

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

**DISTRICT GENERAL HOSPITAL, DIKOYA
SRI LANKA**

Tender

for

**Supply Installation Testing & Commissioning of Medical Gas
Manifold System at District General Hospital, Dikoya, Sri Lanka**

VOLUME – IV

TECHNICAL SPECIFICATION

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(Consultants & Engineers for Mega Hospitals & Laboratories)
E - 6 (A), Sector - I, NOIDA (U.P.) - 201 301 (INDIA)

PHONE : 91-2542436, 2542440 FAX : 91-11-91-2542447
E- mail : www.hsccltd.co.in

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TECHNICAL SPECIFICATIONS OF MEDICAL GAS MANIFOLD SYSTEM

Scope of Work : Supply, Installation, Testing, Commissioning of Medical Gas Manifold System on turnkey basis and handover to the District hospital of Dickoya, Srilanka including services of Defect liability period as per contract.

1.0 OXYGEN SYSTEM

1.1 Oxygen Manifold: Main with Middle Frames

Oxygen Manifold: Emergency with Middle Frames

The Manifold has been configured for 2 x 12 nos. of Oxygen Cylinders and is suitable to withstand a pressure of 145 Kg/cm², along with high-pressure copper annealed tail pipes with end Brass adapter suitable for Oxygen Cylinders and manifold.

Top frame comprising of high pressure copper pipes of size 1/2" NB x 15swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames has been provided to fit both round and flat bottom cylinders safely. The manifold has been tested (hydraulically) at 3500 psig and necessary test certificates accompany along with the supply.

1.2 Automatic Oxygen Control Panel with changeover Alarm

The Oxygen Control Panel shall be of microprocessor based and preferably Digital Display Type. Pressure reduction shall be in two stages. Panel shall be integrated with pressure gauges inside panel on downstream of pressure regulator. Panel shall be fitted with standby line regulator. Line regulators shall have pressure relief mechanism for testing and servicing purpose.

Panel shall be Fully Automatic and shall switch over from "Bank in Use" to 'Reserve Bank' without fluctuation in delivery line pressure and without the need of external electrical power. After the switch-over, the "Reserve Bank" shall become the "Bank in Use" and the "Bank in Use" shall become the "Reserve Bank". The Control Panel will be powered by a microprocessor. The unit shall be compact and enclosed in [NEMA 3](#) enclosure.

A Microprocessor circuit board assembly shall provide a relay output to give indication when or just before the manifold switches from one bank of cylinders to another. The switch over shall be mechanically controlled, not electrically.

To avoid excess pressure being supplied to the distribution system, a pneumatically relief valve for the line regulator shall be incorporated. An intermediate pressure relief valve shall be installed between the high-pressure regulators and the line delivery regulators.

The control panel incorporates six coloured LED's, three for the Left Bank and three for the Right Bank: Green for Bank in use, Amber for Bank ready and Red for Bank empty. Both the Left and Right bank pressures and the main line pressure should be displayed on the front door of the cabinet by means of LED's. All pressure transducers, micro switches, and display LED's shall be pre-wired to an internal microprocessor circuit board.

All components inside the Control Panel like Pressure Regulators, piping and control switching equipment shall be cleaned for Oxygen Service and installed inside the cabinet to minimize tampering with the regulators or switch settings.

The Control Panel should be made to provide Heavy Duty with a Flow Capacity of over 1500 lpm at 60 psig.

- 1.3 Emergency Oxygen system has been configured with 4-cylinder oxygen manifold along with a High Pressure Regulator which will be mounted on the Emergency Manifold System for reducing the cylinder pressure suitable to the line pressure.

Note- To reduce the risk of medical oxygen system from contamination due to ignition of fluorinated polymer materials, only Non Halogenated Polymer materials has been used in the Non Return Valves and high pressure side of the pressure regulator of the manifold system.

2.0 NITROUS OXIDE SYSTEM

2.1 Nitrous Oxide Manifold: Main with Middle Frames Nitrous Manifold: Emergency with Middle Frames

Nitrous Oxide Manifold for 2 + 2 nos. of cylinders is suitable to withstand a pressure of 145 Kg/cm², along with high-pressure copper annealed tail pipes with end Brass adapter suitable for N₂O Cylinders and manifold.

