

# **PVMS OF HOSPITAL ALLIED SERVICES AND MACHINERY**

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<b>PVMS OF MEDICAL EQUIPMENT</b>	
Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>CENTRAL STERILE SUPPLY DEPARTMENT (CSSD)</b>
Clinical Purpose	To establish and maintain sterile processing and distribution standards and to provide supplies of sterile linen packs, basin, instruments and other sterile items.

### **TECHNICAL SPECIFICATIONS**

The specifications of all equipment of CSSD are defined as below. The quantities to be defined by the respective hospital as per its requirement.

#### **1. CLEANING & WASHING UNIT**

- Cleaning & washing unit, Approx. 2000 x 700 x 900 mm (WxDxH) , consisting of Stainless Steel square meter Table Top 50 mm backsplash ,made of Ni-chrome steel/SS sheet.
- 02 Nos. Sinks each approx. 500x500x250 mm made of stainless steel with the provision of counter top; equipped with drain valve and stand pipe and with siphon trap.
- Substructure cabinets with shelf. Cabinet is in-chrome steel/SS design.
- 02 Nos. of integrated Spray Guns for dematerialized water/ air with 08 cleaning nozzles, hose, table lead through
- Space to hose the 02-ultrasonic cleaners.

#### **2. WASHING /DISINFECTION / DRYING UNIT**

- Microprocessor controlled automatic powered vertical down sliding two glass doors type. Washing chamber, washing arms, preheating tanks and water filters made of high quality stainless steel AISI 316 L., Light inside of chamber, Frame made of stainless steel AISI 304.
- Touch screen/panel display on loading and display on unloading side with integrated printer. External steam heated for Automatic rinsing, washing, disinfecting and drying including integrated electric element as backup heating. Capable of washing internal and external surface of items such as instruments, glassware, tubing, syringes, hollow wares etc. Stainless Steel construction. Floor model chamber size 15-18 DIN basket Capacity. 2 dosing pumps of chemical products complete with flow meters and sensor. 10 standard pre-set cycle programs, 5 service programs and Fast/short cycle disinfection program (around 30 min).
- The unit should be complete with baskets, trays, and stands for washing /disinfection of the items mentioned above. The unit should have complete exhaust air condenser for outgoing air with condensate drain. Operation 380-400V.

##### **2.a ACCESSORIES.**

- 1xA.N Wash Cart including tubes-7sets
- 3xOP Cart for 36/45 trays of instruments
- MIS/Lap instruments cart
- 30xInstrument trays for OP Cart
- 1xRack for 25 shoes
- 1xWash cart for Instrument containers
- 2x Transfer trolleys for cart.

### **HEAVY DUTY STEAM STERILIZER**

- High pressure Steam Sterilizer each with external steam supply as primary source with integrated steam generator as backup.
- Fully automatic, programmable, microprocessor type. Touch screen colored display and integrated printer. Automatic motorized/pneumatic two doors pass through system. Time cycled, working pressure 32 psi. Safety interlock. Temperature & Pressure recorder. Chamber pressure indicator. Cycle indicator to determine the phase of sterilization cycle. Program/Cycle selection.
- Complete with standard accessories and removable shelves, capable of taking both packets and containers of all standard sizes. Chamber capacity 12 STU, rectangular shape. Chamber, jacket and doors made of AISI 316 L/Ti. The system complete with built-in water saving system, automatic heat exchanger and Air detector. Two loading / unloading trolleys and two loading carts compatible with system.
- The unit must be according to the standards of CE/FDA in compliance with particular MDD.
- UPS of suitable capacity with minimum 15 minutes for Controller cum display for monitoring and controlling of parameters during power shedding provided/ installed by the manufacturer.

### **MEDIUM STEAM STERILIZER**

- High pressure Steam Sterilizer each with external steam supply as primary source with integrated steam generator as backup.
- Fully automatic, programmable, microprocessor type. Touchscreen colored display and integrated printer. Automatic motorized/pneumatic two doors pass through system. Time cycled, working pressure 32 psi. Safety interlock. Temperature & Pressure recorder. Chamber pressure indicator. Cycle indicator to determine the phase of sterilization cycle. Program/Cycle selection.
- Complete with standard accessories and removable shelves, capable of taking both packets and containers of all standard sizes. Chamber capacity 04 STU, rectangular shape. Chamber, jacket and doors made of AISI 316 L/Ti. The system complete with built-in water saving system, automatic heat exchanger and Air detector. Two loading / unloading trolleys and one loading carts compatible with system.
- The unit must be according to the standards of CE/FDA in compliance with particular MDD.
- UPS of suitable capacity with minimum 15 minutes for Controller cum display for monitoring and controlling of parameters during power shedding provided/ installed by the manufacturer.

### **REVERSE OSMOSIS SYSTEM**

RO system should be compatible with the CSSD equipment requirement and in accordance with the quality of the local water where it is being installed. It should have imported parts that may be locally assembled.

ETHYLENE-OXIDE (EO)H<sub>2</sub>O<sub>2</sub> gas sterilizer.

Ethylene-Oxide (EO) gas sterilizer. Single door. Temperature and pressure recorder.

Complete with baskets and cartridges/Cylinders for at least 250 cycles. Chamber capacity 100-150 liters minimum the unit should be complete with aeration system and should include all safety interlock, complete with built-in safety feature according to international accepted standards.

Note: IO to specify to purchase ETO or plasma sterilizer  
Plasma Sterilizer

Chamber capacity : 110 liter or higher

Microprocessor controlled. Chamber should be made of AISI 316L / TI

System should have integrated thermal printer and compatible UPS, Complete with baskets, the unit should include all safety interlock, complete with built-in safety feature according to international accepted standards

### **TABLE TOP STERILIZER**

Chamber Volume: 19 Liters or better

Microprocessor Controlled with digital display unit Class-B type sterilizer

Different type of programs Temperature range 134oC

Temperature and pressure recorder and printer

The unit must be according to the standards of CE/FDA in compliance with particular MDD.

### **OIL FREE AIR COMPRESSOR**

Compressor oil free, Noiseless, single stage, two cylinders with electric motor, pressure 8-10 bar, Capacity 175 Liter. OR as per same manufacturer recommendations.

### **ULTRASONIC CLEANER**

Ultrasonic cleaner integrated type, cleaning chamber constructed of corrosive resistant 304 SS. Heating thermostatically controlled. Digital display of time and temperature.

Tank Capacity 21-25 Ltr. System complete with basket, lid and other standard accessories. Operation 220V, 50 Hz.

### **TRANSPORT AND DISTRIBUTION TROLLEY**

Distribution trolley, 03 shelves made of stainless steel, size 700x500x800mm. (WxDxH)

### **PAPER DISPENSING TROLLEY**

Movable paper dispenser trolley made of stainless steel for storing of sterilization paper sheets at packing tables. 04 frames for paper sheet of 1200mm and one bottom shelf.

Mobile with two lockable wheels.

### **PAPER SEALING MACHINE**

Microprocessor controlled automatic heat sealer for sterilization bags and pouches. Stainless steel body with printing mechanism. Adjustable temperature up to 2000 C, Speed approx 10m/min.

### **CUTTING DEVICE**

For storage and preparation of paper/Plastic bags in rolls. The cutting knife is made of tempered stainless steel and is self grinding, Size 700-1000mm.

**TAPE DISPENSER**

Tape dispenser for autoclave tape. Main parts of the dispenser are made of metal. Design for two roll of tape.

**BASKET TROLLEY**

Basket Trolley made of stainless steel for storage/transport of baskets. Size approx 600x1500x450mm.

**FREE STANDING BASKETS RACK**

Free standing basket storage rack 04 single sections. Size approx 1500x400x1800mm.

**PACKING TABLE**

Table top of Stainless Steel with one or two drawers, Stand of stainless steel including two top mounted shelves and Illuminated Magnifier. Dimensions approx. 1600 X 800 X 800 mm.

**LINEN TABLE**

Inspection and folding for linen, the table top will be made of Stainless Steel top with inspection window. The frame is made of stainless steel. Approx. Dimensions (1600 X 800 X 900 mm).

**MODULAR WIRE BASKET**

Modular wire Basket made of stainless steel for disinfections, loading/unloading equipment, Sterilizers as well as storage racks and distribution trolley. Pile able when loaded /stackable. Compatible with Instruments/utensils of the system. Size approx (580 X 390 X190 mm) acceptable up to the tolerance of +10% in size.

**CLOSED TRANSPORT TROLLEY**

Closed transport trolley made of stainless steel, lockable, Front wheels with directional locks and back wheels with brakes. Size approx (900 X 650 X 1250 mm)/ 6 STU.

**SPECIAL TERMS & CONDITIONS OF THE PROJECT:**

1. The bidders are required to submit the complete drawing of this turnkey project.
2. The bids with drawing marked with piping routes, panels and other equipment by the manufacturer will determine the completeness of the bid.
3. The installation will be checked and certify by the manufacturer with the effect that the system is as per their design standard and protocols.
4. For CSSD installation; copper/ SS pipes will be used as per standards. The complete flooring of CSSD with PU anti-bacterial sheet, ceramic tiles on walls, dumpa false ceiling will be installed. The partitioning will be made with 2mm Aluminum sheet. Floor cleaning/ polishing machine will be the part of furnishing. Thermo disinfect able shoes sizes 39/40/41/42 (150 pairs).

