

**MINISTRY OF EXTERNAL AFFAIRS
(GOVT. OF INDIA)**

**DISTRICT GENERAL HOSPITAL, DIKOYA,
SRI LANKA**

Tender

for

**Supply, Installation, Testing & Commissioning of Bio Medical
Waste Management System at District General Hospital, Sri Lanka**

VOLUME – IV

TECHNICAL SPECIFICATION

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TECHNICAL SPECIFICATIONS OF BIO-MEDICAL WASTE MANAGEMENT SYSTEM

Scope of Work : Supply, Installation, Testing, Commissioning of Bio-Medical Waste Management System including Turnkey work and handover in satisfactory condition to the District hospital Dikoya, Srilanka and services during Defect liability Period. Providing of environmental clearance for the Incinerator from the local authority.

1. INCINERATOR

Fully automatic in operation

1.00 Solid Waste Incinerator .

- 1.01 Incinerator type Controlled air & pyrolytic.
- 1.02 Combustion chambers 2nos. (PCC & SCC)
- 1.03 Type of waste Biomedical waste.
- 1.04 **Capacity - Capable to combustion 15Kg/hr**
- 1.05 MOC MS castable refractory lined.
- 1.06 Feeding & Dishing system Manual.
- 1.07 Burners 3nos. (2 for PCC & 1 for SCC)
- 1.08 Fuel Diesel
- 1.09 Type of burners Monoblock Fully automatic.
- 1.10 Burner modulation ON/OFF.
- 1.11 Type of venturi ejector Conical & vertical.
- 1.12 Type of fans (Ejector & Combustion) Centrifugal.
- 1.13 Emission parameters As per CPCB norms.
- 1.14 Primary combustion chamber (PCC) temperature $800 \pm 50^{\circ}\text{C}$
- 1.15 Secondary combustion chamber (SCC) temperature $1050 \pm 50^{\circ}\text{C}$

2.00 Primary Chamber

- 2.01 Type- Static Solid Hearth
- 2.02 MOC- Mild Steel 5mm thick
- 2.03 Refractory thickness 115 mm
- 2.04 Material- Refractory Bricks confirming to IS-8
- 2.05 Temperature Resistance-1400 °C
- 2.06 Insulation thickness-115 mm
- 2.07 Material-Insulation Bricks confirming to IS-2042
- 2.08 Waste Charging- Automatic through Hydraulic Ram Pusher Hydraulic power pack-5HP
- 2.09 Ash Removal-Manual

3.00 Secondary Chamber

- 3.01 Type-Static Solid Hearth
- 3.02 MOC- Mild Steel 5mm thick
- 3.03 Refractory thickness 115 mm
- 3.04 Material- Refractory Bricks confirming to IS-8
- 3.05 Temperature Resistance-1400 °C
- 3.06 Insulation thickness-115 mm
- 3.05 Material-Insulation Bricks confirming to IS-2042

4.00 Emergency Stack 1 set.

- 4.01 Type Cylindrical, top mounted on venturi ejector.
- 4.02 Height suitable to the requirement
- 4.03 MOC-Mild Steel 3mm thick
- 4.04 Refractory- 75mm thick castable
- 4.05 Insulation – 25mm thick castable

5.00 Quencher

- 5.01 MOC of Outer Body-Mild Steel Refractory lined from inside
- 5.02 Water circulation System- Provided with Centrifugal pump
- 5.03 Purpose-To reduce flue gas temperature before Venturi Scrubber

6.00 Combustion Fan

- 6.01 Type- Centrifugal
- 6.02 Modulation-Manual Damper Control
- 6.03 MOC-Mild Steel
- 6.04 Drive –Direct Drive

7.00 Oil Piping 1 set.

8.00 Oil Day Tank 1 set.

- 8.01 Capacity suitable to the requirement
- 8.02 MOC-Mild Steel
- 8.03 Other Standard Accessorie- Diesel Oil Level indicator, Piping with valves & N.R Valves
- 8.04 Visual checking of Fuel-To be provided