Top frame comprising of high pressure copper pipes of size 1/2" NB x 15swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle frames has been provided to fit both round and flat bottom cylinders safely. The manifold has been tested (hydraulically) at 3500 psig and necessary test certificates is accompany along with the supply.

2.2 Automatic Nitrous Oxide Control Panel with changeover Alarm

The Nitrous Oxide Control Panel shall be of microprocessor based and preferably Digital Display type. Pressure reduction shall be in two stages. Panel shall be integrated with pressure gauges inside panel on downstream of pressure regulator. Panel shall be fitted with standby line regulator. Line regulators shall have pressure relief mechanism for testing and servicing purpose.

Panel shall be Fully Automatic and shall switch over from “Bank in Use” to ‘Reserve Bank’ without fluctuation in delivery line pressure and without the need of external electrical power. After the switch-over, the “Reserve Bank” shall become the “Bank in Use” and the “Bank in Use” shall become the “Reserve Bank”. The Control Panel will be powered by a microprocessor. The unit shall be compact and enclosed in NEMA 3 enclosure.

A Microprocessor circuit board assembly shall provide a relay output to give indication when or just before the manifold switches from one bank of cylinders to another. The switch over shall be mechanically controlled, not electrically.

To avoid excess pressure being supplied to the distribution system, a pneumatically relief valve for the line regulator shall be incorporated. An intermediate pressure relief valve shall be installed between the high-pressure regulators and the line delivery regulators.

The control panel incorporates six coloured LED's, three for the Left Bank and three for the Right Bank: Green for Bank in use, Amber for Bank ready and Red for Bank empty. Both the Left and Right bank pressures and the main line pressure should be displayed on the front door of the cabinet by means of LED's. All pressure transducers, micro switches, and display LED's shall be pre-wired to an internal microprocessor circuit board.

All components inside the Control Panel like Pressure Regulators, piping and control switching equipment shall be cleaned for Oxygen Service and installed inside the cabinet to minimize tampering with the regulators or switch settings.

The Control Panel should be made to provide Heavy Duty with a Flow Capacity of over 700 lpm at 60 psig

- 2.3 A High Pressure Regulator will be mounted on the single cylinder Emergency Manifold System for reducing the cylinder pressure suitable to the line pressure.

3.0 COMPRESSED AIR SYSTEM

3.1 Compressed Air System

Medical compressed air system comprising of **two nos.** of Oil-free, Air cooled, Reciprocating Air Compressors each having 15 HP Electric Motor with 57 CFM capacity at 8.5 Kg/sq.cm mounted with 1500 litres Receiver Tank and Filter, Non-Return Valve, Isolation Valves, Air Dryer and Pressure Reducing Station along

with interconnecting piping to take care of the requirement of desired no. of air outlets. (Make Anest Iwata/Ingersolrand)

Type of Compressor :

Air Cooled Oil Free Reciprocating Compressors along with TEFC squirrel cage induction motors (V-belt driven). The Compressed Air System has **2 identical Air Compressors** (while one compressor run when the other one remains as stand by).

Air Dryer Type :

Heatless Desiccant Type – 1 no. (Having capacity to take care of the hospital demand) suitable for above compressors.

Pressure Reducing System :

The System should have 2 nos. Pressure Regulators (one in working & one stand-by) to reduce air pressure 4.2 Kg./ cm² required for Medical Air pipeline.

3.2 Auto Drain for Air Receiver should be provided.

3.3 **3-Stage Breathing Air Filters :**

The breathing air filters has maximum contaminant removal efficiency with minimum pressure drop. The filtration system conform to breathing air filtration as per ISO 8573 Ch – I Standard.

