

**Technical Specifications for OXYGEN SYSTEM, MEDICAL AIR SYSTEM, VACUUM PLANT, Copper pipes, VALVES – LINE VALVES, Area Valve Service Units (AVSU) including area line gas alarm, Horizontal Bed Head Panel, Oxygen flowmeter, Ward Vacuum Unit, Colour coding**

Supply, Installation, Testing, Commissioning of Medical Gas Pipe Line System	
GENERAL INSTRUCTIONS	
1	Bidder shall be responsible for design, supply, installation, testing and commissioning of MGPS System including Oxygen Manifold with automatic change over, Medical Air Plant, Vacuum Plant and installation of pipeline system. Bidder shall be responsible for installation medical gas copper pipeline for Medical Oxygen, Medical Air and Vacuum
2	Hospital will provide electrical supply for Medical Oxygen, Medical and vacuum systems. The wiring and control panel must be done by the bidder.
3	The bidder shall be responsible for the complete works including the submission of working Drawings, and isometric views, detailed work schedule and materials. Bidder shall be responsible for installation and commissioning of medical gas supply system in coordination with Consignee authorities. Bidder shall be responsible for free maintenance of Gas pipeline system, other plants and manifolds during warranty period
4	Oxygen equipment must be separated and fully isolated from the other medical gases. The room must be air conditioned and ventilated.
5	Medical air plant and vacuum plant must be installed in an air conditioned and ventilated room. Exhaust air from the systems must be exhausted to the outside with an exhaust duct or pipe
OXYGEN SYSTEM	
1	Oxygen Manifold
1.1	10+ 10 Size Oxygen Manifold should be configured with 2 x 10 nos. of British standard Jumbo Cylinders and should be suitable to withstand working input pressure of 200 bar, 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 10 nos. of double bend connection (each to connect 2 cylinders) pig tail pipes and 20 nos. of non-return valves.
1.2	Powder coated high-pressure header 5-fold to connect 10 British standard jumbo oxygen cylinders on each side. Main shut-off and ventilation valve, high-pressure copper pipe 14 x 2,5 mm, 5 pcs shut-off valves G 3/4", free of oil and grease Capacity: max 20000 kpa (200 bar) Incoming: gas specific in line with DIN 477 Outlet: G3/4"
1.3	The manifold system should conform to DIN EN ISO 7396-1,
1.4	Should be upgradable to include more cylinder banks.
2	Fully Automatic Oxygen Control Panel
2.1	Micro-processor-controlled gas distribution system two-side cylinder batteries, type in line with DIN EN ISO 7396-1, actual state of system as well as all service information are displayed on LCD-screen, potential free connection and RS 485 interface, sensor pressure control, with pneumatic priority switching at power failure,

	double-stage pressure reduction, second stage twin-designed, with control gauges and emergency supply point (NIST), completely installed on assembly panel, removable housing. Manifold system should be capable of connecting a reserve supply and oxygen generator or a tank.
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". If both banks are empty, the manifold system should change over to the reserve supply automatically.
2.3	Input power: 240 VAC, 50 HZ
2.4	Dual line pressure regulators
2.5	Delivery flow capacity: 100 m <sup>3</sup> /h at 5 +/- 0.5 bar
3	Oxygen Emergency Reserve Manifold - 1 X 4 Manifold
3.1	5-cylinder emergency manifold
3.2	<p>Reducer panel for reserve supply  100m<sup>3</sup>/h, 4bar including pressure sensor.  Input pressure: max. 20000 kPa (200bar)  Capacity: max. 100m<sup>3</sup>/h  Output pressure: 400 kPa (4bar)</p> <p>To reduce the pressure of the 3rd supply source (gas cylinder or bundles) suitable for use in medical supply systems according to DIN EN 737-3  Max. input pressure: 200 bar;  Cylinder output pressure: 4 bar (as reserve supply 1bar less than main supply)  Including main shut-off valve, pressure reducers (1x high pressure, 1 x line pressure), pressure gauge, safety valve and emergency inlet (NIST), completely mounted on an instrument panel.  suitable for: O<sub>2</sub>  Delivery should include  1 x pressure reducer panel  1 x outgoing pipe  2 x pipe for safety valve</p>
4	Cylinder connection
4.1	<p>Distribution bend, double to connect two cylinders with one high-pressure header, with compensation helix and gas type specific hand connection  Gas: oxygen  Capacity: max 20000 kpa (200 bar)  Incoming: British standard G5/8"  Outlet: gas specific connection line with DIN 477</p>
4.2	Cylinder supports for all cylinders complete with hooks and chains
5	Alarm system
5.1	<p>operating alarm unit with power supply and casing  Casing: on plaster / hollow wall  Number of messages: 1-6  Encoder: sensor / contact switch  Messages: O<sub>2</sub> Left empty, O<sub>2</sub> Right empty, O<sub>2</sub> Emergency empty, O<sub>2</sub> Net pressure low, O<sub>2</sub> Net pressure high</p>

