Procurement procedure & other details for 1.5 Tesla MRI System for Radiology Department, KEM Hospital.

I) Technical Specifications for 1.5 Tesla MRI System for Radiology Department, KEM Hospital No. KEM/197/TDRE-III.

II) Commercial : (Cost Estimates)

III) Disclaimer

For Your Feedback Please Click Here.

Or

You can mail us at deshikem@gmail.com with subject as KEM/197/TDRE-III. 1.5 Tesla MRI

Please Read Disclaimer Section.
Specifications for 1.5 Tesla MRI System for Radiology Department, KEM Hospital
No. KEM/197/TDRE-III.

1. **MAGNET:**
   a. Latest, Compact and patient friendly 1.5 Tesla actively shielded supercon.
   b. Exclusive supercon compensation for heavy iron objects moving in vicinity.
   c. Cryocooler (inbuilt). Typical Helium consumption <= 0.1 ltr/hr.
   d. Homogeneity by VRMS method to be better than +/- 1.0 ppm (24 angles and 24 planes) or better over 48 cms volume or more.
   e. 70 cm bore diameter with total Magnet length of 170cm or less. Mention the effective tunnel length.
   f. Well ventilated and illuminated; with in-built 2 way intercom system for communication with the patient.
   g. MR compatible patient headset for music in gantry for administering auditory paradigms for functional MRI (fMRI).

2. **ACTIVELY SHIELDED GRADIENT:**
   a. Strength: 45 mT/m (actual, not effective) or higher true usable peak gradient amplitude in all 3 axes for high quality imaging at a true usable peak at Slew rate of 200 mT/m/ms (actual, not effective) or higher to perform all fast sequences at 100% duty cycle. The peak gradient specifications must be usable at max FOV of 48 cms or more (preferred). Water cooled gradient amplifiers should be offered. Acoustic noise reduction features should be available to facilitate increased patient comfort.
   b. Min TE in Gradient Echo (both 2D and 3D in 128 matrix) : 0.5 m Sec or lower (better)
   c. Min TR in Gradient Echo (both 2D and 3D in 128 matrix) : 1.2 mSecs or lower (better)
   d. Max ETL : 200 or better in full fourier transformation
   e. Min Slice thickness 2D : 0.5 mm or lower
   f. Min Slice thickness 3D : 0.1 mm or lower
   g. Max number of phase as well as frequency encoding steps (Acquisition Matrix ) in both 2D and 3D should be 1024x1024.

3. **PATIENT BED:**
   a. Travel : atleast 200 cm
   b. Halogen / Laser light: for accurate positioning
   c. Return-to-scan plane function : for easy administration of contrast.
   d. A second dockable table or trolley with second MR tabletop to be offered for preparing the next patient in patient wait area for higher patient through-put.

2. **RF AMPLIFIER AND RECEIVER:**
   a. Fully digital, solid state Transmit with output power of 15 kW or higher at 100% efficiency
   b. Accurate, flexible on-the-fly generation of gradient and RF waveforms.
   c. At least 32 dedicated receiver channels with Receiver Bandwidth of 1 MHz per channel or higher for superior RF performance. The receiver to support 8 or more elements of PA coils, compatible with parallel imaging techniques like iPAT2, ASSET, SENSE etc., with Scan
time reduction factors of at least up to 6 or more in 2D and 3D sequences (higher true scan time reduction factors in 2D and/or 3D will be given added weightage)
d. Integrated preamplifiers with each coil shall be supplied.
e. Multiple coil connection with active coil decoupling preferred.

1. **WORKSTATION COMPUTER SYSTEM:**

A separate state of the art workstation with identical post processing capabilities as in main console such as: advanced 3D Segmentation, BOLD processing, Color maps of perfusion TTP maps, fMRI analysis, Quantitative Magnetization Transfer analysis, qFLOW packages, fiber tractography, stitching / pasting of multi-station studies, spectroscopy analysis, cardiac analysis, 2D fast Fourier with Image Reconstruction times of 1000 images/sec or higher at 256 x 256 matrix in full FOV to be supplied.

a. Fast and Powerful Computer, 64 bit word length or better.
   i. CPU: core i7, min 3 GHz clk, at least 5 GB DDR RAM, 500 GB HDD, DVD±RW drive, with latest licensed OS.
   ii. Monitor: 24” or more, medical grade flat panel monitor.
   iv. Mouse: optical, 2 keys with scroll.
   v. Printer: Color Laser Printer.
b. 1000 number of DVDs, 4.7GB capacity to be supplied.

