FIRE PROTECTION SYSTEM

1.1 Hose Reels

1.1.1 Recess Hose reels approved to BS EN 671-1: 1995, or any other equable International Standard, Automatic operation, Right or Left hand take off. Including 30m length of Hose, 19mm diameter hose approved to PR EN 694, or any other equable international standard, and nylon twist operated jet / spray nozzle on mounting plate with integral flexi guide for hose withdrawal device. 03 or 04 fixing holes should be provided in position indicated to suit M8/M10 sized fixing screws or M12 fixing bolts. With ball valve inlet and flexible inlet water pipe.

1.1.2 The overall width of the reel should be no more than 850mm. The overall height of the reel should be less than 850mm including Hose and integral Flexi guide for hose withdrawal guide. The overall depth of the reel should no more than 150mm. Color of the reel should be red, fitted with operating instruction plate.

1.1.3 The Hose Reels and the related equipment's should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken for the size of the Hose reels.

The Hose Reels nozzle retainer or hose guide and inlet valve should be fitted at height of about 900mm above floor level.

1.2 Hose Reel Cabinets.

1.2.1 The hose reel should be recess mounting type with or without glass paneled door for use with the above mentioned sized Hose Reels. Hose Reel Cabinet dimension should be no more than 900mm in width, 900mm in height, 300mm in depth (including door).

1.2.2 Color of the cabinet should be Red. Special permission should be taken for other color.

1.2.3 Recessed latch type handle should be installed. Hose reel signage should be in accordance to BS 5499 or any other equable international Standard. Fixing hole should be provided.

1.2.4 The Hose Reel cabinets should be approved by the NSS fire and Rescue Service before Installation.

Water Supply for Hose Reel System.

1.3.1 As a minimum, the water supply to the hose reel should be such that when the two far most reels in the premises are in use simultaneously, each should provide a jet of approximately 6m in length and will deliver not less then 0.5litre/s (30 litre/min).

1.3.1.1 Minimum Quantity of water storage required for hose reel system only.

1.3.1.2 Minimum storage required for the first hose reel; 2275litre.

1.3.1.3 For each additional hose reel; 1137.5litre to a maximum of 9100litre

1.2.5 Tank or inter-connected tanks supplying water for the hose reel should be automatically supplied from the fresh water main(s) controlled by ball valve of a minimum diameter 50mm. Rain water collected from roof can also be stored.

1.2.6 Tanks supplying water for domestic purposes should not be used as suction tanks for hose reel installation unless arrangement have been made these domestic supplies to be drawn off in such a manner that the reserve of water for the hose reel installation is always preserved.

1.2.7 The piping details of the supply o f water for the hose reel system and the water supply system should be approved by the NSS fire and Rescue Service before Installation.

1.2.8 Special permission should be taken if it is different from the above.

1.4 Hose Reel Booster Pump system.

1.4.1 Hose Reel booster pump set, complete with In and Out galvanized steel pipe work with or without expansion vessel.

1.4.1.1 Where the water pressure in the hose reel mains needs to be boosted, the provision of an electrically driven pump is usually a convenient method. A duplicate standby pump should be always provided.

1.4.4.2 Both motors and pump should be sited in fire-protected position and the electrical supply to them should be an Exclusive Circuit with the cables following a route of negligible fire risk or be provided with adequate protection.

1.4.4.3 The booster pumps systems should come into operation automatically on a drop in pressure or a flow of water. Both pumps should be automatically primed at all times.

1.4.4.4 All pumps should also be capable of being started or stopped manually. The standby pumps should be so arranged that it would operate automatically on a failure for any reason of the duty pump.

1.4.2 The Hose Reel Booster Pump set should be approved by the NSS Fire and Rescue Service before installation.

1.4.3 Special permission should be taken if it is different from above.

2.1 Fire Extinguishers.

2.1.1 2Kg Co2 stored pressure Extinguisher approved to BS En 3. Aluminium alloy Body approved to BS5045 Part 3 or any other equable International Standard. Red Body with black band or black colored head cap, swivel Horn, English screen. Fully charged.