5. The furnishing of all rooms including changing, sorting, sitting, waiting etc will also be done along with chairs and tables etc.
6. Computer, Printer, UPS along with table/chair will be provided for recordkeeping.
7. The firm will certify that complete system will be installed in professional manners in compliance with engineering norms and standards for such systems in a turn-key manner. The piping and auxiliary materials will be A1class.

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>ULTRASONIC AUTO DISINFECTOR</b>
Clinical Purpose	Instrument disinfection
<p><b>TECHNICAL SPECIFICATIONS</b>  Unit should have integrated pulsation waveform system Ultrasonic power 400 watt or above  Integrated heating device Temperature up to 90 ° C Volume 20 liters or More</p>	

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>ELECTRONIC AUTOCLAVE</b>
Clinical Purpose	Sterilization
<p><b>TECHNICAL SPECIFICATIONS</b>  Steam Sterilizer Automatic. Capacity 1 STU  Usable Sterilization pressure more than 1.0 kg / cm<sup>2</sup> 134 Deg. C.  Stainless steel chamber, Pressure and temperature indicator/gauge/ electronic With stainless steel wire baskets, bottom container, rubber hose, electric cord, and silicone rubber lining.</p>	

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>MEDICAL LAUNDRY PLANT</b>
Clinical Purpose	For the washing purpose of Hospital dirty linen
<p><b>TECHNICAL SPECIFICATIONS</b>  <b>WASHER EXTRACTOR</b>  The Washer Extractor shall be steam heating free standing type, fully automatic with front loading/unloading. Fully programmable, microprocessor control. Stainless steel in all vital parts for high degree of rust protection, Stainless steel front panels and powder painted side panels. Liquid connections/ power compartment.  Technical specifications:</p> <ul style="list-style-type: none"> <li>• Capacity/Load: 55-65 Kg./ 90-100 Kg (The procuring agency will specify)</li> <li>• Drum Volume: 600 Lit.</li> <li>• Extraction : 770-800 rpm (Approx)</li> <li>• Pneumatic/ electronic drain valve</li> <li>• Cycle Time: Max. 45-60 min.</li> </ul>	

- Frequency controlled motor
- Oil lubrication of bearing gaskets

## **2. WASHER EXTRACTOR HYGIENE**

The Washer Extractor shall be steam heating free standing type, fully automatic with front/back loading/unloading. Fully programmable, microprocessor control. Stainless steel in all vital parts for high degree of rust protection, Stainless steel front panels and powder painted side panels, Multi liquid supply connections/ powder compartment.

Technical specifications:

- Capacity/Load: 30-35 Kg.
- Extraction : 800 rpm (Approx)
- Pneumatic drain valve
- Cycle Time: Max. 45-60 min.
- Frequency controlled motor
- Oil lubrication of bearing gaskets
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## **3. DRYING TUMBLER**

Drying Tumbler with steam heating, fully automatic Microprocessor control having stainless steel drum and 2 full loads per hour. Error codes for easy trouble shooting. Service program for adjustment of parameters, temperature and cool down time. The tumbler to be factory painted with enameled paint and shall have the following specifications:

- Capacity of drying tumbler: 30-40 Kg.
- Drum Volume: 650 Lit.
- Cycle Time: 30-40 min. including loading & unloading

## **4. FLAT WORK DRYER IRONER**

Flat Work Dryer Ironer shall be steam heated, cylindrical type having single roller/cylinder. Automatic speed adjustment. Finger guard protection, Nickel-plated cylinder, Front loading and Front return and shall have following minimum specifications:

- Speed: 1-8 m/ min (variable speed)
- Drive: Electrical Motor
- Feeding: Through Belts
- Cylinder Dia: 450 - 500 mm Approximately
- Working Width: 2500 - 3000 mm Approximately
- The Dryer Ironer to be a compact free standing self-contained unit and to be supplied in factory assembled state.

## **UTILITY PRESS**

Air operated laundry press adjustable squeezing pressure between head and buck.

- Steam heating
- Integrated/ separate air compressor
- Fitted with timer and two hand push buttons

- Water spray gun, condenser and support

## **HAND IRON (STEAM OPERATED) WITH IRONING TABLE**

Steam heated iron, with mechanical steam valve, steam and return pipes with support,



pipes connections set, with cut off valve and thermodynamic trap, iron rest

#### SEWING MACHINE

Motorized, Heavy duty with sewing machine table

#### PACKING/SORTING TABLE

The main structure is completely built with tubular profiles in Stainless Steel AISI 304, settled among them with TIG procedure, with plain in plate strengthened and supported in the underlying part.

With 4 plastic feet in the corners.

Dimensions: Length: 1400 mm, Width: 800 mm, Height: 900 mm

#### DIRTY LINEN COLLECTION TROLLEYS

Made with Aluminium.

Completely closed With upper lid and double front door Upper rim reinforced with light alloy aluminium sections. Walls completely smooth.

Lower bumper made of light alloy and covered with grey anti-track PVC. Water tap 1" ¼ with central run down, with pedal opening command.

Handle fixed on the wall with swivel wheels. Dim.: 1090 x 690 x 1530 h mm

Mounted on 4 rubber wheels, diam.200 mm (2 fixed and 2 swivels) arranged at the corners.

#### DIRTY LINEN TROLLEYS FOR WORKING INSIDE DIRTY AREA

Made with Aluminium plate, walls and bottom.

Framework for supporting wheels and bottom reinforcement, in robust extruded section bar of Aluminium.

Upper edge reinforced with round profile. Entirely welded in the joints with TIG procedure.

In the anterior part of the bottom there is a water discharge tap ¾". Complete with double removable bottom, perforated for the drainage.

Mounted on n.4 rubber wheels diam.200 mm (2 fixed and 2 swivels) arranged at the corners. Dimensions: LENGHT: 1030 mm, DEEPNESS:630 mm ,HIGHNESS:710 mm

#### CLEAN LINEN TROLLEYS FOR WORKING INSIDE CLEAN AREA

Made with Aluminium plate, walls and bottom.

Framework for supporting wheels and bottom reinforcement, in robust extruded section bar of Aluminium.

Upper edge reinforced with round profile.

Entirely welded in the joints with TIG procedure.

In the anterior part of the bottom there is a water discharge tap ¾". Complete with double removable bottom, perforated for the drainage.

Mounted on n.4 rubber wheels diam.200 mm (2 fixed and 2 swivels) arranged at the corners. Dimensions: LENGHT: 1030 mm, DEEPNESS:630 mm ,HIGHNESS:710 mm

#### STORAGE RACKS

Entirely built with Stainless Steel profiles. Electro-polish finishing.

Possibility to insert shelves in Stainless steel wire, adjustable in height each 110 mm.

Mounted on 4 rubber wheels diam.125 mm in grey antimark rubber

Dim: Length: 1400 mm, Width: 800 mm, Height: 900 mm

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>HIGH PRESSURE BOILER</b>

Clinical Purpose	central steam source
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**TECHNICAL SPECIFICATIONS**

Panel of manufacturers: USA, EEC, Japan OR Local (if it is designed and manufactured according to ASME/BS/ISO/JIS/CE/PED standards in collaboration with international manufacturer of USA, EEC or Japan origin).

**HIGH PRESSURE STEAM GENERATOR/ BOILER**

Fire tube natural gas high pressure boiler, of specification mentioned below. The boiler shall be complete with burner, burner controls, gas train feed water pumps, feed water tank, safeties, explosion doors, automatic controls, piping to the CSSD and Laundry plants and other accessories required to complete the installation and to bring the unit into operational state with following main components; **GAS FIRED BOILER**

- a. 02/01/0.5 TPH @ 10Bars gas fired boiler (The procuring agency will specify)
- b. Burner, single fuel
- c. Boiler valves & Control set
- d. Additional feed water pump
- e. Chimney, Local (above the hospital building height)
- f. Boiler Ladder and platform (Local)
- g. Electrical Control panel
- h. Insulation, cladding & Painting **FEED WATER TANK (LOCAL MADE)**
  - a. Capacity 2,000L
  - b. De aerator head, SS
  - c. Valves and controls set

- e. Insulation, cladding & Painting **PIPING AND ELECTRIFICATION**
  - a. Pipes & valves
  - b. Instruments and gauges set
  - c. Electrical cables and electrical construction work complete
  - d. Insulation, cladding & Painting on the installed items **DETAILED SPECIFICATIONS**

Design Code Class-1 of ASME/BS/ISO/JIS/CE/PED

Boiler Type Natural Gas Fired, 3/ 4 pass, Wet Back Technology

Configuration Horizontal, Skid mounted Design Pressure 11.5 bars

Working Pressure 10 bars

Feed Water Temp 85 – 90oC

Steam generation 2,000 kg/hr @ 10bar.

Fuel Natural gas

Boiler efficiency 85-90%

Burner Single burner, Front end flange mounted, complete packaged including Control and power panel.

Insulation Rock wool

Cladding Aluminum

ND Examination Radiography, UT, DPT; as per design code standard

Material Materials used shall be recommended for specific components by ASME/BS/ISO/JIS/CE/PED

Power Supply Electric 380/3/50 **PRESSURE VESSEL**

Pressure vessel consisting of primarily of shell fire tubes, tube plates and furnace, made from material as specified by the ASME/BS/ISO/JIS/CE/PED code, duly approved by

the internationally renowned agency and stamped for compliance.

- a) Complete manufacturing process is to be inspected by the inspecting agency at various stages of construction; in case of locally fabricated.
- b) All welds and procedures adopted are to be strictly in accordance with the ASME/BS/ISO/JIS/CE/PED codes.
- c) All tubes are to be rolled and, 2nd pass entry tubes are to be further welded to the rear and front tube sheets, as provided in the code. All welded joints to be checked by X-Ray and results are recorded as per the provision of the code.