9.00 Venturi Scrubber 1set.

- 9.01 Type High Energy (High Pressure Jet Type)
- 9.02 MOC SS-316L.
- 9.03 Scrubbing medium Water with 5% caustic
- 9.04 Temperature at the outlet 78 °C -80 °C

10.00 Recirculation Pump With Motor 1set.

- 10.01 Type Monoblock./Type Centrifugal
- 10.02 MOC of wetted parts SS 316
- 10.03 Piping PPR

11.00 Droplet Separator cum Recirculation Tank 1 set.

11.01 Type Cylindrical, Vertical.

11.02 Application-To separate water droplets from flue gases

11.03 MOC –(MSRL)Mild Steel Rubber Lined -3mm thick.

11.04 Type of droplet separator Cyclonic.

12.00 ID Fan With Motor 1set.

12.01 Type Centrifugal.(High Pressure)

12.02 MOC Casing - MSRL, Impeller – Stainless Steel 304.

12.03 Drive –Belt Driven

13.00 Alkali Dosing System 1 set.

13.01 Pump Type Plunger pump metering.

13.02 MOC of wetted parts PP.

13.03 Dosing medium NaOH solution

14.00 Stack 1set.

14.01 Type Cylindrical & guy rope/self supported.

14.02 Height 30 Mtrs from ground level or above the nearby buildings

14.03 MOC -Mild Steel

14.04 Other Standard Accessories-Aviation lamp, Lightning Arrestor, Stack drain, Inspection Platform and Sampling Port.

14.05 Paint- The stack should be painted externally two coats of heat resistant Aluminium paint.

14.06 Ladder should be provided till the top

14.07 Inside protection- 3mm thick rubber lining from inside.

15.00 Flue Gas Duct (Between Incinerator, Scrubber, ID Fan &Stack) 1set.

15.01 Type Cylindrical.

15.02 MOC Part MS and part MSRL.

16.00 Manually Operated Dampers 2sets.

16.01 MOC MS.

17.00 Control Panel 1set.

17.01 Type Cubical, control cum MCC.

17.02 PLC based with Printer and Recording device having both manual and auto operation, main switch, MCBs, indicating lamps, contactors, MPCBs, push buttons, hooter etc. duly wired and enclosed in powder coated, dust proof sheet metal box.

17.03 MOC- CRCA sheet

17.04 Type of temperature controller-Digital

17.05 Finishing & Painting Type-Powder coated

17.06 Audio Visual alarm System-To be provided

18.00 Instruments & Sensors

- 18.01 Air pressure switches .
- 18.02 Water pressure switch .
- 18.03 Thermocouples .
- 18.04 Water level switch .
- 18.05 Digital temperature controllers
- 18.06 Pressure gauge
- 18.07 Water level gauge
- 18.08 Limit switches.

19.00 Makes of Bought out Items

- | | |
|---------------------------------|--|
| 19.01 Burners - | Oroflam/FBR/Ecoflam (Italian makes)/Equivalent |
| 19.02 Motors - | ABB/Crompton Greaves/Havells/Equivalent |
| 19.03 PLC - | Delta/Equivalent |
| 19.04 Temperature controllers - | Delta/Selec/Equivalent |
| 19.05 Switchgear - | Telemecanique/Schnieder/Eaton/Equivalent |
| 19.06 Refractory - | Calderys/Equivalent |
| 19.07 Air pressure switches - | Honeywell/Orion/Equivalent. |
| 19.08 Water pressure switch - | Indfos/Orion/Equivalent. |
| 19.09 Limit switches - | BCH/Equivalent. |

2. Bio-Medical Waste Autoclave

Horizontal Cylindrical High Pressure Steam Sterilizer BIS Mark IS: 3829 (Part 1)

Horizontal Cylindrical High Pressure Steam Sterilizer, manufactured as per BIS Specification No. IS 3829 (Part 1)-1978, with the latest amendments and bearing ISI Mark IS: 3829 (Part 1).

