analog, fully automatic type and switches from "Bank in Use" to "Reserve bank " without fluctuation in delivery supply line pressure.
2.2	The changeover system should be taken place pneumatically and without the need for external power so that even during power failure the changeover can be taken place automatically if the "Bank in Use" becomes empty. After the switch-over, the "Reserve bank " then becomes the "Bank in Use" and the "Bank in Use" becomes the "Reserve bank".
2.3	The control panel should have a microprocessor based digital /analog display panel.
2.4	The control panel should be incorporated with three large, red, illuminated LED displays for the Left Bank, the Right Bank and for the Supply Pressure. The control panel also should have six LED's, two Green for "Bank in Use", two Amber for "Bank Ready" and two Red for "Bank Empty".

2.5	Should have fully automatic self-contained shuttle-valve with no electrical power required for switching
2.6	Input power: 240 VAC, 50 HZ
2.7	Control panel display should be readable even in poor lighting conditions
2.8	Units of pressure switchable (psi/kg/cm^2/bar)
2.9	Two limit switches for indication of bank in use
2.10	Dual line pressure regulators
2.11	Delivery flow capacity : Approx **500 l/min** at 55-60 psi pressure
2.12	Should be CE certified/UL listed
3	**Oxygen Emergency Reserve Manifold - 2 X 2 Manifold**
3.1	Should include 4 cylinder manifold bank as either side complete with 2 nos.pig tail pipes and 2 nos. non return valves.
3.2	Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely.
3.3	The emergency reserve manifold shall provide an uninterrupted supply of medical oxygen from equally sized high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 400 kPa.
3.4	Cylinder bank shall be fitted with an isolation valve to enable continuity of supply in the vent of primary supply failure.
3.5	The manifold control panel shall provide a minimum flow of **500 l/min** to the nominal 400 kPa medical oxygen pipeline system.
3.6	There shall be two separate stages of pressure regulation to enable high peak flow rates without a reduction in line pressure.
3.7	All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.
3.8	The line pressure relief valve shall be provided with easing gear.
3.9	A non-return valve shall be provided within a line pressure manifold block and shall provide gas tight isolation in the event of any upstream component failure. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary supply fails.

3.10	The emergency reserve manifold shall be provided with a lockable isolation valve to enable positive tamperproof isolation for maintenance. The emergency reserve manifold shall be supplied fully assembled and tested.
3.11	The manifold system should conform to IS :12827 standard.
II	**NITROUS OXIDE**
1	**Nitrous Oxide**
1.1	**4+ 4** Size Nitrous oxide Manifold should be configured with **2 x 4** nos. of class J Cylinders and should be suitable to withstand working pressure of 145 Kg/cm2, along with 8 nos. of high-pressure copper annealed tail pipes with end brass adapter suitable for Nitrous oxide cylinders and manifold. 4 cylinder manifold bank as left side and 4 cylinder manifold bank as right side complete with 8 nos. of pig tail pipes and 8 nos. of non-return valves.
1.2	Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. The manifold must be tested (hydraulically) at 150 bar and necessary test certificates should accompany along with the supply.
1.3	The manifold system should conform to IS 12827 standard
2	**Fully Automatic Nitrous Oxide Control Panel**
2.1	The Manifold control panel should be digital/analog, fully automatic type and switches from "Bank in Use" to "Reserve bank " without fluctuation in delivery supply line pressure.
2.2	The changeover system should be taken place pneumatically and without the need for external power so that even during power failure the changeover can be taken place automatically if the "Bank in Use" becomes empty. After the switch-over, the "Reserve bank " then becomes the "Bank in Use" and the "Bank in Use" becomes the "Reserve bank".
2.3	The control panel should have a microprocessor based digital /analog display panel.