2.1.2 The Extinguisher Should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken if it is different from above.

2.1.3 9 liter Water Extinguisher (Gal Cartridge Type) approved to BS EN 3 or any other equable International Standard. Red body head cap. English screen, fully charged.

2.1.4 The Fire Extinguisher should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken if it is different from the above.

2.1.5 Fire Extinguishers should be located in conspicuous positions on bracket or stands where they will be readily seen by person. The carrying handle of larger heavier extinguishers should be about 01m from the floor level. But smaller Extinguisher should be mounted so as to position the handle 1.5m from the floor level. Extinguisher installing on the cabinet the height should be approved by NSS Fire and Rescue Service.

2.2. Cabinet for the Extinguishers.

2.2.1 Cabinets for the Extinguishers should be of stainless steel with or without glass-fronted doors. Color of the cabinet Red or to suit the requirements of architectural surroundings. Recessed Latch Type handle should be installed.

2.2.1.1 Fire Extinguisher Single Cabinets dimension should be no more than 190mm in width, 640mm in height, 180mm in depth (including door),

2.2.1.2 Fire Extinguisher Double Cabinets dimension should no more than 440mm in width, 640mm in height, 180mm in depth (including door).

2.2.2 The cabinets for the Fire Extinguisher should be approved by the NSS fire Rescue Service before installation. Special permission should be taken if different from above.

3.1 Fire Doors

3.1.1 All fire doors should be opened to the direction of the flow of the people while in emergency.

3.1.2 These doors should be installed with self-closing device including the panic latch. These panic Latch devices should conform to BS 5725 Pt 1 or any other equable international standard.

3.1.3 Fire doors conforming to the method of construction as stipulated below shall be deemed to meet the requirements of the fire-resisting period.

3.1.3.1 Doors frames constructed in accordance with one of the following specification should be deemed to satisfy the requirements for doors having fire resisting period of half-hour (30min).

3.1.3.2 A single door 900 millimeters wide x 2100 millimeters high maximum or double doors1800 millimeters high maximum construction of solid hardwood core of not less than 37 millimeters laminated with adhesives conforming to either BS 745 “Aminal Glues”, or BS 1204, “Synthetic resin adhesives (phenolic and aminoplastic) for wood” Part 1, “Gap-filling adhesives” or BS 1444 “Cold – setting casein glue for wood”, or any other equable International Standard, faced both sides with plywood to a total thickness of not less than 43mm with all edges finished with a solid edge strip full width of the door. The meeting stiles of double doors shall be rabbeted 12mm deep or maybe butted provided the clearance is kept to a minimum.

3.1.3.3 Doors may be double swing provided they are mounted on hydraulic floor springs and clearance at floor not exceeding 4.77mm and frame and meeting stiles not exceeding 3mm;

3.1.3.4 A vision panel should be incorporated provided it does not exceed 0.065 square meter per leaf with no dimension more than 1370mm and should be glazed with 6mm Georgian wired glass in hardwood stops;

3.1.3.5 Doors constructed in accordance with BS459 part 3 : 1951 or any other equable International Standard fire check flush doors and wood and metal frames (half hour type);

3.1.3.6 Timber frames for single swing half hour fire doors of overall width of 60mm including 25mm rabbet and depth to suit door thickness plus 34mm stop;

3.1.3.7 Metal frames half hour fire doors shall be of sheet steel not lighter than 18 gauge of overall width 50mm including 18mm rabbet and depth to suit the door thickness plus 53mm stop;

3.1.3.8 Timber or metal frames for double swing doors should be as specified above with minimum clearances between frame and door;

3.1.3.9 Double doors with rabbeted meeting stiles should be provided with co-coordinating device to ensure that leafs close in the proper sequence;

3.1.3.10 Fire doors may held open provided the hold open device incorporated a heat activated device to release the door. Heat activated devices shall no be permitted on fire doors protection openings to protected corridors or protected staircase.