4.0 VACUUM SYSTEM

4.1 Vacuum System

To design, fabricate, test & install medical vacuum system comprising of **2 nos.** of System of Lubricated, Air-cooled, Reciprocating Vacuum Pumps each having capacity 110 CFM, 7.5 HP Motor, common 2000 litres Receiver Tank, Filter, Non-Return Valve, Isolation Valves, Auto Switch Gear to set minimum & maximum operating vacuum and interconnecting piping to take care of the requirements of desired no. of vacuum outlets. (Make- Ingersol Rand/ Anest Iwata)

4.2 Type of Vacuum Pumps :

Lubricated, Air-cooled, Reciprocating Vacuum Pumps along with TEFC squirrel cage induction motors (V-belt driven) The Vacuum System has **2 identical Vacuum Pumps** (while one vacuum pump will run, the other one remains as stand by).

Each Vacuum Pump are complete with Base Plate, Belt Guard, V-Belts, Motor and Starter. The system is of Automatic Start and Stop Type. The Pumps are

connected to a common vertical receiver of 2000 Ltrs capacity. The receiver has a drain valve at the bottom.

Vacuum Bacterial filtration:

Medical Vacuum filters are used for removal of bacteria & other contamination from the suction side of vacuum pumps, preventing infection of pump and the atmosphere.

These elements are pleated construction giving a high surface area and long operational life. The efficiency exceeds the 0.005% penetration specified in HTM2022 for infectious disease unit.- i.e. complete bacterial removal.

Element is fitted in an aluminum housing suitable for various capacities. These are internally protected against corrosion by an alocrom treatment. The inner & outer surfaces of the housing are epoxy coated. Complete assembly is fitted with a sterilisable drain flask with isolation valve for removal of liquid if any. Differential pressure indicators are provided to monitor the status of element.

5.0 GAS OUTLET POINTS

Double Lock Outlet

Outlets have been manufactured with a 165 mm length, Copper inlet pipe stub which is silver brazed to the outlet body. Body has been of one piece brass construction. For positive pressure gas services, the outlet has been equipped with a primary and secondary check valve and the secondary check valve has been rated at minimum 200 psi in the event the primary check valve is removed for maintenance.

The outlet assembly has separate colour coding for each service and accepts only corresponding gas specific adapters.

All outlets has been cleaned and de-greased for medical gas service, factory assembled and tested.

The medical gas outlets have been of quick connecting and wall mounted modular type.

6.0 COPPER PIPE

Solid drawn, seamless, de-oxidized, non-arsenical, half-hard, tempered and de-greased **copper pipe** conforming to BS : 6017, 1981, Table 2 (Cu - DHP) and manufactured as per BS : 2871, 1971 Part I, Table X (or as per BSEN 1057). All medical graded copper pipes are de-greased & delivered capped at both ends. The pipes are accompanied with manufacturers test

certificate for the physical properties & chemical composition. Copper pipe also has third party inspection certificate from **Lloyds'** Register Services.

The Pipe Sizes used are from among as under :

Pipe OD (in mm)	Thickness (in mm)
12	0.7
15	0.9
22	0.9
28	0.9
42	1.2
54	1.2
76.1	2

Copper fittings has been made of copper and suitable for a steam working Pressure of 17 bar and especially made for brazed socket type connections. All copper fittings are conform to BS 864/EN 1254.

INSTALLATION & TESTING

Installation of piping is carried out with utmost cleanliness. Only pipes, fittings and valves which has been degreased and brought in polythene sealed bags has been used at site. Pipe fixing clamps has been of non ferrous or non-deteriorating plastic suitable for the diameter of the pipe.

All pipe joints have been made using fluxless brazing method. All joints of copper to copper and are brazed by silver brazing filler material without flux.

Adequate supports have been provided while laying pipelines to ensure that the pipes do not sag. The spacing of supports not exceed 1.5 meter for any size of pipe. Suitable sleeves has been provided wherever pipes cross through walls / slabs. All pipe clamps has been non-reactive to copper.

After erection, the pipes has been flushed with dry nitrogen gas and then pressure tested with dry nitrogen / Medical Air at a pressure equal to twice the working pressure for a period of not less than 24 hours. All leaks and joints revealed during testing has been rectified and re-tested till the pressure in pipes stands for at least 24 hours.