1. **COILS:**
a. High Quality Quadrature/ Circular Polarized (CP) Body Coil (integrated to magnet).
b. Head Coil for imaging and spectroscopy should be offered. Head Coil 8 or higher channels
c. PA Neurovascular 8-channel or higher array coil. Compatible with Parallel Imaging Technique for scan time reduction factor of 4 or better in both 2D and 3D.
d. Quadrature /CP Array Phased Array Spine array coil for Cervical, thoracic and lumbar spine imaging. Spine coil to be compatible with parallel imaging. It must be possible to combine parallel imaging in Lumbar and Thoracic spine imaging.
e. Total neurovascular examination without repositioning the patient by combining the Neurovascular coil and Spine coil.
f. Dedicated coils for Shoulder (4 Ch or better), Knee (8 Ch), Wrist (4 Ch), Breast (Ch to be compatible with biopsy equipment) and small flex coil (4 Ch) with parallel imaging factor 2 or better. Breast coil should have MR guided biopsy equipment.
g. 16 channel or more PA/Body Coil compatible with Parallel Imaging Technique for scan time reduction factor of 4 or better in both 2D and 3D for peripheral angiography.
h. Dedicated 32 channel cardiac/ body coil.
i. Coils with Built-in preamplifier in each coil to ensure high SNR (preferred)
j. Suitable coil for high quality peripheral angio in multi-station angiography study using parallel imaging.

1. **OPERATOR CONSOLE:**

a) The console computer system shall be capable of acquisition and processing of MRI generated data such as: advanced 3D Segmentation, BOLD processing, Color maps of perfusion TTP maps, fMRI analysis, Quantitative Magnetization Transfer analysis, qFLOW packages, fiber tractography, stitching / pasting of multi-station studies, spectroscopy analysis, cardiac analysis, 2D fast Fourier with Image Reconstruction times of 1000 images/sec or higher at 256 x 256 matrix in full FOV to be supplied.

The computer shall be as under or better.
i. CPU: core i7, min 3 GHz clk, at least 5 GB DDR RAM, 500 GB HDD, DVD±RW drive, with latest licensed OS.
ii. Monitor: 24” or more, medical grade flat panel monitor.
iv. Mouse: optical, 2 keys with scroll.
v. Printer: Color Laser Printer.
vi. 19” or higher, High Resolution Medical grade LCD Monitor with 1280x1024 matrix display.

b) Two way intercom system for patient communication

1. PATIENT COMFORT ACCESSORIES:
   a. Soft mattress with head rest, Knee support, positioning wedges, Set of soft velcro immobilization straps and MR compatible sandbags.
   b. Soft, Vacuum operated patient positioning Pads.
   c. Hand held nurse call device.