3.1.4 The Fire doors and its related devise should be approved by NSS fire and rescue Service before Installation.

3.1.5 Special permission should be taken if it is different from above.

4.1 Fire Exit Signs

4.1.1 Photo luminescent Fire exit signs should sign each fire Exit door. The Symbol height should be not more than 100mm.

4.1.2 The fire Exit should be approves by the NSS fire and Rescue Service before Installation.

4.1.3 Special Permission should be taken if it is different from above.

5.1 Fire Detection and Alarm System.

5.1.1 Fire detection and Alarm system should confirm to BS 5839 or any other equable international Standard. Fire Detection and alarm system should be analogue Addressable System with mimic diagram. A system in which signals from each detector and/or call point are individually identified at the control panel. Fire Detection and alarm system should consist of Automatic Detectors, Manual Call Points, Control and indicating equipment, etc. It should also covers System capable of providing signals to initiate, in event of fire, the operation of ancillary services such as fixed fire extinguishing systems and other precautions and actions. Main Fire Control Panel should be located at easy access point.

5.1.1.1 Red Xenon Beacon should be weather resistant IP65 rate Xenon.

5.1.1.2 24 Tone Wall Sounder Compact should confirm BS 5839 Pt. 1 or any other equable international standard.

5.1.1.3 Wiring for detectors should be Fire Resistant Cable.

5.1.1.4 Heat Detectors should comply with BS5445 or any other equable International Standard.

5.1.2 The Fire Detections and Alarm System and all related equipment's should be approved by NSS fire and Rescue Service before Installation including all the relevant equipments.

5.1.3 Wiring details and the positioning of detectors, Call points, etc. for Fire Detection and alarm system should be approved by the NSS Fire and Rescue Service before Installation.

5.1.4 Special permission should be taken if it is different from above.

AC Specification & Installation Criteria for Hospitals, Ward Areas and other areas.

1 Installation Criteria

- Installation party should have at least Minimum experience of completing 2 Fresh Air Hospital Air condition Projects in Maldives over the past 5 years.
- Basic AC shop drawing should be provided with the following details
    - AC unit Location and sizes
    - Ducting Sizes and Locations
    - Grill Sizes and Locations
    - Pipeline Location and Sizes
- Upon Completion AC As build drawing should be provided

2 General AC Specification

- The brand of AC Equipment specified or to be proposed should have minimum 2 Fresh air or Hospital Air-condition Projects completed and delivered over the past 5 years in Maldives
- The Brand of AC Equipment specified or to be proposed should demonstrate that it is adequate to cater for highly corrosive environment of Maldives and should have 5 years of past projects completed
- The brand or AC Equipment specified should demonstrate all specs below from manufacturers original catalogue

3 Outdoor Specs

The Outdoor Unit Shall be Factory assembled with Weather Proof casing, constructed from Heavy Gauge Mild Steel Panels and coated with Anti Corrosive Epoxy resin finish. The unit should be completely factory wired and tested and shall be fitted with all necessary controls and switch gear.

- All outdoor units need to be VRV or Central systems which have the capacity to control & operate multiple indoor units
- The Condenser Coil of the Outdoor must be a black fin Condenser with anti-corrosion
- The brand of AC Equipment proposed should have an outdoor or outdoor sets with a maximum Energy Efficiency Ratio of (EER) kw/kw 4.5
- The brand of AC Equipment proposed should have Outdoor Environment sensor for Compressor Control and adjustment
- The Brand of AC Equipment proposed should have an outdoor or outdoor sets of Sound Pressure Level dB (A) below 60
- All Outdoor units shall be with inverter compressors and be able to operate even in the event of failure of one compressor