Various openings for connecting of services or installation of safety devices are to be provided and reinforced as per the ASME/BS/ISO/JIS/CE/PED code.

#### FEED WATER TANK (LOCAL MADE)

Construction Carbon Steel as per ASME/BS/ISO/JIS/CE/PED Insulation Rock wool

Cladding Pre painted sheet

Capacity 2,000 L

Configuration Horizontal

Control Temperature and level controls with level glass

STRESS RELIEVING (if covered under design code ASME/BS/ISO/JIS/CE/PED)

After the construction of the pressure vessel the entire unit is to be hydraulic tested and then relieved of stresses in a properly designed & appropriate facility.

Stress relieving is to be witness by the local representative of the inspecting agency; in case of locally fabricated. A certificate to this effect is to be provided.

After removal of the Unit from the stress relieving chamber it is to be again hydraulic tested. This test is to be witnessed by the appropriate inspecting agency; in case of locally fabricated. A certificate to this effect is to be also provided.

#### BURNER

- a) The Burner should be packaged type, fronted end mounted, factory tested and easily removable type.
- b) Complete packaged burner shall be of U.S.A. Japan or Europe to be forced draft combustion air system, utilizing a heavy duty backward curved impeller in a fully machined cast housing. Air housing should be of open able type for inspection and service of firing head components without detaching the burner from the boiler front end.
- c) Complete burner assembly is to be bolted to the front end of the boiler through the use of flange.
- d) Burner should be suitable to burn natural gas.
- e) High turn down capability is to assure smooth starts and response to wide load demands. The control switches, should permit selection of fixed rate or fully modulating operation.
- f) Gas and combustion air are to be intimately mixed in the combustion zone. Flash back is to be avoided as possible.
- g) The burner is to be listed by Underwriters Laboratory & carry a U.L. certification however other regulatory agency mentioned above may also be acceptable. Burner is to be completely assembled, wired and tested at the factory. Main gas train components like PRV, gas cock etc are to be shipped by the burner manufacturers.

#### VALVES & CONTROLS

1. 220/50/1 control circuit.
  2. Burner mounted control panel.
  3. Steam Stop Valve
  4. Blow Down Valve
  5. Isolation valve
  6. Feed Check valve
  
  7. Non return valve
  8. Pressure gauge for Boiler pressure
  9. Boiler water level control valve
  10. Water gauge glass assembly
  11. Pressure switch
  12. Safety valves for Boiler
  13. Temperature Gauges Dial type
  14. Motor starters for 380/50/3.
  15. Panel signal lights for, power "ON" ignition, flame fail, manual/auto, Gas operation.
  16. Flame safeguard controller with ultraviolet flame detector. Controller to be of the "Self Check" design.
  17. Combustion air interlock (switch).
  18. Provision for interlock of low water cut off and operating pressure control.
  19. External alarm bell to sound on main flame failure, low water.
- Main line circuit breaker, Blower motor circuit breaker. Feed water pump air cut breaker.

#### TRIM SAFETIES AUXILLIARIES AND OPERATING CONTROLS.

Packaged fire tube boiler shall include following trim, safety, operating controls and auxiliaries. These are to be wired into burner panel which is to provide appropriate interlocks.

Following are over & above the controls/auxiliaries/trim to be supplied with burner.

- Operating ON/OFF type pressure controller (Field adjustable).
- Solid state type low water cut off with feed water control side and gauge glass set with tri-cocks mounted on one side of boiler. Auxiliary gauge glass set with valves mounted on the other side.
- Stack thermometer.
- Coded safety relief valve not less than two.
- Combustion relief door.
- Alarm bell to sound on low water cut off, main flame failure, pilot flame failure, Hi-pressure etc.

#### STEAM GENERATOR ELECTRIC (OPTIONAL; QUOTE SEPARATE PRICE)

Electric Steam Generator as a backup in case of Boiler's failure of suitable capacity to feed steam for at least two washer, 02 dryer, 02 utility Press and Ironer.

NOTE: The complete project is a turn-key project and all those piping, minor civil works, platforms, erection of mechanical/ electrical/ instrumentations, installation & commissioning shall be the responsibility of the Contracting firm. All other associated instruments/ equipment/ works required for safe operation of the Boiler, as per design

code will also be the responsibility of the Contracting firm.

All sorts of Chemicals for Phosphate treatments/ Chelants/ Polymeric sludge conditioners and dispersants/ Alkalinity builders etc will be the responsibility of the Contracting firm during the warranty and then regularly as per requirement.

**CONDITIONS:**

1. The unit must be designed and fabricated as per ASME/BS/ISO/JIS.
2. All equipment must be according to international safety standard as per ASME/BS/ISO/JIS.
3. The bids with drawing marked with piping routes, panels and other equipment by the manufacturer will determine the completeness of the bid.
4. The manufacturer will quote directly; otherwise, it will certify that in case of change of its agent, they will provide the after sales services themselves or through newly appointed agent.
5. All those piping, minor civil works, platforms, erection of mechanical/ electrical/ instrumentations, installation & commissioning shall be the responsibility of the Contracting firm.
6. All other associated instruments/ equipment/ works required for safe operation of the Boiler, as per design code will also be the responsibility of the Contracting firm
7. The Room/ foundation and utility services like water, electricity, Natural gas in the Boiler Room will be the responsibility of the Institute.
8. All will give all consumables required for 3 month operations.

**WATER TREATMENT UNIT**

Water treatment unit assembled of USA, Europe or Japanese components; locally, will be provided. The capacity, flow and reservoir should be as per requirement of these systems.

The reverse osmosis unit including filters, hardness stabilizing unit, activated carbon with pre-filter 5um, Pre-filter 1um, DS reverse osmosis system. Capacity of 50/100/150 or higher L / h( As per actual requirement) Storage tank 1,000L (for laundry and CSSD). Level control for tank, vent filter, pressure pump, ion exchanger, conductivity meter control, distribution manifold, hose set and installation material.

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>HOSPITAL WASTE INCINERATOR</b>
Clinical Purpose	To destroy the hospital infected waste

**TECHNICAL SPECIFICATIONS**

The INCINERATOR (waste management system) is a turn-key project which will comprise a hospital grade incinerator, allied accessories and operation for proper disposal of hospital solid waste material and amputated human organs. The incinerator shall also be suitable for plastic, paper, textile and rubber dry and wet infectious waste of the hospital. The unit shall be of high performance to be operated continuously for at least 12 hours daily. The primary source of fuel will be natural gas based on

pyrolytic combustion with smokeless emissions having standby fuel arrangements of LPG as the pressure of natural gas drops and supply fluctuates throughout the year. For ensuring the clean environment, it should strictly comply with EPA standards having EIA certification. The system should have following specifications:

**BURNING CAPACITY:**

- 50/ 100/150/200 kg / hour (The procuring agency will specify as per its requirement)

**CONSTRUCTION:**

- Packaged type skid mounted rectangular shape dual chamber construction.
- The steel sheet shall be at least 6-8mm thick & front of 10-12mm. It should be externally painted with heat resistant paint.
- The internal surface of the incinerator shall be lined with non-cracking refractory bricks or cast able concrete to withstand a temperature of 14000C backed by thermal insulation. The thickness will be from 220-250mm. SS for chimney.
- The temperature of outer surface of the burning chambers should not rise beyond a temperature of 600 C after operation of several hours.

**PRIMARY CHAMBER (COMBUSTION):**

- Primary chamber for Pyrolytic combustion mechanism of 0.2-2.5m<sup>3</sup>.
- Volume of primary chamber will be according to capacity in rectangular shape.
- It should have separate doors for waste feeding and ash removal. The feeding door should be in accordance to load size.
- Blower centrifugal fan(s) shall be provided to inject air to burn the waste and gases in combustion chamber.
- Automatic electronically controlled air distribution and regulation system.
- The temperature should not be less than 6000C.
- A see through window with protection flap for inspection of burner's flame.
- One electrically operated natural gas burner with the provision to operate on standby LPG fuel.
- Thermocouple/sensors to monitor the temperature of the primary chamber.

**SECONDARY CHAMBER (POST COMBUSTION):**

- The post combustion chamber for flee gases with retention time of 2.0 seconds to burn further for ensuring smokeless exhaust emissions.
- Volume of primary chamber will be according to capacity in rectangular shape.
- Blower centrifugal fan(s) shall be provided to inject high pressure air to burn the waste and gases in post combustion chamber for ensuring proper burning of gases before exhaust. These fans will have an automatic servo controlled system for proper pumping of air according to the requirements.
- Automatic electronically controlled air distribution and regulation system.
- The temperature should not be less than 10000C.
- Two medium electrically operated natural gas burners or one large with the provision to operate on standby LPG fuel.
- Thermocouple/sensors to monitor the temperature of the secondary chamber.

**BURNERS:**

- Combustion and Post combustion chambers with electrically operated burners suitable for natural gas operation as well as standby LPG fuel / Diesel.

- Regulated automatically for controlling temperature inside the chamber.
- Automatic closing of burners with opening of respective chamber's door.
- Electrical safeties to prevent start up of burner unless its shutter is fully opened.
- Closure of burner's shutter on its switching off.
- Protection from radiant fire bed.
- Two/three burners for ensuring proper burning of gases.
- Electrical power requirement 220V, 50Hz single phase.
- Average natural gas consumption 20-25m<sup>3</sup>/hr.