Capacity: Sterilization shall be 200 Ltrs

Mode of Heating: Electrically heated by immersion heaters wired for operation on

- Capacity suitable to the bio-medical waste of the AIIMS for autoclave
- Working pressure: 20 Lbs/Sq.Inch. 1.26 kgf/cm².
- Operating Pressure: 1.05 + 0.15 kgf/cm² approx. (20 psi).
- Operating Temperature: about 110 & 121 degrees centigrade.
- Exhaust: Fast Exhaust within 7 minutes & slow exhaust from 7 to 30 minutes.
- Hydrostatic Test: The shell is subject to hydrostatic test to twice the working pressure.
- Performance: The sterilizer shall be capable of performing the following operations constituting one full cycle of sterilization.
 - Generate steam and build up working pressure in the jacket, without admitting it to the chamber:
 - Admit steam to the chamber and allow it to build up to working pressure and temperature.(maintaining pressure in the jacket) and retaining working temperature for at least 2 hours;
 - Exhausting the chamber pressure, retaining the jacket pressure; and

- Drying of load in chamber (if required) through the circulation of dry filtered air entering through a drying system.
- Dished Door: Fitted with one dished door SS-316 and brass Hinges, with SS radial arms to manipulate smoothly by well-insulated handles, and shall have gunmetal Door Locking assembly & automatic pressure locking device to provide complete safety to the operating personnel against any explosive opening of the door under high pressure. Provision is made to tighten the dished door while in locked position. A molded steam and heat resisting silicone joint less gasket shall be fitted to the door.

Material of Construction:

- Chamber & Back Plate: SS sheet of grade (04Cr18Ni10 Mo02) 316 non-magnetic-10 SWG.
- Jacket: SS sheet of grade (04Cr18Ni10) 304 non-magnetic.
- End Ring: SS 304 non-magnetic
- Connections & Piping: Made of Stainless Steel having bright finish.
- Dished Door: Stainless Steel.
- Outer cover: SS sheet 304 Quality.
- Operating Valve: To Control the cycle of sterilization as per ISI standards.
- Safety Valve: As a pressure switch for controlling pressure is provided on jacket, spring-loaded safety valve is provided to jacket as a safe guard against excess pressure in the jacket.
- Ejector: A powerful ejector system to create partial vacuum, which shall help in quick drying.
- Drying System (Vacuum): With Bacteria Filter allows dry filtered hot air into the chamber during drying cycles.
- Vacuum Breaker: Prevents formation of accidental vacuum in jacket due to steam condensation.
- Plug Screen: Fitted in Chamber, prevents the Chamber from clogging with lint and sediment.
- Dial Thermometer: Indicates the working temperature in the Chamber accurately.
- Pressure Gauge: Indicates the pressure of steam in the jacket.
- Compound Gauge: Indicates the vacuum and pressure in the chamber.
- A Pocket (For Thermograph): The provision to fit the bulb for the temperature recorder.
- Steam Trap and Check Valve: Fitted into the discharge line for automatic removal of residual air and condensate to give optimum sterilization temperature.
- Boiler (Steam Generator): Fitted to underside of shell. Boiler shall be fitted with:
- Immersion type heating elements suitable to the requirement..
- A low water protection for heaters provided to cut off electricity supply to heaters through a float level switch and magnetic air break contactor if the water level runs below heater level. Feed water System to feed water in to the Boiler as and when water level goes down.
- Water level gauge glass indicates level in boiler (capable of self-locking in case of breakage).
- Water inlet with non-return valve and drain valve etc.
- Pressure controls switch to control and keep pressure constant in the jacket.