2.4	The control panel should be incorporated with three large, red, illuminated LED displays for the Left Bank, the Right Bank and for the Supply Pressure. The control panel also should have six LED's, two Green for "Bank in Use", two Amber for "Bank Ready" and two Red for "Bank Empty".
2.5	Should have fully automatic self-contained shuttle-valve with no electrical power required for switching
2.6	Input power: 240 VAC, 50 HZ
2.7	Control panel display should be readable even in poor lighting conditions
2.8	Units of pressure switchable (psi/kg/cm^2/bar)
2.9	Two limit switches for indication of bank in use
2.10	Dual line pressure regulators
2.11	Delivery flow capacity : Approx **250 l/min** at 55-60 psi pressure
2.12	Should be CE certified/UL listed
3	**Nitrous Oxide Emergency Reserve Manifold - 2 X 1 Manifold-Indigenous**
3.1	Should include 2 cylinder manifold bank as either side complete with 1 no .pig tail pipes and 1 no. non return valves.
3.2	Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely.
3.3	The emergency reserve manifold shall provide an uninterrupted supply of medical oxygen from equally sized high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 400 kPa.
3.4	Cylinder bank shall be fitted with an isolation valve to enable continuity of supply in the vent of primary supply failure.
3.5	The manifold control panel shall provide a minimum flow of **250 l/min** to the nominal 400 kPa medical oxygen pipeline system.
3.6	There shall be two separate stages of pressure regulation to enable high peak flow rates without a reduction in line pressure.
3.7	All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.
3.8	The line pressure relief valve shall be provided with easing gear.

3.9	A non-return valve shall be provided within a line pressure manifold block and shall provide gas tight isolation in the event of any upstream component failure. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary supply fails.
3.10	The emergency reserve manifold shall be provided with a lockable isolation valve to enable positive tamperproof isolation for maintenance. The emergency reserve manifold shall be supplied fully assembled and tested.
3.11	The manifold system should conform to IS :12827 standard.
III	**MEDICAL AIR AND SURGICAL AIR SYSTEM**
1	**General**
1.1	The medical gas system contractor shall supply, install and commission the compressed air plant (for medical air duplex type) with plant and associated equipment including control equipment , monitoring and alarm instrumentation, after coolers, receivers, filters and dryers, regulators, drain taps and relief valves. The Air system shall in all respects comply with the recommendation made in HTM 2022/HTM 02-01 standards. .List of Air outlets are provided to calculate flow requirements
1.2	The installed system shall be of oil free, non lubricated, dust free. Generating pressure of medical air (4 bar) and Surgical air (7 bar) shall be as per HTM 2022/HTM 02-01 standards .Isolating valve shall be fitted wherever appropriate to enable maintenance of duplex units and without completely shutting down of plant. Safety relief valves shall be fitted at suitable positions to protect plant from damage; and shall vent to a safe place
1.3	Bidder will be responsible for providing surgical air to Neuro theatres and Surgical theatres
2	**Air Compressor Pumps**
2.1	The Duplex medical air system package shall include two oil-free reciprocating/rotary vane/rotary screw/scroll type , air cooled, air compressors each having capacity over **1500 LPM at 4 bar** with common **1200 litres receiver tank** along with filter, non-return Valve, isolation valves, dual desiccant air dryer, dual pressure reducing station, etc. Compressor should be from high quality internationally approved manufacturer.

2.2	The medical air compressor shall operate in a “Duty” and “standby “mode, with each compressor being able to be selected to carry out either role. Each compressor shall be capable of supplying the system design flow rate on its own. An inlet filter and silencer shall be fitted to the outlets of each compressor. The contractor shall take all suitable precautions to prevent vibration being transmitted from compressor/motor units to the building structure. Suitable anti vibration mountings shall be provided.
2.3	The compressor units shall be fitted with after coolers which shall be of the air blast type and shall be fitted with an automatic drain with manual by-pass valves.
3	**Control and Instrumentation**
3.1	The compressor plant shall be supplied with a three compartment control panel with protection to IP65, two compartments shall contain equipment individual to each compressor i.e. motor starters, isolators, control circuit, fuses, ammeter and an hour run meter. The central compartment shall contain any common equipment including control pressure switches, alarm pressure switches, and the control logic circuitry.
3.2	The compressed air plant shall link with the alarm and monitoring system to provide a four stage alarm system as mentioned below.
	1. Plant Fault Caused by control circuit failure, overload trip for high after cooler temperature, any other fault such as delay for build up dew point failure, filter/dryer pressure fault. etc.
	2. Plant emergency caused by receiver pressure 0.5 bar below compressor cut-in pressure, dew point above - 26 deg Celsius at atmosphere pressure.
	3. Reserve fault caused by reserve manifold pressure less than 50%
	4. Pressure Fault caused by low pipeline pressure, high pipeline pressure
4	**Air Receiver**
4.1	The air receiver shall be constructed to HTM 2022/HTM 02-01standards. The vessel shall incorporate all suitable lifting lugs and mounting feet and shall be complete with a relief valve, fusible plug, an inspection/access panel and an automatic drain with manual by pass. Receiver capacity should not be less than **1200 litre (Approx)**.
5	**Filtration/Dryer System -**