#### STANDBY LPG FUEL:

- There should be a manifold system for reserve LPG cylinders to hook up two large cylinders or multiple medium size cylinders having sufficient capacity to run the incinerator for at least 16hrs.

#### FEED SYSTEM:

- Manual feeding system in batches.
- Calorific value of the feeding waste: 3500 – 4000 kcal/kg.

#### CHIMNEY:

- Circular mild steel aluminium clad or Stainless Steel self-supported flanged sections chimney.
- Lined with high grade cast able concrete or refractory bricks followed by insulation material.
- Proper port for taking sample of exhaust gases to monitor emission levels as per international standards provided with a cover to be opened and closed when necessary without affecting the chimney's function. The sampling port will be in proper direction for easy usage.
- The chimney shall have height of 10 meters or better from ground level.

#### GAS WASHER/ SCRUBBER:

- Mild steel integrated pass through type gas washing system with water sprayer and filter.
- Water saving system with re-circulating system and cooling tower.
- Average water consumption 10-15L/hr.

#### WATER TREATMENT:

The bidder will be responsible to provide water treatment plant as per WHO standards

#### CONTROLS:

- Microprocessor/PLC based control box with hinged sealed door.
- Pre-installed control circuitry should be rugged enough to withstand the temperature effect of the incinerator.
- It should house the ignition burner timer, feed interval timer, shut down timer post combustion chamber temperature controller, and controls for burner, blower fans, gas washer etc.
- Digital display of temperature and set timing parameters.
- The control panel shall be fitted with a functional synoptic view showing the operating situation of the whole installation
- Emergency Shutdown button for shutting it off in case of emergency.
- Electrical requirements 220V, 50Hz.

#### EMISSION STANDARDS:

- Emission standards should be in accordance with environmental department.

The flue gases should have the contents according to the following emission levels;

- Dioxins/ Furans 0.1mg/N m<sup>3</sup>
- Carbon Mono Oxide (CO) 800mg/N m<sup>3</sup>
- Particulate Matter (Dust) 300mg/ N m<sup>3</sup>
- Oxides of Sulphur (SO<sub>x</sub>) 400mg/ N m<sup>3</sup>
- Oxides of Nitrogen (NO<sub>x</sub>) 400mg/ N m<sup>3</sup>
- Smoke Opacity 01 Ringelmann Scale

#### QUALITY STANDARDS:

The Incinerator should comply with the standards of their respective regions also conforming to the standards prevailing in Pakistan.

#### POWER REQUIREMENT:

- Power consumption 3-4kW in full operating mode.
- 220V, 50Hz operation.

#### ACCESSORIES:

1. Manual ash removal tool
2. Manual particulate removal tool from water trough.
3. Digital weighing scale with minimum 60x60cm platform for weighing the waste.
4. Closed Mobile main SS trolleys for transportation of hospital waste from wards to incinerator site/room approx. 100cmx50cmx50cm (IO to decide), 15cm wheels size.

#### Minimum Heavy

5. Bin trolley in yellow colour with a flap to open cover (foot operated) to hold yellow plastic bag of 5kg mixed waste. MS with powder coating or heavy Fiberglass / Plastic
6. Chlorine free bags, as per WHO approved standards for 5kg mixed waste
7. Pair of leather gloves for hospital waste handling staff
  
8. Pair of long rubber shoes for hospital waste handling staff
9. Masks for odor, disposable
10. Syringe cutter with lifting
11. Sharp Container (pulp), incinerate-able, 10L capacity

#### CIVIL WORKS:

Following civil works, electrification etc will be conducted by the contracting firm:

- Incinerator room, waste storage/ segregation room will be constructed as per recommendations of the manufacturer and maintained at 4°C for storage.
- Electrical cables from main board to the incinerator.
- Provision and laying of gas pipeline.
- Construction/ laying of sewerage and water supply system for the incinerator.
- Civil works in the incinerator room will be considered as standard component of the installation of the incinerator.
- The construction will be conducted with A-1 materials.

#### SPECIAL TERMS & CONDITIONS:

- The firm will get it approved/ certified from the EPA as per their requirements.
- The contracting firm will install commission and operate the incinerator as a turn-key project.
- The contracting firm shall maintain, control and supervise the incineration process, segregation of waste, periodic monitoring of exhaust gases by EPD for proper functioning and implementation of hospital disposal system for at least three years out



of their own staff. The firm will be responsible for their dailies, boarding, lodging etc.

- The contracting firm shall also impart training to the hospital staff and conduct the workshops so that after complete handing over the system, the hospital should have sufficient technical expertise and skilled persons competent to handle the infectious waste for its efficient disposal.
- The contracting firm will be responsible for testing and maintaining of emission levels and get it monitored regularly by the EPA during warranty period.
- The standby LPG fuel arrangement will be done by the firm but the hospital will pay the expenditures of LPG. The LPG cylinders must comply with international standards like BS/EN/DOT.

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>AUTOPSY TABLE</b>
Clinical Purpose	For postmortem examination
<p><b>TECHNICAL SPECIFICATIONS</b>  Dissecting / Autopsy Table Fixed type.  Dissection table and organ basin may be quoted separately, Glue underlay to reduce noise,  Inclined in direction of sink.</p> <p>Support column made from stainless steel with water- protected plug-in socket and lever mixing battery for cold and hot water with hose-shower.  With telephone showers. Built in sprinklers to wash the body. Slid able body support on table.  Attached notes table &amp; organ weighing facilities.  Dimension Table approx. Length x Width x Height 2600 x 850 x 850 mm  Organ Basin approx. Length x Width x Height 400 x 500 x 250 mm with mesh basket.  <b>ORGAN TABLE</b>  Entirely from stainless steel.  The addable organ table facilitates dissection of individual organs.  Stable welding construction with inserted cutting plate and perforated instrument plate.  The organ table can be moved forth and back the overall length of the dissection table.  <b>NECK SUPPORT</b>  Entirely from stainless steel <b>BODY SUPPORT</b>  Stainless steel in columns</p>	

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>MORTUARY REFRIGERATOR</b>
Clinical Purpose	For storage of human corpses awaiting for autopsy/ burial etc.
<p><b>TECHNICAL SPECIFICATIONS</b>  Preservation temp: from -10 C to -20 C individual door with Key locks. Liter trays of stainless steel on rail. Trays located on removable angle rails with extension door easy service,  Evaporator with automatic defroster and compressor, hermetically sealed air cooled</p>	

vibration free adjusted to capacity of the refrigerator 1 x 2 bodies = 2 bodies  
Working on single phase 220V 50 Hz With all standard accessories including :  
Digital temperature display, interior light, card holders, alarm system, door frame heating, side window for inspection.

Voltage stabilizer compatible. Operating ambient temperature 50°C or better.

9. INSTRUMENTS FOR AUTOPSY (LUMP SUM): Reference: BVH

Minor deviation in sizes acceptable

3Nos. Scalpel metal handle

1No. Cartilage knife with wooden handle 2 Nos. Scissors with head, 145 mm

1No. Bowel scissor, 210 mm

1No. Dissecting forceps, 160 mm

1No. Chirurgical forceps, 145 mm 1No. Chirurgical forceps, 250 mm 1No. Rachiotome , 160 mm

2Nos. Blow pipes, 250 mm

3Nos. Post Mortem needles

2Nos. Metal rulers 300 mm and 1,5 m 2Nos. Bone saw with spare blades.

2Nos Bone saw with chargeable battery. (oscillating) with spare blades. 1No. Bone shears, 230 mm

1No. LexerChisels , 230 mm 1No. Metal mallet

1No. Rachiotome 200 mm

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>INSTRUMENTS FOR AUTOPSY</b>
Clinical Purpose	For Autopsy dissection
<p><b>TECHNICAL SPECIFICATIONS</b></p> <p>Minor deviation in sizes acceptable</p> <p>3Nos. Scalpel metal handle</p> <p>1No. Cartilage knife with wooden handle 2 Nos. Scissors with head, 145 mm</p> <p>1No. Bowel scissor, 210 mm</p> <p>1No. Dissecting forceps, 160 mm</p> <p>1No. Chirurgical forceps, 145 mm 1No. Chirurgical forceps, 250 mm 1No. Rachiotome , 160 mm</p> <p>2Nos. Blow pipes, 250 mm</p> <p>3Nos. Post Mortem needles</p> <p>2Nos. Metal rulers 300 mm and 1,5 m 2Nos. Bone saw with spare blades.</p> <p>2Nos Bone saw with chargeable battery. (oscillating) with spare blades. 1No. Bone shears, 230 mm</p> <p>1No. LexerChisels , 230 mm 1No. Metal mallet</p> <p>1No. Rachiotome 200 mm</p>	

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>MEDICAL GAS PIPE LINE SYSTEM</b>
Clinical Purpose	For supplying piped oxygen, nitrous oxide, nitrogen, CO <sub>2</sub> and

## **TECHNICAL SPECIFICATIONS**

### **GENERAL:**

This is the requirements for design, installation, function, performance, documentation, testing and commissioning of pipeline systems for compressed medical gases, gases for driving surgical tools and vacuum in healthcare facilities to ensure continuous delivery of the correct gas and the provision of vacuum from the pipeline system. It will include requirements for supply systems, pipeline distribution systems, control systems, monitoring and alarm systems and non-interchangeability between components of different gas systems.

### **NOTE:**

The given below is the designed solution of complete hospital. In case of requirement of medical gas system in the already running hospital, Procuring agency may select the required items and can fix the quantities as per its actual requirement. However, In case of requirement of medical gas system in new hospitals, procuring agency only need to define the quantities of each items as per the bed strength of hospital.