All the piping system has been tested in the presence of the engineer or his authorized representative.

PAINTING

All exposed pipes has been painted with two coats of synthetic enamel paint and colour codification has been as per IS : 2379 of 1963.

7.0 ISOLATION VALVES

The **isolation valves** are Non Lubricated Ball type, **suitable for oxygen service**. All valves has been pneumatically tested for twice the working pressure and **factory de-greased** for medical gas service before supply.

8.0 _Valve Box Assembly :

Valve Box are made of Powder Coated M.S. Material.

Valve Box Assembly consist of the following :

- Lever operated quarter turn valve (i.e. 90 degree shut off ball valve- has been manufactured by ISO 9001 company and factory degreased) with brass body and chrome plated brass ball.
- Brass fittings (Nut, Nipples and extruded brass Adapter) KE Type Seat Brass Block for pressure gauge
- 2" Dial gauges (0 - 10 kg/cm², 0 - 760mm Hg)
- Nylon Bush for copper pipes holding with the valve box
- Beeding for box lead
- Lockable cover with breakable glass so that during normal operation access has been by key. But during emergency operation, access by breaking the glass panel.

9.0 ALARM SYSTEM

9.1 The Master Alarm

9.2 Area line pressure alarms

should be as per required locations.

The main alarm and area line pressure alarm (Digital) are micro-processor based which monitor the pressures of medical gases like oxygen, nitrous oxide, compressed air and vacuum levels at a specific area of piped gas system in any hospital. The electronic circuitry has been such that if the pressure / vacuum in the gas pipeline drops below the present limit, the equipment is give an audio-visual alarm. Visual alarm remains active even after pressing of "Mute" button. But it comes to normal condition when gas pressure / vacuum return to normal level.

The equipment has following features:

- Four Channel Microprocessor Controlled Alarm for Pneumatic & Vacuum Services has the following features:
- Digital Display of Line Pressure for all the services with factory calibrated pressure sensors.
- Color coded LED Display of Line pressure status (High – Caution – Normal – Caution– Low)
- Audible Alarm for High & Low pressure condition.
- Test and Alarm Acknowledge (Mute) facility. (Alarm acknowledge(Mute) time span is programmable from 1 to 60 min).
- Programming facility of alarm limits from front panel (Password protected, preferably to has been done through supplier's engineer).
- Facility to connect to remote alarm box by potential free contacts provided in the alarm box.
- Small and compact design. Light Weight (3 kg)
- Imported highly sensitive gas pressure sensors & CE marked power supply.
- Mounted on a powder coated MS box.
- Nut & Nipples are provided for connection with Pneumatic supply line.
- Low voltage internal operation with input power supply of 220V AC.
- Wall mounting facility.
- Low voltage operation for safety
- High / Low indication
- Test facility
- Mute / silence facility

10.0 CEILING PENDANTS

10.1 Rigid Ceiling Pendant

The pendant has been rectangular (365mm x 232mm) and fabricated from stainless steel (18 swg), with all edges and surfaces having polished satin finish. A trim bezel has been provided to trim the column shroud to the finish ceiling. The bezel has been adjustable to compensate for variation in finished ceiling thickness. The column length has been fabricated for specified ceiling height.

The ceiling column structure has been supported from a steel mounting plate furnished with the column. The mounting plate has four, 3/4" diameter holes, one in each corner for attachment to structural ceiling support.

Each pendant has provision for :

Two Oxygen outlets

Two Vacuum outlets

One Nitrous Oxide outlet

One Compressed Air outlet

Two duplex 230 V, 5/15 Amp electrical sockets

Two IV hook

11.0 AGSS (Anesthesia Gas Scavenging System)- (Imported)

VACUUM SYSTEM

The Simplex tank mount design medical vacuum system must include Rotary Vane Dry vacuum pump and associated equipment, one ASME air receiver and one control panel. The only field connections required are system intake, exhaust and power connection at the control panel. All components has been completely pre-piped and pre-wired to a single point service connection.