5.1	On leaving the air receiver the air shall pass through either leg of a duplex pre-filter, oil removal filter and twin column dryer assembly, each leg shall be capable of passing the full flow of one air compressor. The pre-filters shall be in accordance HTM 2022/HTM 02-01 standards with an efficiency of 95%. Oil filters shall be of the coalescing absorption type, removing 99% of oil and water particles between 5 and 40 microns. Filtering should ensure complete oil removal so that only oil free air enter the desiccant dryer.
5.2	The dryers shall be the double absorber 'heatless' type, fully automatic and use activated alumna desiccant. Re-activation shall be on a time cycle using a bleed of purge air from the in-service dryer assembly. Dust filters shall be fitted after the dryer to ensure that air quality complies with HTM 2022/HTM 02-01 standards. Each dryer assembly shall incorporate a dew point alarm to enable automatic changeover to the stand by dryer, in the event of the dew point rising to above 0ºC at 7.2 bar or - 26ºC at atmospheric pressure..
6	**Pressure Control**
6.1	The compressor shall be supplied with regulator arrangements to regulate the pressure to: 4 bar +/-0.12 medical air and Surgical air to 7 bar
IV	**VACCUM PLANT**
1	**General**
1.1	The medical gas system contractor shall supply, install and commission the vacuum plant and associated equipment. This shall include a packaged duplex pump and reservoir(s) system complete with all necessary controls, drainage traps, bacterial filters and individual exhaust lines. The vacuum system shall in all respects comply with the recommendation made in HTM 2022/HTM 02-01 stanndards.
1.2	The medical vacuum pipeline system should be designed to maintain a vacuum of at least 300 mm Hg (40 kPa) at each terminal unit during the system design flow tests.List of vacuum outlets are provided to calculate flow requirements.
2	**Vacuum Pump Units**

2.1	The pump installation shall be duplex system consisting of two identical rotary vane pumps each of which shall be capable of independently producing designed systems flow rate. The pump shall be clearly marked with its performance, both its free air displacement and its volumetric throughput. Each pump should have capacity of minimum **1500 LPM**. Pump should be capable of providing a vacuum of not less than 650 mm Hg (87 kPa).
2.2	The driving motor shall directly drive the pump unit and it shall be manufactured in accordance with HTM 2022/HTM 02-01 recommendations.
2.3	Each pump shall have a built in non-return valve and pressure switch such that inadvertent reversal of the motor will not pressurize the reservoir or the distribution system.Pump should be of reputed make as per international standards.
3	**Control and Instrumentation**
3.1	The vacuum plant control panel shall consist of three separate compartments, two compartments shall hold the motor starters, isolators, ammeters, and hours run-meters, for each pump. The remaining compartment shall house the vacuum switches, status monitoring equipment, delay timer and interlock material (to prevent simultaneous starting of the pumps) and the duty selector switch with automatic change over.
3.2	Indication of vacuum level shall be provided for line vacuum and reservoir vacuum
4	**Reservoir Vaccuum**
4.1	A differential pressure indication shall be provided across the filter and drainage trap assemblies. These indications shall be provided by gauges of at least 100 mm diameter and calibrated in mm Hg. The working pressure of gauges shall not exceed 65% of the full scale range. The duplex installation shall be such that each pump is capable of operating in either the duty mode or the standby mode ensuring that wear is equal to both pumps..
4.2	The vacuum plant shall have three stages of alarm conditions as input to the alarm system and these shall be as follows:
	1. Plant faults caused by: Control circuit failure, activation of any other safety device or failure of a selected pump to run up to speed on time.
	2. Plant emergency caused by: Low receive vacuum(50mm Hg below cut in pressure of the standby pump).
	3. Pressure Fault caused by: Pipeline vacuum less than 360 mm Hg.