### **APPLICABLE STANDARDS/ CONFIGURATION:**

The Medical gas Pipe line should strictly comply with the international standards and configuration for requirements of HTM 2022, however, ISO 7396-1 can also be used. It would be the choice of the bidder for adherence to any standard which would be mentioned in the bid. The objectives are to ensure the following:

- a) non-interchangeability between different pipeline systems by design;
- b) continuous supply of gases and vacuum at specified pressures by providing appropriate sources;
- c) required flow rates in particular areas/ outlets;
- d) use of suitable materials;
- e) cleanliness of components;
- f) correct installation;
- g) provision of monitoring and alarm systems;
- h) correct marking of the pipeline system;
- i) following of testing and commissioning protocols;
- j) maintaining the purity of the gases delivered by the pipeline system;
- k) correct operational management.

The firms will follow the specifications mentioned below and if found contradiction between specifications and design standard then the design standard would prevail (only if the quantities mentioned are less; otherwise adjustment will be made).

A (I) AUTOMATIC MANIFOLD FOR OXYGEN.

The Manifold shall be a fully automatic type & shall switch from "Bank in Use" to "Reserve" bank without fluctuation in delivery supply line pressure & without the need for external power after the switch over the "Reserve" bank shall then become the "Bank in Use" and the banking use shall become the reserve bank. The system should be able to maintain continuous supply in case of power failure.

Capacity:

(2 X 20) with capacity of 100-120, m3/h. OR The procuring agency may define the Capacity as per its actual requirement.

Function:

Fully automatic self-contained shuttle-valve with no electrical power required for switching.

Microprocessor based monitoring display unit for monitoring of different parameters and loggings (if the design/standard (latest versions) allow for this requirement; otherwise the system standard design with standard design requirements will be followed).

Units of pressure measurement (psi/Pa/bar).

LCD /LED display for the left bank, the right bank & for the supply pressure. Complete with relief valve, Emergency shut off valve and battery / bank room alarm for left and right cylinder bank.

VIE Connection with shut off valve, controlled by the manifold cabinet.

The primary source of Oxygen will be the VIE System.

The complete automatic manifold unit with shifting from VIE System to Main Bank and then to Reserve Bank automatically with display of pressures for each source.

NIST Connection.

#### B: (I) AUTOMATIC-MANIFOLD FOR NITROUS OXIDE

The Manifold shall be a fully automatic type & shall switch from "Bank in Use" to "Reserve" bank without fluctuation in delivery supply line pressure & without the need for external power after the switch-over the "Reserve" bank shall then become the "Bank in Use" and the bank in use shall become the reserve bank. The System -should be able to maintain continuous supply in case of Power failure.

Capacity:

(2 X 10) with capacity of 70-90, m3/h. OR The procuring agency may define the Capacity as per its actual requirement.

Function:

Fully automatic self-contained shuttle-valve with no electrical power required for switching.

Microprocessor based monitoring display unit for monitoring of different parameters and loggings (if the design/standard (latest version) allow for this requirement; otherwise the system standard design with standard design requirements will be followed).

Units of pressure measurements (psi/Pa/bar)

LCD / LED display for the left bank, the right bank for the supply pressure. Complete with relief valve, Emergency shut off valve and battery / bank room alarm for left and right cylinder bank.

NIST Connection

C: (I) AUTOMATIC-MANIFOLD FOR CARBON DIOXIDE and ENTONOX (IO to specify)

The Manifold shall be a fully automatic type & shall switch from "Bank in Use" to "Reserve" bank without fluctuation in delivery supply line pressure & without the need for external power after the switch-over the "Reserve" bank shall then become the "Bank in Use" and the bank in use shall become the reserve bank.

The System should be able to maintain continuous supply in case of Power failure.

Capacity:

(2 X 4) with capacity of 30-50, m3/h. OR The procuring agency may define the Capacity as per its actual requirement.

Function:

Fully automatic self-contained shuttle-valve with no electrical power required for switching.

Microprocessor based monitoring display unit for monitoring of different parameters and loggings (if the design/standard (latest version) allow for this requirement; otherwise the system standard design with standard design requirements will be followed).

Units of pressure measurements (psi/Pa/bar)

LCD / LED display for the left bank, the right bank for the supply pressure. Complete with relief valve, Emergency shut off valve and battery / bank room alarm for left and right cylinder bank.

NIST Connection

C. GAS OUTLETS (BS/DIN SYSTEM)

Gas outlets, complete in Box/casing gas Specific, Self sealing valve, indexed to eliminate interchangeability /erroneous tapping of gas, Filter and cover plate as per Standard Design requirements of the bidder with following colour coding;

Oxygen White

Nitrous Oxide Blue

Carbon Dioxide Grey

Compressed Air 4 bar Black/ B&W Stripes Vacuum. Yellow

Surgical Air @ 07 bar B&W Stripes

D: BED HEADS UNIT FOR ICU

- Each unit consists of: 1,500 mm and above
- Horizontal type with railing

- Built in over bed Light with ON/OFF switch.
  - Built in reading Light with ON/OFF switch.
  - Provision for Nurse Call/ Alert Button
  - Gas outlets (1x Vacuum, 2x Air, 2x Oxygen complete fitted).
  - Electrical provisions;
- Electrical sockets: 6 Nos. & 2Nos. Multi Pin Plug and above schuko/Ftype All wiring conforms to standards, ground/earth
- Monitor shelf with railing clamp
  - IV pole with railing clamp
  - Separate ducts for Electrical & Gas Pipes.

**E: BED HEAD UNIT FOR WARDS & PRIVATE ROOM**

- Each unit consists of: 1,000 mm and above
  - Horizontal type
  - Built in over bed Light with ON/OFF switch.
  - Built in reading Light, with ON/OFF switch.
  - Provision for Nurse Call/ Alert Button
  - Gas outlets (1x Vacuum, 1x Air, 2x Oxygen complete fitted).
  - Electrical provisions;
- Electrical sockets: 4 Nos. & 2Nos. Multi Pin Plug and above schuko/ F type All wiring conforms to standards, ground/earth
- Separate ducts for Electrical & Gas Pipes.

**G: ALARM AREA WITH REMOTE SENSORS UPTO SIX GASES:**

Individual display and sensor module.

Self diagnostic & error message display readable for ease of maintenance psi, kPa or bar read out. Test & Mute Button, low alarm condition.

**H: MULTIPLE ZONE VALVE BOX UPTO SIX GASES.**

Each wall type zone valve box shall consist of the following Components. A steel valve box which can house two to six shutoff ball valves.

Pressure gauges to display the pressure of various gases.

**I: CEILING PENDANTS FOR THEATRES:**

**(I) Ceiling Pendants for Anaesthetist:**

Ceiling pendants with 300o rotating arm Adjustable height with pneumatic brakes.

Height 750 mm

Telescopic arms on both side

Payload of 1 minimum 150kg

Hooks/ Clamps to lift the anaesthesia machine

Two shelves for monitor and/ or other equipment/ accessories

Outlets with arm for 2xO<sub>2</sub>, 2xAir (4 & 7 bar), 1xVacuum, 2xN<sub>2</sub>O & 1xAGSS with color

coded hoses & terminal unit, user-definable hose length integral fist fix check valves. 6xElectrical Sockets;schuko/F type, Switches and facility for low voltage outlet for data transmission/ telephone/NC system.

(I) Ceiling Pendants for Surgeon:

Ceiling pendants with 300o rotating arm Adjustable height with pneumatic brakes.  
Height 750 mm

Telescopic arms on both side Payload of minimum 80kg

Two shelves for other equipment/ accessories

Outlets with arm for 2xAir (7 bar) with color coded hoses & terminal unit, user-definable hose length integral fist fix check valves. 6xElectrical Sockets; schuko/F type, Switches.

J: OXYGEN & AIR FLOW METER:

(I) Oxygen flow meter with humidifier and probes Oxygen Flow meter complete set from 1 to 15 lpm With autoclave able and unbreakable humidifier bottle

(II) Vacuum regulator with gauge / digital

The Vacuum Controller should be connected to Wall Source of Vacuum using direct probe or rail mounting System. Vacuum Levels 0 to 750 mm HG, complete with 1 Ltr suction Bottles, Unbreakable/ autoclaveable (2 each). Complete with overflow safety system.

K: COPPER PIPING:

Supply and installation of seamless copper pipe, deoxidized and degreased along with required fitting etc., various sizes /diameter as per Drawing of the Surgical Towerand Design standard of the bidder with matching colour indications of out lets. The sizes will vary from minimum of 10mm to onward as per design offered by the firm;

Oxygen White

Air Black/ B&W Stripes

Nitrous Blue

Vacuum Yellow Carbon Dioxide Grey stripes

M: ANESTHESIA SCAVENGING SYSTEM:

Passive/ Active Anesthetic Gas Scavenging System designed to remove exhaled anesthetic gas mixtures from operating theatres.

N: DUPLEX/ TRIPLEX MEDICAL VACUUM SYSTEM:

The capacity of Vertical Vacuum System is 2,500 L/min per vacuum pump OR  
The

procuring agency may define the Capacity as per its actual requirement.

Vacuum level @ 700-725 mm Hg.

Vibration Isolation, Pads, Hour meters, Circuit barkers, Vacuum pump run lights.

Tank mounted system. Complete with filters.

Vertical Tank Capacity 1,000 Ltr. Or as per actual requirement.