- All outdoor units need to have aluminium fins with 105+2 µm thickness, with special Anti-corrosive coating of 1.3 ± 0. 35 µm thickness and an outside Hydrophilic layer coating of 0.35 ± 0. 07 µm thickness.
- All outdoor units shall be equipped with high efficiency optimized heat exchangers with variable heat exchanger circuits
- The outdoor units shall be provided with its own microprocessor control panels
- The manufacturer needs to provide a warranty of 18 months replacement for the outdoor units

4 Indoor Specs

The indoor units shall be

4.1 In General:

a. Ceiling Concealed Duct Systems for all General Wards, Operation Theatres & ICU's
b. Ceiling Concealed Fresh Air Systems for all General Wards, Operation Theatres & ICU's
c. Ceiling Cassette System for General Areas, Corridors, Consultation rooms

4.2 Ceiling Concealed Duct System & Fresh Air System

- The address of the indoor unit shall be set automatically in case of individual and group control
- In case of centralized control, it shall be set by liquid crystal remote controller
- The fan shall be a dual suction, aerodynamically designed turbo, multi blade centrifugal type fan which shall be statically & dynamically balanced to ensure low noise and vibration free operation. The fan shall be direct driven, mounted directly on motor shaft having support from the unit housing.
- The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The tubes shall be staggered in the direction of airflow and shall be hydraulically/ mechanically expanded to bond to the fins. Each coil shall be factory tested at 21kg/sqm air pressure under water.
- Each unit shall have a cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be a slide out type and shall be neatly inserted.
- All AC duct systems must have an H14 Hepa filters attached with 99.99% efficiency on Supply & Return Duct as well
- The capacity of Indoor unit have to be calculated as per the volume of the occupied space and should have Air exchange of the Minimum apart from operation theatres
    - 9 – 12 air changes per hour from the AC system
    - 2 -3 air changes per hour of Outside Air (Via Fresh Air System)
- For operation Theatres the Air Exchange Guideline should be
    - 25 air changes per hour from the AC system
    - 5 air changes per hour from Outside Air (Via Fresh Air System)
- Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling .
- Each unit shall be provided with a hand held multi-function remote controller. The controller shall be able to change fan speed and angle of swing, temperature and mode.
- Each Unit shall have service Ball valves for After sale service and future Isolation of FCU

5 Ducting & Ventilation System

- All Conceal Duct Indoor System shall be connected to a Duct Ventilation system which shall be designed to provide the most appropriate air flow for designed Air-condition areas
- The Duct System shall be made with Pre-Insulated Panels with the below specs
    - Panel Thickness: 20 – 30mm
    - Foam Density: 45-48kg/m3
    - Aluminium thickness: 80/80m
    - Alimunium Type: Embossed
    - The Boards should be Anti-Bacterial, Anti Fungus & Fire Restiant
- All supplier & Return Diffusers shall be
    - The Supply and return air diffusers/grills shall be made of extruded aluminum section with flush fixed pattern
    - White Powder Coated RAL9010 or 9016 standard
    - Supply Diffusers shall be with opposed Blade Volume dampers
    - Thickness of frame should not be less than 1.2mm. The core of the diffuser is 0.9mm thick pressed aluminum.
- All ducts shall be installed generally as per the drawings and in strict accordance with approved shop drawings to be prepared by the Contractor.

- The Contractor shall provide and neatly erect all PID Sheet work as may be required to carry out the intent, of these specifications and drawings. The work shall meet with the approval of Owner's site representative in all its parts and details.

- All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and/ or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained, all as per the site requirements.

6 Refrigerant Piping

All refrigerant piping for the air conditioning system shall be constructed from Hard seamless copper up to outer diameter of 41.3 mm and hard drawn copper above outer diameter of41.3 mm. Fittings shall have silver-soldered joints and connections to equipment shall us compression fittings. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and shall to include charging connections, suction and liquid line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be swag joints using low temperature brazing and or silver solder. Before joining any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.
After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 580 PSIG. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated

to minimum vacuum of 700mm hg and held for 24 hours.