5	**Reservoir & Filters**
5.1	The reservoir shall be manufactured in accordance with HTM 2022/HTM 02-01 standard tested to a minimum pressure of 3 bar and the test certificate shall be supplied to the user.
5.2	The reservoir shall be provided with a manual drain valve. The reservoir shall be designed according to the recommendation made on HTM 2022/HTM 02-01.Reservior capacity should not be less than **1500 Litres.**
5.3	A bacterial filter shall be fitted between each pump and the reservoir, which shall have replaceable elements and each shall be capable of passing the total design flow. The filters shall be arranged such that one filter can be taken out for servicing without interrupting or restricting the vacuum service as a whole.
5.4	The filters shall have a penetration not exceeding 0.05% when tested by the sodium flames test in accordance with BS3928. Moisture traps shall also be fitted on each leg. These may be combined with the filter units. The traps shall have removable transparent drain bowls which can be removed without affecting plant operation. The bowls shall be sterilisable by using moist steam at 2.2 bar and 138 degree Celsius in porous load sterilizer.
6	**Vacuum Pump Exhaust**
6.1	The exhaust gas shall be discharged outdoors above the roof level of the plant room, and not in the building in the immediate vicinity, windows and air intakes in order to ensure that the discharge does not constitute a health hazard. Each pump shall have its own exhaust line and each shall be fitted with suitable drain valves and transparent jars at the lowest points. The outlets shall be suitably protected to prevent the ingress of rain, and wind pressure. A weatherproof notice shall be provided at the discharge points which states:“Medical Vaccuum Discharge Point – DO NOT OBSTRUCT.” The exhaust system shall be designed so that the back pressure does not exceed 80 mm Hg (1.0 psi) at the design flow rate. A length of flexible pipe work shall be included before the exhaust passes through a wall in order to isolate the building structure from pump vibration. Antivirbation mountings shall be used for the pumps.
7	**Scope**

7.1	The sub-contractor of Medical Gas shall supply, install, test and commission a complete and fully operational medical vacuum plant as per recommendation of HTM 2022/HTM 02 -01 standard. Contractor shall supply complete drawings, including all related electrical and civil works.
V	**Oxygen flow meter with Humidifier Bottle**
1	Back Pressure Compensated flow meter should be of accurate gas flow measurement with following feature .
2	Control within a range of 0 – 10 LPM.
3	It meets strict precision and durability standard.
4	The flow meter body is made of brass chrome plated materials.
5	The flow tube and shroud components are made of clear, impact resistant polycarbonate.
6	Inlet filters of stainless steel wire mesh to prevent entry of foreign particles.
7	The humidifier bottle should be made of unbreakable polycarbonate material and autoclavable at 121^{O} Centigrade temperature
8	Should be supplied with suitable connector probe to match with Oxygen outlets.
VI	**Vacuum regulator with Suction bottle**
1	Should be of light weight and compact. The unit will consist of-
2	A regulator with 0 – 760 mm gauge.
3	A 600 ml. reusable collection jar, made of unbreakable poly carbonate /poly sulfone material and fully autoclavable at 121 degree centigrade.
4	A wall bracket for mounting the jar assembly on the wall.
5	The vacuum regulator with instant ON / OFF switch should be infinitely adjustable and with vacuum gauge which will indicate suction supplied by the regulator. Safety trap must be provided inside the jar to safeguard the regulator from overflowing.
6	Should be supplied with suitable connector probe to match with Vacuum outlets.
VII	**Gas/Vacuum Outlets**
1	Front loading type terminal outlets should be designed to dispense medical gases (or an inlet for medical vacuum) to the secondary equipment (flow meters, Surgical Tools, Suction regulators, etc.) at the point of use and it should be gas specific so that secondary devices cannot be “attached” to the wrong gas.