## O. MEDICAL COMPRESSED AIR STATION.

Medical Air Plant with Breathable Air. Elimination of Toxic Gases such as carbon dioxide, Nitrogen dioxide, Nitrogen monoxide, Carbon monoxide; and other pollutants as per design standard; followed.

### Compressor

- Duplex Compressor unit.
- Reciprocating/ Screw/ Scroll type. (IO to specify)
- Capacity of air producing approximately minimum of each compressor:- 2500 liters/min/FAD at 13 bar The procuring agency may define the Capacity as per its actual requirement.
- Mounted on anti-vibration base.

### Reservoir (Qty 2 No.)

- Compatible medical grade.
- Air receiving tank 1,000 L. or As per actual requirement.
  - Vertical type.
- Galvanized internally with auto drain.
- Minimum 13 bars out put pressure of tank.

### AIR Dryer

- Desiccant type, Duplex.
- Dew Point range between -40 to -80oC
- Dew point monitoring on LCD Panel
- Capacity suitable according to the compressor output.
- Including oil water separator.

### Filtration System

- Clean Medical Grade Air supply in accordance with the requirements of HTM/ISO standards.
- Consisting of Pre-filter / humidity, Oil free and sterile/bacteria filter.
- Mounted with shut-off valves on an assembly panel.
- Parallel Connections of the filters. This will make it possible to exchange filter without interrupting the air supply.
- Flow / filtering rate according to the compressed air output.

### Reducer Panel Compressed Air

- Parallel switched reducer with gauge, safety valve, pressure switch for high and low Pressure and shut off valve with assembly panel size 4+ 7 bar.
- Complete with distribution block according to requirement, Incl. Shut off valve and pressure gauge for every distribution block, complete assemble panel with incoming and outgoing copper pipe for complete system.

### Control



- Complete with 1x main warning system for compressed air for visual and acoustic monitoring of alarms conditions for the compressor room.
  - Test point in the system for air quality.
  - 1x switch cabinet for automatic Unit incl. All necessary fitting and installation material for smooth running of the system without any interruption.
- POWER: Power Supply- 3 Phases, 380 – 400V/50 Hz.

**SPECIAL TERMS & CONDITIONS:**

1. The equipment must be from USA, Europe or Japan based manufacturers. And all major equipment like manifold, pendants, bed head units, outlets, Vacuum System and air compressor should be from the same manufacturer.
2. All equipment must be according to international safety standard.
3. The colour of outlets, piping and cylinder for recognition will be BS type for all the system equipment.
4. The drop outlet/ Connection will be flushed surface. Separate ducts for piping and electrification.
5. The bids with drawing marked with piping routes, panels, alarms and other equipment by the manufacturer will determine the completeness of the bid.
6. The manufacturer will certify that the bid/ drawing are strictly in compliance with the design standard.
7. The installation will be checked and certify by the manufacturer with the effect that the system is as per their design standard and protocols.
8. The bids will be evaluated as per standard design followed by the firms.
9. The bidders are required to mention the price of individual item separately.

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>POSITIVE COLD ROOM</b>
Clinical Purpose	For keeping bodies for several weeks with ongoing decomposition. <ul style="list-style-type: none"> <li>• Bodies that have been identified or autopsy has been done upon them they are stored in positive cold room because it does not prevent decay.</li> </ul>

**TECHNICAL SPECIFICATIONS**

11. POSITIVE COLD ROOM Ref:EPI

Size 40m<sup>3</sup>

Required refrigerant of cold room is R404A or equivalent. Required Cooling range is 3900 to 4000 W.

Treated air flow range must be 1800 m<sup>3</sup>/h Approx. Air projection of the system is 10 m Approx.

Compression type should be hermetic. De-Icing through hot gas cycles.

Required Insulation material of cold room is polyurethane or equivalent. Insulation thickness range should be 100mm to 110mm.  
 Foam Density 40 kg/m<sup>3</sup> Approx.  
 K value of Panel, 0.22 W/m<sup>2</sup>.K Approx.  
 Ambient temperature of usage should be up to +45 Degree Centigrade. Temperature range +2 Degree Centigrade to +8 Degree Centigrade.  
 Provision of galvanized shelves with five levels each with 100 Kg load bearing of every level, depth should be 500mm to 450 mm.  
 The interior should have door safety, lighting, strip curtains, Anti slippery floor and thermometer (-40 C to +40 C).  
 The systems should have redundancy of the refrigeration units with manual switch over.

The system should have independent temperature recorders with discs and power reserves. Power Supply/Frequency: 380- 400 Volt / 50 Hz  
 Prequalified manufacturer of WHO.

Clinical Specialty	Allied Equipment and Machinery
Generic Name	<b>NEGATIVE COLD ROOM</b>
Clinical Purpose	For keeping bodies when not been identified at this temperature body frozen and decomposition reduced. <ul style="list-style-type: none"> <li>Bodies that are stored for preservation reduced for autopsy in future are stored in negative cold room and prevent decay.</li> </ul>

**TECHNICAL SPECIFICATIONS**

Size 40m<sup>3</sup>  
 Required refrigerant of cold room is R404A or equivalent. Required Cooling range is 4000 -45000 W.  
 Treated air flow range must be 3900 m<sup>3</sup>/h Approx. Air projection of the system is 10 m Approx.  
 Compression type should be hermetic. De-Icing through hot gaz cycles.  
 Required Insulation material of cold room is polyurethane or equivalent. Insulation thickness range should be 100mm to 110mm.  
 Foam Density 40 kg/m<sup>3</sup> Approx.  
 K value of Panel, 0.22 W/m<sup>2</sup>.K Approx.  
 Ambient temperature of usage should be up to +45 Degree Centigrade. Temperature range -20 Degree Centigrade to -15 Degree Centigrade.  
 Provision of galvanized shelves with five levels each with 100 Kg load bearing of every level, depth should be 500mm to 450 mm.  
 The interior should have door safety, lighting, strip curtains, Anti slippery floor and thermometer (-40 C to +40 C).  
 The systems should have redundancy of the refrigeration units with manual switch over.  
 The system should have independent temperature recorders with discs and power reserves. Power Supply/Frequency: 380- 400 Volt / 50 Hz  
 Prequalified manufacturer of WHO.

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Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Digital Oscilloscope</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to measure small and large AC and DC signals present inside circuit boards of any of the Bio-Medical Equipment. It assists in detection of the faulty signals / components / boards present inside electronic circuitry of the equipment.

**TECHNICAL SPECIFICATIONS**

Bandwidth 100Hz or better  
Channels 2 or better  
Rise time < 3.5ns  
Sample rate 2 GSa/s or better  
Maximum acceptable input voltage 400V (DC + AC)  
Input ports DC, AC, GND  
USB and LAN Interface  
Math operations like Add, Subtract, Multiply, Divide, FFT  
"Can measure Vpp, Vmax, Vmin, Vamp, Vtop, Vbase, Vavg, Mean, Crms, Vrms, ROV, FOV, RPRE, FPRE, FREQ, Period, Rise Time, Fall Time, BWid, + Wid, - Wid, + Duty, - Duty, Phase, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF"  
Display 7" TFT or better  
Display Resolution 480 x 234 or better  
Operatable on 220V 50Hz AC input

Accessories:  
Passive probes (one per channel), power cord, USB cable

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>ECG Analyzer</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to test ECG machine accuracy and fault detection. It acts like a patient and generate ECG that can be readily detected and measured on a ECG machine.

**TECHNICAL SPECIFICATIONS**

<p>Rate: 30 to 320 BPM Amplitude: 0.15 to 5mV  Waveforms: Sine, Triangle, Square Atrial Pacer, Ventricular Pacer  Arrhythmia : Atrial,Ventricular  Respiration: Normal Physiological Simulation Blood Pressure  Impedance 350 Ohms  Excitation 2 to 16 Volts  Synchronized with all normal sinus rates Physiologically track all  arrhythmia selections Accuracy <math>\pm 1\%</math> of reading  Display LCD Key Pad  Output Connectors ECG</p>	
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Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Ventilator Analyzer</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to analyze and calibrate different available parameters in the ventilator including gas pressure, temperature & humidity measurement, Volume measurement, flow measurement, O2 concentration measurement etc.

### TECHNICAL SPECIFICATIONS

Flow measurements for oxygen, air and nitrous oxide, both high and low range Volume measurement
Pressure measurement high and low range for compressed gasses and patient pressure Oxygen concentration form 0 -100%
Gas temperature measurement Gas humidity measurement
Interface with RS232,Ethernet,US to shift data on PC or Printer Following To be supplied Locally:
Digital Oscilloscope(100 MHZ) (01) IC Tester(01)
Oscilloscope(50 MHZ) (01) Digital Power Supply (02)
Digital Multimeter(04)
Analog Meter (04)
Watt Meter(02)
Soldering Station(04)

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>High Voltage Analyzer</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to analyze high voltages in the sophisticated Bio-Medical

	equipment. It assists in calibration and fault detection of the high voltages generated inside equipment.
<b>TECHNICAL SPECIFICATIONS</b>	
<p>Maximum system voltage 11kV  Maximum voltage to earth 6.6kV  Threshold voltage 300V  Sensitivity AC/DC  2.3mA nominal @6.6kV 7uA nominal @ 13.8kV  Length (mm) 330 Contact electrode type :Domed</p>	

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>SPO2 Analyzer</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to analyze the oxygen saturation of the patient. It also assists in calibration of the oxygen saturation reader.