CONTROL PANEL

The system include a control panel in a NEMA 12 enclosure with externally operable circuit breaker with door interlock, control circuit transformer with fused primary and secondary circuits, H-O-A switch, magnetic starter with 3 leg overload protection, hour meter, motor running light and minimum run timer to prevent short cycle operation.

VACUUM PUMP

The medical vacuum pump operate completely dry with air cooled design, and has been equipped with self-lubricating carbon/graphite vanes with no water requirements. Bearings has been permanently lubricated and sealed.

VACUUM PUMP DRIVE

The Vacuum pump has been direct driven. Torque is transmitted from the motor to the pump through a shaft coupling.

VACUUM PUMP MOTOR

The motor of 1.2 HP capacity has been a continuous duty, 1750 RPM, TEFC NEMA C-face, foot mounted and suitable for 230-440V, 50 hertz, 3 phase electrical service. The pump has the capacity at 19" Hg.

12.0 HP A/S TUBING

High Pressure Tubing for AIR

High Pressure Tubing for vaccum

High Pressure Tubing for vaccum

LP Tubing

13.0 HORIZONTAL BED HEAD PANELS

13.1 Bed Head Panel

- Has been made of High Strength Anodised Aluminium Extrusions with inbuilt single railing.
- The chamber of Medical Gas Outlets has been made of anodized aluminium
- Has been powder coated as per the customer's choice.
- The panel has been designed to have provision to accommodate the following:
 - a). Gas Outlets,
 - b) Electrical Sockets / Switches
 - c). Audio Unit
 - d). Room Lighting
- The railing has been designed to have provision to accommodate the following accessories:
 - a). I V Pole
 - b). Infusion pump / Syringe pump stand
 - c). I V Bottle holder
 - d). Medicine / disposable tray
 - e). Examination lamp
 - f). Reading lamp

14.0 ACCESSORIES:

14.1 BPC Flow meter with Humidifier :

Back Pressure Compensated flow meter is of accurate gas flow measurement with following features:

- Control within a range of 0 – 15 lpm.
- It meets strict precision and durability standard.
- The flow meter body is made of brass chrome plated materials.
- The flow tube and shroud components are made of clear, impact resistant polycarbonate.
- Flow Tube has large and expanded 0 – 5 lpm range for improved readability at low flows.
- Inlet filter of stainless steel wire mesh to prevent entry of foreign particles.
- The humidifier bottle is made of unbreakable polycarbonate material and autoclavable at 121 degree Centigrade temperature.

14.2 Ward Vacuum Units :

Ward Vacuum Unit has been of light weight and compact. The unit consists of-

- A regulator,
- A 600 ml. reusable collection jar, made of unbreakable poly carbonate material and fully autoclavable at 121 degree centigrade
- A wall bracket for mounting the jar assembly on the wall.

The vacuum regulator with instant ON / OFF switch has been infinitely adjustable and has vacuum gauge which indicates suction supplied by the regulator. Safety trap has been provided inside the jar to safeguard the regulator from overflowing.

14.3 Theater Vacuum Units :

The unit has been consisting of two reusable 2000 ml shatter resistant bottle, each made up of poly carbonate material and fully autoclavable at 121 degree centigrade.

The vacuum regulator with instant ON / OFF switch has been infinitely adjustable and has vacuum gauge which indicates suction supplied by the regulator. Safety trap has been provided inside the jar to safeguard the regulator from overflowing.

There are a three way selector switch with an option to operate either

- Left, Right or Both.

All the above items has been mounted on a Metallic Trolley having free moving castor wheels.

15. IN ADDITION TO THE ABOVE, FOLLOWING TURNKEY WORK FOR INSTALLATION AND COMMISSIONING OF MEDICAL GAS MANIFOLD SYSTEM FOR DICKOYA HOSPITAL SRILANKA IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR:

- Bidder must take into consideration in its bid, costs to be incurred for any additional work pertaining to Civil, Electrical, Mechanical and any other protections relevant as per State/Central Govt. regulation/local authority of Srilanka, 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 equipment/system is to be considered a package in itself and contractor to execute the order package on a "turn key basis".
- Providing fixing of **Electrical Gadgets** like ELCB, MCB, Light Points, Power points, etc in the Medical Gas Manifold System.
- 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 Plant Room from single point power supply in the Room(Provided by the hospital).