2	When not in use, the gas should be in a non-flowing state within the Outlet (Terminal unit) sealed by “O” ring.The adapter when inserted pushes the poppet inside and the gas starts flowing and sealing is ensured by the “O” ring or a seat.
3	The outlets should Quick Connect Type and gas specificity is accomplished by "Diametric indexing." The outlets should have following features:
4	Push to insert and press-to-release mechanism for probes.
5	Allows plugging of probes from front.
6	Parking Type probe / connector
7	Self-sealing valve on disengaging the probe (Quick disconnect)
8	Smooth quite action.
9	Non return valve for on line servicing/ repairing
10	Indexed to eliminate inter-changeability of gas services
11	Color-coded gas specific front plate
12	Flow rate exceeds the requirements of ISO 9170 – 1.
13	Totally leak proof, safe & easy to operate
14	Configurations possible: surface, flush & Bead-head.
15	The terminal outlets should comply with ISO 9170-1:2008 certification
VIII	**Copper Pipes**
1	Solid drawn, seamless, deoxidised, non- arsenical, half hard, tempered and degreased copper tubes manufactured to metric outside diameters and should have mechanical properties in accordance with HTM 2022/HTM 02-01.
2	All indigenous copper pipes should be inspected and certified by Third Party Inspecting Agency Lloyds' Register Services before despatch and the pipes will be delivered capped at both ends. Imported Copper pipe should have equivalent certification. Copper Fittings should be as per. HTM 2022/HTM 02-01. All plastic saddles will have brass screws.
a	28mm OD x 0.9 mm thick
b	22mm OD x 0.9 mm thick
c	15mm OD x 0.9 mm thick
3	Rates of above mentioned copper pipes for 100 metres should be mentioned in the price bid so that variable quantity can be calculated and paid accordingly. Valves and lines additional sizes if required, may be quoted as optional.
IX	**VALVES – LINE VALVES**

1	Line Valves shall be provided for use in plant rooms and to facilitate the isolation of areas or areas where area zone valve are unnecessary. These shall be of the ball valve type and shall be constructed of a nickel plated brass body, PTFE seats and brass chrome plated ball. The valve shall be operated by a manual operating lever by 90º turn . All medical gas line ball valves shall provide a full bore flow and shall be cleaned for oxygen service and fully tested. The valve assembly shall terminate in copper stub pipes to enable brazing directly into the distribution system using the flux less brazing technique. A locking device shall be provided to lock the valve in either the fully open or fully closed position. Line valves shall be located in readily accessible areas of ducts and shafts, however care should to ensure safety to prevent danger from leakage.Line valve installation should be carried out as per HTM 2022/HTM 02-01 standards.
	Valve Size are indicated
a	15mm Ball Valve
b	22mm Ball Valve
c	28mm Ball Valve
2	Number of Valves are mentioned above.Unit rate should be quoted in the price bid so that variable quantity can be calculated and paid accordingly. Valves and lines additional sizes if required, may be quoted as optional.
X	**Area Valve Service Units (AVSU)**
1	The Area Valve Service Unit (AVSU) shall provide area isolation facility for use either in an emergency or for maintenance purposes. It shall be possible to insert a physical barrier (spade) on either side of the valve when required without the necessity to totally dismantle the line valve. The area valve service unit shall be fully gas specific, permanently labeled to identify the Medical gas service and shall incorporate gas specific NIST connections to BS5682:1984 on each side of the line valve. Pressure gas services (not vacuum) NIST connections shall incorporate self sealing valves which are normally held closed by gas pressure.
2	The line valve shall be brass 25 mm ball valve with PTFE seats operated by a quarter turn handle with a pin to prevent over travel in both directions. The ball valve shall be connected by pipes to the distribution system by either top, bottom, side or rear entry pipes.