1. SOFTWARES :
   a. Spin Echo (SE); Modified Spin Echo (MSE); Fast Gradient Echo (FGRE), Inversion Recovery (IR) and mixed SE-IR.
   b. Dynamic Study for pre and post contrast scans, Time intensity studies (Wash in and Wash out) and kinetics.
   c. Fast Spin Echo Package which generates superb images with conventional SE contrast in scan times typically 10 time shorter for faster MRCP applications. Fast Recalled Spin Echo technique for better fluid contrast should be available.
   d. Complete Angio Software package including both 2D and 3D Angios with gated inflow to suppress artifacts from retrograde flow and pulsations.
   e. Angio technique without using contrast agent for peripheral angios, with cardiac gating and subtraction.
   f. Fast Gradient Echo technique,2D and 3D mode, ideal for contrast agent wash-in and wash-out studies. True FISP, Fiesta 2D/3D, 2D/3D bFFE or equivalent must be supported for high contrast, flow independent imaging capability.
   g. Single and Multi Shot EPI (Echo Planar imaging). High resolution multi shot EPI with real time motion detection and correction capabilities would be an added advantage. (Propeller, 2D/3D PACE, Phase Trak or equivalent)
   h. Multi shot EPI sequences for high SNR, full volume coverage for perfusion and BOLD imaging with real time motion detection and correction techniques.
   i. Single-shot EPI based diffusion with ADC maps on console, perfusion with TTP color maps and functional imaging including processing (statistical maps) and real time fMRI studies.
   k. Diffusion for kidney, muscle, heart( solid organs) including whole body diffusion
   l. Cardiac Morphology, anatomical, multi-slice perfusion and viability ultrafast, free-breathing examinations and functional imaging including VCG gating and 2D and 3D True Fisp, bFFE/bTFE, 2D and 3D FIESTA and FIESTA C to be offered. Real time interactive imaging capability to be offered to be able to manipulate the scan parameters on the fly.
   m. Flow Quantification for measurement of velocity in real time including cardiac flow assessment should be possible
   n. Single slice, Multiple single slice, Multiple slice, Multiple stack, Radial / Spiral stack and 3D acquisitions for all applications.
o. Retrospective gating for cardiac imaging capabilities including Cine display for cardiac anatomy studies
p. Acquisition Resolution from 64 x 64 upto 1024 X 1024 matrix.
q. Artifact suppression for Respiratory, motion, moving blood etc.,
r. Fat sat, Chemsat for high quality images. Offer features to offer high quality Spine, whole spine imaging, fat suppressed large FOV body imaging including free breathing techniques, musculoskeletal and good off center imaging feasible on 1.5T.
s. MULTITASKING : During scan operators console may be used for any viewing, post processing, archiving or hardcopy
t. Proton Spectroscopy with Single as well as Multi voxel Spectroscopy including color metabolite maps on main console. Single coil for both Spectro imaging and routine neuro imaging. Prostrate, Liver and Breast spectroscopy including suitable coil to be quoted. 2D and 3D SI should be offered.
u. Fluro Triggered MRA/ Bolus Track / Care Bolus or equivalent and Smart Step/ Mobitrac or equivalent for automated lower peripheral angiography with techniques for avoiding venous enhancement should be offered. 4D CE MRA techniques like TRACS, TRICKS XV, Syngo TWIST or equivalent to be offered.
v. Techniques for bilateral sagittal breast imaging including axillary coverage with suitable coils should be offered with Parallel imaging capability (BLISS, VIBRANT XV or equivalent)
w. System should be offered with SENSE / SMASH / I-PAT Plus/ ASSET/GRAPPA or equivalent technique with up to factor 4 or better in 2D and 3D of real acquisition time reduction in all sequences. Please specify compatibility with sequences, Scan techniques and gating techniques clearly.
x. High resolution whole body Imaging for metastases screening/ CE angios in one go (single automated table movement for entire 6 ft or higher virtual z-axis FOV) without coil change or interruption in scan for T1, T2 and IR contrasts up to patient height of 6 ft at least with seamless stitching of images in one click on the main console for a single virtual FOV of whole body coronal images is preferred.
y. Motion Correction Techniques such as BLADE, Multivane, Propellor for neuro as well as other applications should be offered
z. THRIVE, LAVA XV, VIBE for multi-phasic liver studies to be offered
aa. Isotropic 3D T2 weighted imaging which can be reconstructed in any desired plane.

1. **FUNCTIONAL MRI:**

A fully integrated paradigm generator with MR console to be offered as standard for functional MRI. It should have minimum 30” LCD screen with 2500X1400 resolution with flexibility to be positioned at multiple places in the exam room. It should have Head phones, Button response units, corrective lenses, Computer with paradigm software, 15” touch screen display for operator, fMRI software pack for visual, motor, auditory and language. System should be compliant and compatible with all DICOM and HL7.

11) UPS cum Power Conditioner for the entire system including dry chemistry imager to be supplied to back up the system for atleast 15 mins.

12)Chiller for the cryocooler and gradient amplifiers.

13) RF Cabin with complete interiors including wall finish, flooring, false roofing, high quality room lighting, A/C ducting, Gas Pipelines and Top up Helium during handing over.