II	MEDICAL AIR SYSTEM
1	Dual Medical Air compressor with LCD display, Screw compressor with fail safe mechanisms of changing over from one compressor to the other in case of failure or at specific time intervals
1.1	Capacity: 1.29 M3/min
1.2	Electrical Voltage: 400VAC, 50Hz
1.3	Pressure: 13 bar
1.4	Switch board for Power supply according to ISO 7396-1 including fuses and brakers
1.5	Each compressor should have a zinc coated receiver unit of 750 L vertical unit with tested 16 bar pressures
1.6	Each receiver unit should have pressure gauges and safety valves
1.7	Each receiver unit should have automatic drain valve with fault contact
1.8	Each receiver unit should have desiccant dryer with capacity of 86m3/hr, complete with filtration and air purging control unit
1.9	1 set of bacterial filter unit with the capacity of 150 m3/hr
1.10	All necessary cables as connections must be supplied
1.11	Should conform to DIN EN ISO 2151:2009 and ISO 1217
2	Compressed Air reducer panel
2.1	Reducer panel compressed air for reduction of tank pressure to 5 bar according to DIN 13260 part 1 each pressure reduction step doubled with shut-off valves, contact switch, mounted on an assembly panel Capacity: 300 Nm3/h Gas: compressed air / AIR Pressure: 500 kPa (5 bar) Contact switch: 400 / 600 kPa (4 bar / 6 bar)
3	Alarm unit
3.1	Operating alarm unit with power supply and casing casing: on plaster number of messages: 6 encoders: contact switch messages: air reserve left side empty air reserve right side empty vac plant fault vac plant emergency fault vac net pressure fault
III	VACUUM PLANT
1	Triplex Medical Vacuum pumps
1.1	The medical gas system contractor shall supply, install and commission the vacuum plant and associated equipment. This shall include a packaged triplex 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 standards.
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.
2	Vacuum Pump Units
	The pump installation shall be triplex system consisting of two identical rotary

2.1	vane/Reciprocating/Rotary Screw/Scroll pumps each of which shall be capable of independently producing 100 m <sup>3</sup> /hr. 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 100 m <sup>3</sup> /hr. 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 / in accordance with EN IN 7396-1
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.
2.4	The manufacturer of vacuum pump should be in accordance with EN IN 7396-1
3	Control and Instrumentation
3.1	Digital control unit with LCD screen
3.2	Indication of vacuum level shall be provided for line vacuum and reservoir vacuum
4	Reservoir Vacuum
4.1	A differential pressure indication shall be provided across the filter and drainage trap assemblies. These indications shall be provided by gauges calibrated in mm Hg/psi or bar. The working pressure of gauges shall not exceed 65% of the full-scale range. The triplex 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 all three pumps
4.2	The vacuum plant shall have alarm conditions as input to the alarm system and these shall be as follows: 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 / EN IN 7396-1 standard tested to a minimum pressure of 3 bar
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 / EN IN 7396-1. Reservoir capacity should be of 2x1000 L
5.3	2 bacterial filters shall be fitted before the reservoir from the hospital gas line, 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.
5.3	Secretion jar of minimum 5 liters and must be sterilizable using moist steam at 2.2 bar and 138 degrees 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 Vacuum 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. Antivibration mountings shall be used for the pumps.
IV	Copper pipes
1	Solid drawn, seamless, deoxidized, non-arsenical, half hard, tempered and degreased copper tubes manufactured to metric outside diameters and should have mechanical properties in accordance with HTM2022/HTM 02-01 or EN IN 7396-1
2	Copper Fittings should be as per. HTM 2022/HTM 02-01 / EN IN 7396-1
3	Thickness of pipes
a	54 mm OD X 1.2 mm thick
b	42mm OD X 1.2 mm thick
c	28mm OD x 0.9 mm thick
a	22mm OD x 0.9 mm thick
b	15mm OD x 0.9 mm thick
c	12mm OD x 0.7 mm thick
V	VALVES – LINE VALVES
1	<p>Line Valves shall be provided for use in plant rooms and to facilitate the isolation of areas or areas where area zone valves 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.</p> <p>The valve shall be operated by a manual operating lever by 90° 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 ensure safety to prevent danger from leakage. Line valve installation should be carried out as per HTM 2022/HTM 02-01/ EN IN 7396-1 standards.</p>
VI	Area Valve Service Units (AVSU) including area line gas alarm
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 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 degrees, 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 buildup 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	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.
8	Three Channel Alarm for Oxygen, Air & Vacuum should have the following features:
9	Digital / Analog Display of Line Pressure for all the services with factory calibrated pressure sensors.
10	Color coded LED Display of Line pressure status (High – Caution – Normal – Caution– Low)
11	Audible Alarm for High- & Low-pressure condition.
12	Test and Alarm Acknowledge (Mute) facility.
13	Small and compact design.
14	Mounted on a powder coated MS box.
15	Nut & Nipples should be provided for connection with Pneumatics supply line.
16	Low voltage internal operation for safety with input power supply of 230 V, 50 Hz AC.
17	Wall mounting facility.
18	High / Low indication with Test facility
19	AVSU must be in accordance with DIN EN ISO 7396-1 standards
VII	Horizontal Bed Head Panel
1	It should be made of High Strength Anodized Aluminum Profiles with separate railing for medical gases and separate railings for electrical and other necessary cables
2	Modular design with future expansion possibilities with easily removable front panel with high quality wood / powder coated metal surface
3	The panel should be designed to have provision to accommodate the following:
a	Gas Outlets British Standard - Provision for two Oxygen, two Vacuum and One air outlets
b	Electrical Sockets / Switches-at least 6 nos. with individual switches
c	Data Socket-RJ 45-02 nos.

d	Should be supplied with Nurse call switch mounting option.
e	Should be supplied with clamp for mounting ward vacuum unit.
f	Should be supplied with ISO rail
g	Should be supplied with rail mounted examination light (LED)
VIII	Oxygen flowmeter
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 <sup>0</sup> Centigrade temperature
8	Should be supplied with British standard oxygen probe
IX	Ward Vacuum Unit
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 polysulfone material and fully autoclavable at 134 degrees centigrade.
4	A wall bracket for mounting the jar assembly near the bedside
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 British standard vacuum probe
X	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