3	The assembly shall be housed in a valve box which shall be capable of both surface or concealed mounting incorporate a hinged lid which opens through 180 degree, to provide maximum access. The hinged door shall be fitted with a glass panel to enable a visual check on the line valve selected position and for access in an emergency.
4	Area or Zone identification facilities shall be provided. The hinged door shall normally be locked closed and area zone valves installed adjacent to each other shall be operated by different key lock combinations.
5	The area zone valve assembly shall provide for natural ventilation to prevent any localized build up of gas within the valve box.
6	The valve box and door shall have a white finish. Area/Zone service units shall be fitted in readily accessible locations adjacent to the area which they serve and shall be clearly labeled to indicate function, valve position and area. Each valve box shall accommodate only one valve, several valve boxes may however be grouped together within a single housing.
7	**Scope:**
	a. The contractor of Medical gas shall supply, install, test and commission all safety required for the medical gas system safety relief valves as specified in HTM 2022 /HTM 02-01 standards.
	b. The sub-contractor of Medical Gas supply shall install test and commission all area valve and service unit AVSU in the hospital as shown on the drawing and as specified in HTM 2022 /HTM 02-01, to all necessary equipment, pipe work fittings, boxes, accessories, connectors pressure gauges, switches including the zone pressure alarm panel and all related electrical works to have complete and full operational AVSU unit. The contractor shall clearly specify the number of zone wall units comprising of AVSUs area alarm panel pressure switches and pipe works.
	c. The sub-contractor of Medical Gas shall supply, install, test and commission all required valves, check valves for the medical gases and vacuum system.
	d. 2 Nos of Area Valve Service Units (AVUS) should be supplied for all gases
XI	**Area Line Pressure Medical Gas Alarm**

1	The area line pressure alarm should be micro-processor based digital / analog which monitor the pressures of medical gases like oxygen, compressed air and vacuum levels at a specific area of piped gas system in the hospital. The electronic circuitry should be such that if the pressure / vacuum in the gas pipeline drops below the present limit, the equipment should give an audio-visual alarm. Visual alarm should remain active even after pressing of "Mute" button. It should come to normal condition only when gas pressure / vacuum return to normal level.
2	Three Channel Alarm for Oxygen, Air & Vacuum should have the following features:
3	Digital / Analog Display of Line Pressure for all the services with factory calibrated pressure sensors.
4	Color coded LED Display of Line pressure status (High – Caution – Normal – Caution– Low)
5	Audible Alarm for High & Low pressure condition.
6	Test and Alarm Acknowledge (Mute) facility.
7	Small and compact design.
8	Mounted on a powder coated MS box.
9	Nut & Nipples should be provided for connection with Pneumatic supply line.
10	Low voltage internal operation for safety with input power supply of 230 V,50 Hz AC.
11	Wall mounting facility.
12	High / Low indication with Test facility
XII	**Horizontal Bed Head Panel**
1	It should be made of High Strength Anodised Aluminium Profiles with single railing and should have the following features :
2	Should be powder coated as per the customer's choice.
3	The panel should be designed to have provision to accommodate the following:
a	**Gas Outlets -** Provision for one Oxygen ,one Vacuum and One air
b	**Electrical Sockets / Switches**-at least 4 nos.
c	**Data Socket**-RJ 45-01 no
XIII	**Portable Vacuum Unit**
	It must consist of the following: - 1no. Suction Regulator and 2nos. 4000ml polysulfone collection jar and both to be mounted on a trolley.