- Boilerplate of Stainless Steel AISI-316 & Nuts and bolts shall be of stainless steel.
- An extra pressure gauge and safety valve is provided in the boiler.
- In addition, equipped with Toggle Switch and indicating red & green Lamps.
- Tray (Stainless Steel): Provided in the Chamber of suitable size.
- The whole unit shall be mounted on a tubular pipe stand duly painted with best heat resisting paint.
- The unit shall be made as per I.S.I. Specification No. IS:3829 (Part 1) and bear I.S.I. Mark IS 3829 (Part 1).
- **Secondary Sterilization system should be incorporated with the Waste Autoclave for sterilization of infected steam condensate of the Waste Autoclave.**

Accessories:

- Audio Visual Alarm with Timer.
- Thermograph with 500 recording charts.
- Rack with Trays complete SS-316.
- Digital Temperature Controller with probe.
- Digital temperature indicator with 2 temperature probes.
- Water Softener Plant.
- Additional manual arrangement for filling Boiler with solution to descale boiler.

3. Medical Waste Shredder (Low Speed)

- Should be of robust design with minimum maintenance requirement.
- Should be properly designed and covered to avoid spillage and dust generation. It should be designed such that it has minimum manual handling.
- The hopper and cutting chamber of the shredder should be so designed to accommodate the waste bag full of biomedical waste.
- The shredder blade should be highly resistant and should be able to shred waste sharps, syringes, scalpels, glass vials, blades, plastics, catheters, broken ampoules, intravenous sets/ bottles, blood bags, gloves, bandages etc. It should be able to handle/ shred wet waste, especially after microwave/ autoclave/ hydroclave.
- The shredder blade should be of non- corrosive and hardened steel.
- The shredder should be so designed and mounted so as not to generate high noise & vibration.
- If hopper lid or door of collection box is opened, the shredder should stop automatically for safety of operator.
- In case of shock- loading (non- shred able material in the hopper), there should be a mechanism to automatically stop the shredder to avoid any emergency/ accident.

- In case of overload or jamming, the shredder should have mechanism of reverse motion of shaft to avoid any emergency/ accident.
- The motor should be connected to the shredder shaft through a gear mechanism, to ensure low rpm and safety.
- The unit should be suitably designed for operator safety, mechanical as well as electrical.
- The shredder should have low rotational speed. This will ensure better gripping and cutting of the biomedical waste.
- The discharge height (from discharge point to ground level) should be sufficient (minimum 3 feet) to accommodate the containers for collection of shredded material. This would avoid spillage of shredded material.
- The minimum capacity of the motor attached with the shredder should be adequate enough for carrying out for **10Kg/hr** and should be three phase induction motor. This would ensure efficient cutting of the bio-medical waste as prescribed in the bio- medical waste (Management & handling) Rules.
- Anti-vibration mounting should be provided
- Control panel should be provided with auto stop/reversing
- Emergency stop should be provided for safety
- Limit switch should be provided to switch off the Shredder if hopper lid of the door of the Collection Box is opened

4. Needle destroyer

- Should incinerate the needle using low voltage electrical current.
- It should reach a temperature of 1600-1700°C to turn the needle into ash.
- The process should be rapid taking 1-2 seconds
- There should be no visible sparking or arcing
- After incineration the needle debris should be contained in a built in receptacle/container which may be disposable or reusable
- Should have a cutter to cut the nozzle of the syringe with minimal agitation
- Should destroy or deform the needle and syringe by mechanical means
- The cutting blades should be of the best quality

5. Waste Collection Containers

The waste collection containers shall be of steel construction with synthetic enamel paint of approved colours.

The waste collection containers must have foot operated lids.

The approximate sizes of the collection containers shall be as per the BOQ

The waste collection containers should have Bio-medical hazard symbol printed on them

The colours of the waste collection containers should be as per the July 1998, Gazette Notification of Ministry of Environment & Forest for identification of category of wastes that shall be collected in to it.