The thickness of copper piping shall not be less than mentioned below as per Standard ASTM B280-03:

Pipe Size in mm(OD)	Minimum Wall Thickness in mm
a) 41.3	1.52
b) 38.1	1.52
c) 34.9	1.40
d) 31.8	1.40
e) 28.6	1.27
f) 25.4	1.27
g) 22.2	1.14
h) 19.1	1.07
i) 15.9	1.02
j) 12.7	0.81
k) 9.5	0.81
l) 6.4	0.76

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, Cable tray, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

7 Refrigerant Pipe Insulation

The whole of the liquid and suction refrigerant lines including all fittings, valves etc. shall be insulated with 25mm thick insulation for all copper sizes. Insulation shall be closed cell elastomeric nitrile rubber.

a. Protection of exposedRefrigerant Pipe Insulation

To protect nitrile rubber of exposed piping from degrading due ultra violet rays & atmospheric conditions, it shall be covered polychelid coating with at least two coats of resin and hardener (Make-Polybond /Paramount Polytreat). Fiberglass tape shall be helically wound & painted with two coats of resin with hardener to give smooth & plain finish.

Technical Specifications

Solar Panels

- Panel Wattage: Minimum of 550W or higher
- Panel Type: Monocrystalline
- Minimum Cell Efficiency: At least 22.5%

Grid-Tied Inverter

- Inverter capacity as per the requirements allocated in the island.
- Rated Voltage: 400V
- Frequency: 50Hz
- Communication: Wi-Fi or Ethernet

Material Characteristics and Standards

All materials provided must comply with international standards for photovoltaic systems. The equipment should adhere to the latest editions of the following codes, standards, and regulations (or their equivalents):

1. Maldives Energy Authority Codes and Regulations.
2. IEC 61730; IEC 61730-1:2004 and IEC 61730-2:2004 – Safety qualifications for photovoltaic modules.
3. IEC 61215 and IEC 61646; IEC 61215:1993 and IEC 61215:2005 – Design qualification and type approval for crystalline silicon PV modules.
4. IEC 60364-7-712 – Electrical installations for buildings, focusing on solar PV systems.
5. IEC 61727 – Specifications for utility interaction of PV systems.
6. IEC 61683 – Efficiency measurement procedures for photovoltaic systems.
7. IEC 62446 – Documentation, testing, and inspection requirements for grid-connected PV systems.

Scope of Supply

1. **Documentation post-completion:**
   Upon project completion, the following documents must be provided:

   - **System Information:**

     1. General system details.
     2. Single-line power connection diagram.
     3. Installation layout.
     4. PV module specifications.
     5. Datasheets and manuals for inverters.
     6. Relevant authority-approved documents.

   - **Testing and Commissioning Results:**

     1. Technical screening report.
     2. Inverter protection settings (e.g., voltage and frequency thresholds).
     3. Electrical single-line diagrams.
     4. Inspection reports.
     5. PV array test data.
     6. Certification of verification.

   - **Operation & Maintenance:**

     1. System operation verification procedure.
     2. Troubleshooting guide for system failures.
     3. Shutdown and startup procedures.
     4. Maintenance and cleaning instructions.

Quality Assurance

The contractor must implement a quality system that aligns with current British Standards 5750 Part 1 or comparable international standards.

Major Equipment Requirements

1. **Photovoltaic Modules:**
    - Must meet the latest IEC standards or equivalent BIS standards for PV qualification and safety.
    - Modules must conform to IEC 61215, IEC 61701, and IEC 61730 Part I & II.
    - Monocrystalline modules with aluminum frames and durable face covers.
    - Tested and packaged to withstand shipping without damage.
    - PV modules shall be PID resistant
    - PV modules shall be guarantee 30 years power performance with not more than 1% power degradation in first year and 0.4% annual power attenuation
    - PV modules shall be guarantee 12 years against any kind of production defect.
    - PV module brands must be from reputable and renowned manufacturers.
2. **Grid-Tied Inverter:**
    - High-efficiency inverters (minimum 98%) with a built-in DC isolation switch and surge protection.
    - Capable of remote monitoring via the internet.
    - The inverters shall have an inbuilt DC isolation switch.
    - The inverters shall have surge protection.
    - IP65 rated for outdoor use.
    - Utilizes natural cooling technology.
    - **Accepted Brands:**
        - ABB
        - Huawei
        - Fronius
        - SMA Solar Technology AG
        - Sungrow
    - Warranty: Minimum of 10 years.