	Suction Regulator: Suction regulator should be supplied with a safety jar, including an anti-bacterial filter and an anti-overflow safety device. Should have wide membrane continuous suction controller
	Should have vacuum levels : 0-760 mm of Hg
	Should have vacuum gauge fitted with a protective bumper device.
	Should have on/off knob allowing for the quick restoration of a readjusted vacuum level.
	Must have central adjustment knob with a color coded for 0-760 mm of Hg. Should have polysulfone safety jar, autoclavable at 134^{o} C, unbreakable, fitted with an anti overflow safety device and equipped with a plastic antibacterial filter.
	Collection jar should be totally transparent, to ensure perfect sucked liquid visibility.
XIV	**Single Arm Movable Pendant**
	The Ceiling Pendants should comply with NFPA 99C/HTM 02-01. The support arms should be extremely robust and revolve on high quality bearings, so that the pendant head glides smoothly and quickly to any desired position. .
	The Pendant should be available as follows:
	• 1000 mm moveable arm with 340 deg. Horizontal.
	• The weight carrying capacity of the arm should not be less than 200 Kgs.
	• Should have electromagnetic brakes.
	• Arm should be capable of 300-340 degrees of rotation, which can be easily adjusted to suit the desired mode of operation.
	• The arms may be fitted with pneumatic brakes to prevent inadvertent movement.
	• The Pendant Service Heads should have modular head. The head should be capable of accepting a range of shelves, and infusion poles or other accessories.
	• The Pendant Head should support the range of Monitor Mounting Solutions.
	• The Pendant Service Head should be supplied with medical gas terminal units and 5/15 Amps. Electrical Sockets.
	• The medical gas outlets should be provided with pendant as per specification of gas outlets. Each pendant should have:

	Oxygen Outlets– 2,
	Nitrous Oxide Outlet – 1,
	Air (4 bar) Outlets– 1,
	Air (7 bar) Outlets-1
	Vacuum Outlets– 2,
	Electrical Sockets - 6 nos. (atleast 3nos of UPS sockets).
	Shelf with two rails one on each side – 1 no. &Monitor rack
XV	**INSTALLATION & TESTING**
1	Installation of piping shall be carried out with utmost cleanliness. Only pipes, fittings and valves, which have been degreased and brought in polythene sealed bags, shall be used at site. Pipe fixing clamps shall be of non-ferrous or non-deteriorating plastic suitable for the diameter of the pipe.
2	All pipe joints shall be made using flux less brazing method. Inert gas welding technique must be used by passing Nitrogen gas at the flow of 6 LPM (min.) inside the copper pipes during silver brazing in order to avoid carbon disposition inside the copper pipes. All joints should be made of copper to copper and shall be brazed by silver brazing filler material without flux.
3	Adequate supports shall be provided while laying pipelines to ensure that the pipes do not sag. The spacing of supports shall not exceed 1.5 meter for any size of pipe. Suitable sleeves shall be provided wherever pipes cross through walls / slabs. All pipe clamps shall be non-reactive to copper.
4	After erection, the pipes should be flushed with dry nitrogen gas and then pressure tested with dry nitrogen / Medical Air at a pressure equal to twice the working pressure for a period of not less than 24 hours. All leaks and joints revealed during testing should be rectified and re-tested till the pressure in pipes stands for at least 24 hours.
5	Installation, Testing and Commissioning of Medical gas pipelines should be carried out as per HTM 2022/HTM 0201 standards.
6	All the piping system should be tested in the presence of the engineer or his authorized representative.
XVI	**Colour Coding**
1	All exposed pipes should be painted with two coats of synthetic enamel paint and colour codification should be as per British standards.

a	Oxygen Line--------White Colour
b	Air Line----------Black and White
c	Vacuum Line---------Yellow Colour
	APPROVED MAKES
	Copper pipe - mehta tube
	Vacuum Pump - Anest Iwata/Ingersoll Rand
	Air plant -Anest Iwata/Ingersoll Rand

LIST OF GAS OUTLETS,CARDIAC ICU &TRAUMA,TMC

DESCRIPTION OF ROOM	NO OF OUTLETS				BEDHEAD PANEL	PENDANT
	OXYGEN	VACUUM	AIR	N20		
Cardiac ICU -16 bed	16	16	16	0	16	0
ICU-4 bed	4	4	4	0	4	0
Minor OT	2	2	1	1	0	0
Pre operative area -10 bed	10	10	10	0	0	0
Postoperative ward-10 bed	10	10	5	0	0	0
Major OT -01	2	2	2	2	0	1
Major OT -02	2	2	2	2	0	1
OT- 01	2	2	1	1	0	0
OT- 02	2	2	1	1	0	0
OT- 03	2	2	1	1	0	0
	52	**52**	**43**	**8**	**20**	**2**