6. Waste Collection Bags

The waste collection bags shall be of yellow, red and blue/white translucent colours for collection of different categories of wastes and black for collection of routine waste as per the recommendations of the Ministry of Environment and Forests in their latest gazette notification.

The yellow coloured waste collection bags for the collection of incinerable waste should be made of non chlorinated plastic so as to facilitate incineration of waste without having to open the bags

The bags of red, blue/white translucent colours should be safe for autoclaving and should be capable to withstand high temperatures and pressure during autoclaving.

All the bags must contain the Bio-hazard symbol printed on it.

The sizes of the bags should be such that the can be placed inside the waste collection containers for the collection of waste.

The bags should be supplied with non reversible locking strips at no extra cost.

7. Transportation Trolley

- The container should be made of sturdy plastic material resistant to acid, alkali and chemicals and should be constructed of suitable capacity.
- Should be designed and constructed so that they do not have sharp edges.
- Container must be detachable and there must be provision for washing the container
- Should be easy to clean, disinfect and drain.
- Should be covered with a sturdy plastic lid attached with hinges and latch facilities so that biomedical waste bags are not exposed to environment.
- Iron body frame of trolley MS angle.

- Should be able to contain any leakage from the damaged containers.
- The waste should be easily loaded, secured and unloaded.
- Should hold minimum number of bags as per the requirement.
- Should be color coded yellow/blue/white/black and have biohazard sign and name of the hospital.
- Should have four wheel drives, two wheel movable and two fixed. Should be rubber bounded to cast iron long life, high load capacity and road grip size 6 inch with sealed ball bearing.
- Should have wheel locks to prevent the wheel barrow from rolling on its own.

8. INDUSTRIAL WEIGHING MACHINE Capacity -300 Kg.

Electronic weighing machine with digital display. Electronic weighing scales of standard make to weigh upto 300 kg. The certificate from Weights & Measures Dept. is to be attached with the machine, duly certifying the serial no. complete with accessories as per specification. Make- Atco/Sanchit

9. IN ADDITION TO THE ABOVE, FOLLOWING TURNKEY WORKS FOR INSTALLATION AND COMMISSIONING OF BMWs ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR :

- **Environmental clearance** from the Regulatory Body/Local authority
- Contractor must take into consideration in its bid, costs to be incurred for any additional work pertaining to Civil, Electrical, Plumbing, Sanitary and any other protections relevant as per State/Central Govt. regulation/local authority of Office Furniture, Servo stabilisers, U.P.S. etc. required for successful installation testing and commissioning of the system and the offered price should include all such costs, each Schedule is to be considered a package in itself and contractor to execute the order package on a “turn key basis”.
- **Plumbing, Laying of GI water pipe line** with necessary taps, joints, elbows, Unions, Tees and valves of GI made and IS-1239 standard (Latest version) to various supply points in the BMW Room from single point supply(Provided by the hospital).
- Installation and commissioning of **Electric distribution panel** with all switchgears, wiring and controls etc of L&T/ Siemens/ ABB/GE or Schneider make) for distribution of power supply to various load points in the BMW Room from single point power supply(Provided by the hospital). **Earthing system** of control panel and other electrical instrument and accessories in the BMWs area **as per standard guidelines of BIS(Latest edition)**. All cable trenches and railings should be made wherever required.
- Providing fixing of **Electrical Gadgets** like ELCB, MCB, Fluorescent light and Light Points, Power points, Fans, Cool air Fans, Exhaust fan etc in the BMW room.