3. **Combiner Box:**
    - IP65-rated distribution boards and combiner boxes adhering to IEC 62271.
    - Properly mounted with durable materials resistant to environmental conditions.

4. **Earthing System:**
    - A complete and reliable earthing system designed for the PV installation.

5. **Mounting Structures:**
    - Anodized Aluminum or corrosion-resistant materials.
    - Designed to withstand wind speeds of at least 60 km/h.
    - Guaranteed stability for 12 years in harsh environments.

6. **Cables:**
    - All DC cables must be tinned copper, corrosion-resistant, chemical-resistant, and UV-resistant.
    - All cables should be enclosed in conduits or cable trays.
    - All AC cables must be copper with UV protection.
    - All the cables must be power rated.

Warranty Requirements

- The warranty for key components must meet or exceed the following minimum standards:
    - **PV Modules:** 12 years against defects and 20 years with 91% efficiency with 30 years performance warranty.
    - **Inverters:** 10 years.
    - **Mounting Structures:** 12 years.
- The contractor is responsible for all regulatory and service documentation required for permits, net metering, and grid connection. Relevant signatures from the client will be provided, but the contractor must handle all other formalities.

To meet evaluation standards, the proposal should clearly outline:

- Manufacturer warranties for PV panels and inverters.
- Service warranties for the installed PV system.

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
I	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 pressureof 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 10cylinder 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 failurethe 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 m3/h at 5 +/- 0.5 bar
3	Oxygen Emergency Reserve Manifold - 1 X 4 Manifold
3.1	5-cylinder emergency manifold
3.2	Reducer panel for reserve supply 100m3/h, 4bar including pressure sensor. Input pressure: max. 20000 kPa (200bar) Capacity: max. 100m3/h Output pressure: 400 kPa (4bar) 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: O2 Delivery should include 1 x pressure reducer panel 1 x outgoing pipe 2 x pipe for safety valve
4	Cylinder connection
4.1	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
4.2	Cylinder supports for all cylinders complete with hooks and chains
5	Alarm system
5.1	operating alarm unit with power supply and casing Casing: on plaster / hollow wall Number of messages: 1-6 Encoder: sensor / contact switch Messages: O2 Left empty, O2 Right empty, O2 Emergency empty, O2 Net pressure low, O2 Net pressure high

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 filer 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 shallinclude 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 avacuum 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 m3/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 m3/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 02-01recommendations / in accordance with EN IN 7396-1
2.3	Each pump shall have a built-in non-return valve and pressure switchsuch 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 capableof 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 alarmsystem 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 mut 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	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. 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 shallbe cleaned for oxygen service and fully tested. The valve assembly shall terminate in copper stub pipes to enable brazing directly into thedistribution 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 7396-1standards.
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 aquarter 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 installedadjacent to each other shall be operated by different key lock combinations.
5	The area zone valve assembly shall provide for natural ventilation toprevent 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 asingle 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 alarmshould 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 thefollowing features:
9	Digital / Analog Display of Line Pressure for all the services withfactory 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 Pneumaticsupply line.
16	Low voltage internal operation for safety with input power supply of230 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 Profileswith 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 thefollowing:
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 flowmeasurement 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 foreignparticles.
7	The humidifier bottle should be made of unbreakable polycarbonatematerial and autoclavable at 121^{O} 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 degreescentigrade.
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 providedinside 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 syntheticenamel 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