BILL OF QUANTITIES

ABSTRACT

SL. NO	ITEM	AMOUNT (Rs.)
1	Medical Gas System	
	Total Amount	

Supply, Installation, Testing, Commissiong of Medical Gas Pipe Line System at the old OPD & Causality block at Medical college Trivandrum on turnkey basis				
Sl N.	**Item Description**	**Qty**	**Rate (In words and figures)**	**Amount (In words and figures)**
1	Solid drawn, seamless, deoxidised, non-arsenical, half hard, tempered and degreased copper pipes--			
	42mm OD X 1.2mm thick	25		
	28mm OD X 0.9mm thick	50		
	22mm OD X 0.9mm thick	100		
	15mm OD X 0.7mm thick	250		
2	**Gas Outlet Points/ Terminal Unit** : Supply,Installation, testing and commissioning of Gas outlet points for Oxygen, Nitrous Oxide, Medical Air 4 Bar , and Vacuum			
	Oxygen	52		
	Nitrous Oxide	8		
	Medical Air 4 Bar	43		

	Vacuum	52		
	Surgical 7 bar	2		
3	**AREA VALVE SERVICE UNITS (AVSU) -Indigenous)**			
	AVSU Module - 4 gas	1		
	AVSU Module - 3 gas	1		
4	**MEDICAL GAS ALARM PANEL** : Supply, Installation, testing and commissioning of Medical Gas Alarm Panel			
	Master Alarm panel 4 services (Oxygen, N2O, MA4 Air , Air and Vacuum)	1		
	Medical Gas Area Alarm for 3 services (Oxygen ,Air and Vacuum)	1		
5	**LINE ISOLATION VALVES -**			
	22 mm ball valve	7		
	15 mm ball valve	4		
6	**Fully Automatic Oxygen Control System** : Supply, Installation testing and commissioning of Fully Automatic Oxygen Control System.	1		
7	**Oxygen Manifold (2x10) -** : Supply, Installation, Testing and Commissioning of Oxygen Manifold. .	1		

8	**Emergency Oxygen Supply System** : Supply, Installation, testing and commissioning of (2x2 size) cylinder Emergency Oxygen Supply System as per technical specifications.	1		
9	**Oxygen Flow meter with Humidifier Bottle** - Supply installation, testing and commissioning of flow meter with humidifier bottle 0-15Litres. As per tender technical specifications	50		
10	**Fully Automatic Manifold Control Panel for Nitrous Oxide**: **:** Supply installation testing and commission of Fully automatic manifold control panel for Nitrous Oxide• As per tender technical specifications	1		
11	**Nitrous Oxide Manifold (2x4) (Indigenous)-**: Supply installation testing and commissioning of nitrous Oxide Manifold . As per tender technical specifications	1		
12	**Emergency Nitrous Oxide Supply System 2x1 size :** Supply installation, testing and commissioning of 1+1 cylinder Emergency Nitrous Oxide supply System as per technical specifications.As per tender technical specifications	1		
13	**Medical Air Plant (Package Unit) with Duplex Air Compressor including electrical control panel** : Supply, Installation, testing and commissioning of Medical Air Plant .As per technical specification	1		
13A	Air Filtration System	2		
13B	Pressure reducing station	2		

14	**Medical Vacuum Plant Package Duplex vacuum pumps:** Supply installation testing and commissining of Medical vacuum plant	1		
15	**Ward Vacuum Unit** : Suply installation testing and commissiong of Ward suction unit .As per Technical specifications.	50		
16	**Portable Vaccum Unit for OT** .As per Technical specifications.	6		
17	Supply installation testing and commissioning of Medical gas hose assemblies Hoses shall be color coded throughout their length as specified in British standards .	25		
18	Supply of O2 cylinders-Class J-	25		
19	Supply of N2O cylinders-Class J-	10		
20	O2 male probe-	50		
21	N20 male probe-	10		
22	MA 4 bar probe	40		
23	Vaccum probe	50		

24	Bed Head Horizontal Wall Panel -	20		
25	Single Movable Pendant for Major OT-	2		
26	Electric wiring inside the gas manifold and plant room (Hospital will provide three phase power cable at one point)	1.00		
	Total			