- Number of fans, **power point**, bulbs/tube light. Apart from these supplies to the individual equipments with ELCB & MCB in the BMW room.
- Installation of **MCB, ACB, ELCB & OCB** of Havell/Siemens/L&T/Schneider etc for LT Control Panel for BMW.
- Installation of all **electrical cabling** must be of IS: 1554 (As per latest amendment) standard and wiring as per IS: 732 standard and proper earthing of all BMW equipments and other electrical instrument and accessories in the BMW room as per standard guidelines of BIS.
- Necessary Ducting of GI sheet with grills at the suitable places for **supply of fresh** at the working place inside the BMWS and **exhaustion of hot air** for creating comfortable working zone within the BMWS. Motors shall be of continuous duty S1 type of IS: 325 standard (Latest version) and of Kirloskar/NGEF/Siemens/ABB/GEC/ Crompton Greaves make.
- Construction/laying of **Draining/Sewer system** from all the equipments/Sinks to the main drain (outside the BMW) with Grating, proper trap and flow system and tapping.
- Arrangement for requisite **Fire Fighting** system (Fire Extinguishers of suitable capacity at the appropriate places for BMWS including approval from or as per State/Central Govt. regulation/local authority/Statutory body if required.
- **Water Softener** (ION Exchange/Thermax make) of suitable capacity for BMWMS

In addition to the above mentioned equipment/appliances, if the contractor thinks it necessary to include any other equipment/appliances, accessories etc. for the BMWS then that may be provided after approval from Engineer in-charge.

The sizes are approximate. Minor variations in sizes shall be acceptable subject to prior approval of the Engineer.

APPROVED MAKES FOR BMWS

1.	Air Blower	SWAM/ EVEREST/ KAY/Beta
2.	Blower/Pump/ Motor	KIRLOSKAR/ NGEF/ SIEMENS/CROMPTON/ABB
3.	Compressor	EMERSON/ TECHUMSHAH/COPELAND/DANFOSS
4.	Cable	SKYTONE/KEI/UNIVERSAL/NATIONAL/RR CABLE
5.	Aeration System	NORTON/ UEM/ V.K.ENVIROTECH/MM AQUA
6.	Butter Fly Valve	AUDCO/ KEYSTONE/ KSB/CRI/Castle

7.	Control Panel	L & T/ SIEMENS/ SCHNEIDER
8.	Valve	LEADER/ ZOLOTO /CRI/Castle
9.	PVC Pipe Class III with Fitting	FINOLEX/ SUPREME/ PRINCE/ ORI-PLAST
10.	G.I. / M.S. Pipe Heavy Class	TATA/ JINDAL/SAIL /SURYA PRAKASH/HSL/ITC
11.	MCCB/Contactor/Relay	L&T/ABB/SIEMENS/SCHNEIDER
12.	Pressure Gauges	H.GURU /FIEBIG
13.	Stainless steel	TATA/SALEM/JINDAL/MUKUND/ BHAYANDER/ AMBICA
14.	GI Sheets	TATA/SAIL/JINDAL/BHUSHAN STEEL
15.	Aluminium Sheet	BALCO/NALCO/HINDALCO
16.	Grilles/Diffusers	RAVISTAR/CARYAIRE/ MAPRO/DYNACRAFT

Note :

- **The contractor shall be responsible for the complete works including submission of working drawing and walk through view.**
- **The contractor should provide complete Operation Manual/Equipment manual/Service manuals for all systems and subsystems.**
- **The contractor should provide Final electrical safety test, system test and calibration to be done by authorized person with test instruments.**
- **All electrical accessories like cable wire, electrical outlets, switches etc supplied by the contractor should be fire proof of reputed make, certified for electrical safety.**
- **Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of HSCC.**
- **The contractor should provide test certificate for all materials and equipments used for BMWMS**
- **Training of personnel of the Institute should be 30 days at least by the contractor.**
- **The contractor should prepare and submit layout plan to HSCC for approval before beginning of supply and installation.**
- **The contractor should prepare and submit layout plan as well as As-Built drawing for Electrical Wiring, Electrical Distributional Panel, Plumbing, Fire Fighting System, Air Washing and Ventilation and Drain line to HSCC for approval before beginning of supply and installation and As-Built drawing after installation.**
- **Environmental Clearance from the Local Authority/Regulatory Body is the sole responsibility of the Contractor.**