<b>TECHNICAL SPECIFICATIONS</b>	
<p>Simulation Optronic (Electronic &amp; Optical), indirect via probe adaptor box  Simulation via Probe &amp; full chain  Range 50 to 100%  Heart Rate 20-300 bpm  Accuracy ± 1bpm  Arrhythmias :Tachycardia, Bradycardia, (upgrade)  Artefacts: Motion, light (AC-DC) (upgrade)</p>	

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Electrical Safety Analyzer</b>
Clinical Purpose	It is used by Bio-Medical Engineer and Technologist to analyze power in the circuit in different phases. It informs about any abnormal voltage being generated or delivered in the circuit. It can check point to point voltage, resistance and leakages.

<b>TECHNICAL SPECIFICATIONS</b>	
<p>Power Measurement: Method VA rating Range 0.1KVA – 4KVA  Accuracy ±10% + 2 counts Mains Outlet Test:  Input Voltage Range 0-300V AC, max current 16A Measures L – E, N – E &amp; L – N  Accuracy ± 5% of reading + 2 counts IEC Mains Lead Test:  Test Duration 2s</p>	

Clinical Specialty	Bio-Medical Engineering
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Generic Name	<b>Vital sign monitor analyzer</b>
Clinical Purpose	It is used by the Bio-Medical Engineer and Technologists to the multiple parameters available in the vital signs monitor and assists in their calibration and fault detection. These parameters include IBP, NIBP, O2 Saturation, ECG, Arrhythmias etc.

**TECHNICAL SPECIFICATIONS**

Non-invasive Blood Pressure Simulation Waveform Oscillometric Digital Manometer  
 Oxygen Saturation: Range 50 to 100% Accuracy  $\pm$  1 bpm  
 ECG Arrhythmia Simulator:  
 ECG Full 12 lead simulation including high level output Performance Waveforms Sine, Square, Triangle, and Pulse Pacer Waveforms  
 Synchronous Atrial, Asynchronous Atrial Arrhythmia Waveforms:  
 Temperature: Range 37 and 41°C Respiration:  
 Rates 5, to 180 Breaths per Minute Apnea Simulation  
 Invasive Blood Pressure: Channels 2 channels  
 Static: 0 to 300mmHg. Typed values  
 Dynamic: 0 - 300mmHg for systolic & diastolic

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Electrosurgical / Cautery Analyzer</b>
Clinical Purpose	It is used by the Bio-Medical Engineer and Technologists to test the cutting and coagulation powers that are being actually delivered to the patients. It assists in calibration of the electrosurgical / cautery machine.

**TECHNICAL SPECIFICATIONS**

The required characteristics and specific /critical functional requirements. e.g. modules, components, measured and/or delivered parameters and associated values and ranges, compatibility / inter-operability requirements, etc.

User interface information requirements (e.g. display of pressure, volume, flow, status indicators, inspiration and expiration times, etc.) and format (continuous waveform display, digital, trends, etc.).

Device functional parameters, alarms, language, etc. that should be adjustable at the discretion of the users.

Detailed requirements  
 Displayed parameters  
 User adjustable settings

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Defibrillator Analyzer</b>
Clinical Purpose	It is used by the Bio-Medical Engineer and Technologists to test the energy being actually delivered by the Defibrillator to the patient. It assists in the calibration of the defibrillator.

**TECHNICAL SPECIFICATIONS**

Energy Range 0-550 Joules Internal Load 50Ω non inductive  
 External Loads 25 - 200Ω Voltage 0 - 6000V  
 Current 0 - 120A Cardiac Synchronization  
 ECG Full 12 lead simulation including high level output  
 Waveforms NSR, Atrial, Atrial Conduction, Ventricular and Pacer  
 wave forms Rate 20 – 300BPM  
 Waveforms:Sine, Square, Triangle and Pulse External Connections  
 External paddle and load box PC Connections

Clinical Specialty	Bio-Medical Engineering
Generic Name	<b>Mechanical Tool Kit</b>
Clinical Purpose	It is used by the technologists to repair the most of the Electro-Medical Equipment available in the hospital at the installation site. It helps technician to decrease downtime of the equipment and make it functional quickly.

**TECHNICAL SPECIFICATIONS**

Screw drive large - type  
 Screw drive large + type  
 Screw drive X large - type  
 Screw drive X large + type  
 Screw driver thin long - type  
 Screw driver thin long + type  
 Thumb screw driver + type  
 Thumb screw driver - type  
 Tweezers  
 Brush  
 Hex Saw small  
 Lock opener  
 Scrubber  
 Star Kit  
 Soldering Iron  
 Soldering Wire  
 Soldering paste

Files  
 Combination pliers  
 Flat nose pliers  
 Side cutter  
 Knife cutter  
 Monkey wrench  
 Wrench  
 Adjustable spanner full kit  
 Allen keys star  
 Allen keys  
 Torch  
 Watch maker set  
 Teflon tape  
 Sand paper  
 Clamps  
 Depoxi  
 Wraps  
 Alcohol Swaps  
 Gloves  
 Gauze swabs  
 Contact cleaner  
 WD 40  
 Pipe Wrench  
 Glue (elfi) pack  
 Fuse (1A, 1.5A, 2A, 2.5A, 3A, 3.5A, 10A)  
 Glue Gun  
 Glue Gun sticks  
 Wire Cutter  
 Wire Stripper

Clinical Specialty	Emergency Medical Services
Generic Name	<b>CARDIAC AMBULANCES</b>
Clinical Purpose	To provide acute medical care to cardiac patient and to transport them to cardiac care unit.

**TECHNICAL SPECIFICATIONS**

**MODEL**

Latest production. High Roof. CLASS  
 Two rear wheel Drive, ENGINE TYPE

Four cylinder, four stroke Diesel. ENGINE DISPLACEMENT  
 Naturally aspirated or Turbo charged, 2500-3000 cc. AIR-CONDITIONER AND  
 HEATER

Fully air-conditioned (originally fitted) and standard heater. PATIENT COMPARTMENT  
 Minimum patient compartment size must be 2700 x 1500 x 1600 mm (L x W x H)

**STEERING:**

Right hand drive BRAKES:

Hydraulic / pneumatic STANDARD ACCESSORIES:



- a). Tool Kit.
- b). Spare Wheel.
- c). Vehicle Manuals.
- d). Standard Fire Extinguisher (Halotron).
- e). Standard instruments and accessories.
- f). Front seat safety belts.

## **TECHNICAL SPECIFICATIONS**

### **GENERAL**

The ambulance must be assembled / fabricated by professional fabricators with proper industrial set up, strictly in accordance with international standards.

### **AMBULANCE COMPONENTS, EQUIPMENT AND ACCESSORIES:**

- i. Red Crescent Sign and word AMBULANCE on front / rear sides and Name of Institution with logo on left and right sides.
- ii. Side and back window glasses will be partially frosted.
- iii. Main Stretcher
  - Collapsible type
  - Aluminum Alloy material
    - Three sections stretcher top with adjustable head and foot section. Head section can be raised at any desired position.
    - Castors 6- Nos. and two will be used in the collapsible position.
    - Vinyl Leather bed and body straps.
    - Side protections
    - Weld free fabrication.
    - Right and front Side stretcher-locking mechanism in patient cabin.
  - Overall Dimensions
 

Length	78"	
Width	22"	
Maximum Height in full standing condition		48"
Minimum height in collapsible condition	12"	
- iv. Fiber Glass Spine-Board with straps (18"x72") and Head Immobilizer system
- v. Sub Stretcher folding type, Aluminum Alloy.
- vi. Four persons seat with straps and seat belts. (Genuine seats of the van will be used)
- vii. Folding One-person crew seat with seat belts. (Genuine seat of the van will be used)
- viii. Instrument and medicine storage cupboard and boxes with dividers, durable material.
- ix. Standard Horizontal Red Strobe light set (combination of rotary lights, siren, speaker, amplifier and microphone). Spot lamp with flexible neck for patient examination.
- x. Back flood light for patient handling.
- xi. Hooks for intravenous infusion set.
- xii. Linoleum flooring with a ply wood of 5-layers.
- xiii. Standard size oxygen cylinder (MF type) with one standby containing regulator, pressure gauge, flow meter, humidifier, key, masks with tubing ready for oxygen

delivery through two outlets installed in patient cabin.

- xiv. Portable First Aid box – Standard.
- xv. Trash box 5L with lid (SS material non magnet).
- xvi. Portable Oxygen cylinder with masks and regulator.
- xvii. Ice box, Plastic 02 liters.
- xviii. Re-chargeable portable Torch and emergency light.
- xix. Universal Resuscitation hard carrying case with following items:
  - a. Manual resuscitators (Ambubag ), Adult and Paeds size.
  - b. Laryngoscope with straight and curved blades.(USA,Europe and Japan)
  - c. Endotracheal tubes (all sizes)
  - d. Stethoscope (01) (USA,Europe and Japan)
  - e. Professional Torch
  - f. Tongue depressor (disposable) (one box)
  - g. Airways assorted sizes (01 set).
  - h. Mouth gag.
  - i. Disposable gloves ( 04) and contaminant bags (04)
  - j. Thermometer, flat type (02).
  - k. Hammer with rubber ends for examination.