- Installation of MCB, ACB, ELCB & OCB of Havell/Siemens/L&T/Schneider etc for Control Panel for Medical Gas Manifold System.
- 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 Medical Gas Manifold System and other electrical instrument and accessories in the Medical Gas Pipeline System as per standard guidelines of BIS.
- Arrangement for requisite **fire fighting** for Manifold Room & Plant Room and its maintenance for the contract period

In addition to the above mentioned equipment/appliances, if the contractor thinks it necessary to include any other equipment/appliances, accessories etc. for the MGMS 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 MEDICAL GAS PIPE LINE SYSTEM

- | | | |
|-----|---------------------------------|--|
| 1. | Compressor | INGERSOLLRAND/ANESTATA |
| 2. | Motor | CROMPTON/ABB/NGEF/SIEMENS/KIRLOSKAR |
| 3. | Cable | GLOSTER/UNIVERSAL/NATIONAL/ KALINGA |
| 4. | Electrical Control Panel | L & T/ SIEMENS/ SCHNEIDER |
| 5. | PVC Pipe Class III with Fitting | FINOLEX/ SUPREME/ PRINCE/ ORI-PLAST |
| 6. | G.I. / M.S. Pipe Heavy Class | TATA/ JINDAL(HISSAR)/SAIL /SURYA PRAKASH |
| 7. | MCCB/Contactor/Relay | L&T/ABB/SIEMENS/SCHNEIDER |
| 8. | Pressure Gauges | H.GURU /FIEBIG |
| 9. | Stainless Steel | TATA/SALEM/JINDAL/MUKUND/BHAYANDER/ AMBICA |
| 10. | Aluminium Sheet | BALCO/NALCO/HINDALCO |
| 11. | Copper Pipe | MEHTA/MAXFLOW |

Note :

- **The bidder should attach Technical Compliance item wise with respect to the above technical specifications and turnkey work along with Printed catalogues and Manufacturer's Authorization in the techno-commercial bid.**
- **The contractor shall be responsible for the complete works including submission of working drawing and walk through view.**
- **Bidder should provide complete parts manual/Service manuals for all systems and subsystems.**
- **Final electrical safety test, system test and calibration should be done by authorized person with test instruments.**
- **All electrical accessories like cable wire, electrical outlets, switches etc, 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 MGMS**
- **Training of personnel of the Institute should be 15 days at least**
- **The contractor should prepare and submit layout plan for to HSCC for approval before beginning of supply and installation.**

OUTLET DISPOSITIONS AT DISTRICT HOSPITAL, DICKOYA, SRILANKA

			Oxygen	Nitrous	Air	Vac.	AGSS	Pendant
Lower Ground Floor								
	Minor OT		2	1	2	2	1	
	Procedure/ Endoscopy		1	x	1	1	x	
Upper Ground Floor								
	Minor OT		4	2	4	4	2	1
	Recovery		1	x	1	1	x	
	Burns Unit		1	x	1	1	x	
1st Floor								
	ICU Beds		20	x	10	20	x	
	OTs		4	3	4	4	3	3
	Pre-Ops		4	x	x	4	x	
	Post Ops		8	x	8	8	x	
2nd Floor								
	Labour Room		4	2	2	4	x	
	Delivery Room		2	2	2	2	x	
	Neo-natal ICU		8	x	8	8	x	
	Labour OT		2	1	2	2	1	1
	Semi-Pvt Wards	(4x2 beds)	8	x	x	8	x	
	Pvt Wards	(2x1 beds)	2	x	x	2	x	
	Gen.Ward	(5x8 beds)	30	x	x	30	x	
	TOTAL							
3rd Floor								
	Semi-Pvt Wards	(4x2 beds)	8	x	x	8	x	
	Pvt Wards	(2x1 beds)	2	x	x	2	x	
	Gen.Ward	(5x8 beds)	30	x	x	30	x	
	TOTAL		141	11	45	141	7	5