**MEDICAL EQUIPMENT:( USA ,Europe and Japan)**

- 1. Single Channel ECG machine with 50 rolls.
- 2. Transport Emergency Ventilator, 5 Inch Screen Display, Adult/Paeds. Battery operated with 6- hours backup time.
- 3. Battery operated rechargeable Suction apparatus, 20 l/min, 500 mmHg, single two litres with 2- autoclave able bottles.
- 4. Oxygen saturation monitor with NIBP measurement, adult and Paed cuffs.
- 5. Nebulizer- Battery operated, Rechargeable.
- 6. Fully Automatic External Defibrillator
  - Battery Operated.
  - Biphasic mode
  - Automatic and manual operation.
  - ECG monitoring
  - External pace maker facility, built-in.
  - 100- pads, adult and Paediatric.

NOTE: The fabrication and fitting of the equipment will be ensured for its safety during transportation.

Clinical Specialty	Emergency Medical Services
Generic Name	<b>TRAUMA AMBULANCES</b>
Clinical Purpose	To provide acute medical care and transport to patients.
<b>TECHNICAL SPECIFICATIONS</b>	
MODEL	
Latest production. High Roof. CLASS	
Two rear wheel Drive engine type	
Four cylinder, four stroke Diesel. ENGINE DISPLACEMENT	

Naturally aspirated or Turbo charged, 2500-3000 cc. AIR-CONDITIONER AND HEATER

Fully air-conditioned (originally fitted) and standard heater. PATIENT COMPARTMENT Minimum patient compartment size must be 2700 x 1500 x 1600 mm (L x W x H)

STEERING:

Right hand drive BRAKES:

Hydraulic / pneumatic STANDARD ACCESSORIES:

- a). Tool Kit.
- b). Spare Wheel.
- c). Vehicle Manuals.
- d). Standard Fire Extinguisher (Halotron).
- e). Standard instruments and accessories.
- f). Front seat safety belts.

### **TECHNICAL SPECIFICATIONS**

#### **GENERAL**

The ambulance must be assembled / fabricated by professional fabricators with proper industrial set up, strictly in accordance with international standards.

#### **AMBULANCE COMPONENTS, EQUIPMENT AND ACCESSORIES:**

xx. Red Crescent Sign and word AMBULANCE on front / rear sides and Name of Institution with logo on left and right sides.

xxi. Side and back window glasses will be partially frosted.

xxii. Main Stretcher

- Collapsible type
- Aluminum Alloy material
  - Three sections stretcher top with adjustable head and foot section. Head section can be raised at any desired position.
- Castors 6- Nos. and two will be used in the collapsible position.
- Vinyl Leather bed and body straps.
- Side protections
- Weld free fabrication.
- Right and front Side stretcher-locking mechanism in patient cabin.
- Overall Dimensions
  - . Length 78"
  - . Width 22"
  - . Maximum Height in full standing condition 48"
  - . Minimum height in collapsible condition 12"

xxiii. Fiber Glass Spine-Board with straps (18"x72") and Head Immobilizer system

xxiv. Sub Stretcher folding type, Aluminum Alloy.

xxv. Four persons seat with straps and seat belts. (Genuine seats of the van will be used)

xxvi. Folding One-person crew seat with seat belts. (Genuine seat of the van will be used)

xxvii. Instrument and medicine storage cupboard and boxes with dividers, durable material.

xxviii. Standard Horizontal Red Strobe light set (combination of rotary lights, siren,

speaker, amplifier and microphone). Spot lamp with flexible neck for patient examination.

- xxix. Back flood light for patient handling.
- xxx. Hooks for intravenous infusion set.
- xxxi. Linoleum flooring with a ply wood of 5-layers.
- xxxii. Standard size oxygen cylinder (MF type) with one standby containing regulator, pressure gauge, flow meter, humidifier, key, masks with tubing ready for oxygen delivery through two outlets installed in patient cabin.
- xxxiii. Portable First Aid box – Standard.
- xxxiv. Trash box 5L with lid (SS material non magnet).
- xxxv. Portable Oxygen cylinder with masks and regulator.
- xxxvi. Ice box, Plastic 02 liters.
- xxxvii. Re-chargeable portable Torch and emergency light.
- xxxviii. Universal Resuscitation hard carrying case with following items:
  - a. Manual resuscitators (Ambubag ), Adult and Paeds size.
  - b. Laryngoscope with straight and curved blades.(USA,Europe and Japan)
  - c. Endotracheal tubes (all sizes)
  - d. Stethoscope (01) (USA,Europe and Japan)
  - e. Professional Torch
  - f. Tongue depressor (disposable) (one box)
  - g. Airways assorted sizes (01 set).
  - h. Mouth gag.
  - i. Disposable gloves ( 04) and contaminant bags (04)
  - j. Thermometer, flat type (02).
  - k. Hammer with rubber ends for examination.

**MEDICAL EQUIPMENT:( USA ,Europe and Japan)**

- 7. Battery operated rechargeable Suction apparatus, 20 l/min, 500 mmHg, single two litres with 2- autoclave able bottles.
- 8. Nebulizer- Battery operated, Rechargeable.

NOTE: The fabrication and fitting of the equipment will be ensured for its safety during transportation.

Clinical Specialty	Applied Equipment & Machinery
Generic Name	<b>Integrated Shredded Sterlizer</b>
Clinical Purpose	To reduce in volume and to convert hazard/infected waste into ordinary waste

**Specifications**

- System should use Non-burn technology, incorporating shredding followed by steam sterilization method. Treatment should be in one continuous automated cycle with no use of conveyor belts for transporting waste to a separate shredder.

**Capacity:**

- Should have a capacity to treat minimum 130 liter of waste (15- 25 Kg) per cycle.

**Chamber:**

- The treatment vessel should be vertical (to optimize space occupied) and built of sturdy material like Stainless steel 316 L, same material to be used for built in shredder.

**CYCLE:**

**Cycle Duration:**

- Should preferably be around 25 - 35 minutes and after treatment, the system should ensure substantial volume reduction in the range of 70 – 90%.

**Temperature range**

- Should be between 134 - 140 Celsius degree and pressure range of 2.5 – 5.0 bar with provision for sufficient vacuum pulses to ensure proper sterilization

**Air removal:**

- The system should have the possibility to create vacuum in order to evacuate part of the air.
- The system should able to separate liquid and the solid in the chamber itself before downloading the treated waste. The outgoing liquid has to be sterilized
- The system should take out the air before sterilization starts
- Final treated waste should be unrecognizable and totally safe and be handled and disposed as normal municipal waste. The final treated waste is also non Reusable.

**Unloading:**

- Should have a minimum diameter for the unloading of treated waste

Clinical Specialty	Electrical Engineering
Generic Name	<b>AC System</b>
Clinical Purpose	Air conditioning system
<p><b>Specifications</b></p> <ul style="list-style-type: none"> <li>• Supply and installation of T3 Super Tropical decorative Cassette/wall mounted/Floor Standing/Ceiling Mounted Type Heat &amp; Cool Split Units complete with compressor, evaporator section with fan, condenser section, , LED tube display, Remote Control, duly vacuumed complete in all respect having 1/1.5/2/4/8/10 TR</li> </ul> <p><b>Working Ambient Conditions upto 50Deg C Super Tropical Type, Auto Restart,</b></p>	
<p>Optional: IO to specify following Copper pipe size and length, Electric cable size and length, Outdoor hanging material, Circuit breakers rating capacity as per AC TR, Drain pipe size and length.</p>	

Clinical Specialty	Electrical Engineering
Generic Name	<b>Generator</b>
Clinical Purpose	To supply electric power during main electric supply failure
<p><b>Specifications</b></p>	

Generator Type:

Heavy duty fabricated steel skid type based frame with anti-vibration mounting/ isolators. Skid mounted radiator engine driven blower type fan and protecting guards. Diesel day fuel tank for minimum 8 hours of continuous run. Earthing & neutral connections upto first water level.

Engine:

Prime Power Rating in 10/20/30/50/100/200/300/400/500/750. 4 stroke diesel engine. Water cooled. Direct cooled. Direct coupled with Alternator. Self-ventilated/ regulated.

Alternator:

Brushless. Self-excited. Automatic Voltage Regulated. Automatic Frequency Regulated. 230/ 400 Volt 3-Phase, 4-Wire, 50 Hz (Nominal frequency). F/H Type insulated.

Speed: 1500 RPM

No. of Cylinders: Inline 4/6/8

Aspiration: Turbo charged.

Ambient Temperature: 50 °C or better

Cooling System: Water cooled, tropical radiator with water level switch/ indicator.

Exhaust System: Heavy duty residential grade silencer with flexible exhaust pipe.

Governor: Electric

Protections: Overload shutdown, short-circuit shutdown, low oil pressure shutdown, high water temperature shutdown, under-speed shutdown, under-voltage shutdown, over-winding temperature shutdown, over-voltage monitoring and tripping, low-voltage monitoring and tripping, phase sequence monitoring and tripping, phase failure monitoring and tripping.

Monitoring/ Control Panel: Automatic alarm monitor, under/ over voltage, emergency stop, low oil pressure, high coolant temperature, fail to start, low/ high battery voltage meter.

Metering: Voltmeter, frequency meter, ampere meter, hour meter.

Batteries: Maintenance free, heavy duty lead acid batteries, battery rack and cable, auto battery charger.

Standard Accessories: Standard toolkit, one set of air fuel and lubricating oil, filters.

Technical and operation manual (two sets).

The country of origin of Engine, alternator and assembler from USA/ Europe/ Japan

Optional: IO to specify following

RCC Foundation, Electric cable size and length, weather and sound proof and acoustic canopy with matching silencer of approved makes 85 db (A) (Residential guarding),

AMF panel system, manual changeover panel system. Earthing Rod, Mesh Wire Cage,