1. **MRI COMPATIBLE ANAESTHESIA WORKSTATION**
a. Should be three gas Anaesthesia workstation for use in MR environments in operating, induction and recovery rooms. It should be able to use in MRI scanner rooms with magnet of 1.5 tesla by fringe field strength of 40 mtesla or less. (40mtesla = 400 gauss)
b. Should have an integrated ventilator for infants to adults and integrated colour TFT display for airway pressures, volume and oxygen monitoring.
c. The machine should be suitable for low and minimal flow anesthesia application with compliance compensation of breathing circuit, fresh gas flow compensation/ decoupling.
d. The flow delivery should be electronic for ease of use and electronic data transfer.
e. The machine should have trolley with central brake and minimum 2 drawers with atleast one with lock.
f. The system should have minimum 45 minutes online battery backup independent of the main MRI system.
g. The manufacturer should provide compatibility certification for MRI system offered.
h. **Gas delivery system**
   1. Should have pin index yokes for Oxygen and Nitrous Oxide besides separate connection for Central gas supply for Oxygen, Nitrous Oxide and Air.
   2. The machine should have pressure gauges for cylinders and central supply lines mounted on front of Anaesthesia machine for better visibility. The gas connections should be non-interchangeable.
   3. Automatic cutoff of N2O by Oxygen pressure failure.
   4. Hypoxic guard for linear regulation of minimum oxygen concentration at 23% volume and must ensure a minimum Oxygen flow of 200 ml at low fresh gas flow settings even below total 500 ml fresh gas flow
   5. Audible visual oxygen failure alarm.
   6. Emergency Oxygen flush at 30 – 70 L/min bypassing the vaporizer.
   7. Should have auxiliary oxygen flowmeter
   8. Should have electronic settings of Air,N2O and O2, with a total fresh gas flowmeter for indication and virtual flow tubes on screen.
   9. Gas delivery during power failure must be unrestricted
   10. Capnometer should be included.
i) **Vaporizer**
   1. Machine should have possibility to mount two quick mount type vaporizer for easy interchangeability, and safety.
   2. Should be provided with a Temperature / pressure compensated and flow independent Vaporiser for Isoflourane and Sevoflourane.
   3. Vaporizer should have extended delivery range from 0 to 6 Vol. %
   4. The vaporiser design should be maintenance free.

j) **Breathing System**
   1. Should have fresh gas de-coupled semi closed circle absorber system.
   2. Should have adjustable pressure relief valve from 5 to 75 mbar.
   3. Should have change over from Spontaneous to Bag ventilation with single step.
   4. Should have optimised absorber canister approx 1.5 Ltr.
   5. Should have an external fresh gas outlet for connecting Magill or Bain’s circuit

k) **Ventilator**
   1. Electronically controlled electrically driven ventilator should not require any driving gas
   2. Should not require changing of bellows for adult and infants.
   3. Modes: Volume controlled, Manual/Spont, Pressure controlled mode, Volume controlled mode, SIMV/PS and pressure support
   4. Tidal Volume : 20 ~ 1400 ml
   5. PEEP : 0 ~ 20 mbar
   6. Breathing Frequency : 4 to 60 BPM
7. I:E Ratio : 4:1 to 1:4
8. Inspiratory pause : 0 – 50% of Ti
9. Frequency 1 to 60 / min, I : E = 2:1 to 1:3.
10. Should automatically compensate for Compliance of breathing system.
11. Should be able to ventilate with atmospheric air, incase of missing gases.
12. **Airway monitoring:**
   Integrated colour screen monitor for electronic monitoring and display of following parameters :
   i. FiO2
   ii. Expiratory Tidal Volume
   iii. Expiratory Minute volume
   iv. PEEP, Peak and Mean and Plaetau airway pressure
   v. Frequency
   vi. Waveform display for Airway pressure.

(13) **Alarm limits and alarms:**
   i. Should have two teslameter sensors detection and should alarm independently by 40 mtesla (400 gauss)
   ii. Machine should have two additional sets of alarm LED’s integrated into top plate for viewing from distance
   iii. Adjustable high / low limits with audio and visual alarms for the following :
      - Minute volume,
      - Airway pressure (incl stenosis and disconnect),
      - Insp oxygen concentration,
      - Audio power supply fail alarm,
      - Fail to cycle warning.
   1. Machine should have RS 232 connectivity port

1) **Patient Monitor**
1. Should be suitable for adult, paediatric neonatal patients monitoring in fixed environment.
2. Should have minimum 8 channels of waveforms with 19” display with vertical and horizontal cursors
3. Should be capable of display of minimum 30 waveforms
4. Should have automatic graphic and tabular trending of all monitored parameters as standard
5. Should have event recall minimum up to 50 events, graphical and tabular trends, drug dose calculations, alarm logs
6. Should have Arrhythmia detection including All life threatening arrhythmias such as VTACH , ASYST, VFIB as standard feature
7. Should have minimum ECG, respiration, NIBP, SpO2, 2 IBPs, 2 Temp., OxyCRG as standard . All other parameters should be through upgrades as pods or modules/ software.
   i. **ECG**
   1. 5 lead or 6 lead ECG cable (for dual V lead display)
   2. Should be able to monitor single or two leads of ECG waveform simultaneously.
   3. Should display 12 leads of ECG by connecting 6/5 ECG lead wires(Reduced lead set algorithm) as standard feature.
   ii. **RESPIRATION**
      Through impedance pneumography method for Adult, Pediatric and Neonatal patients
   iii. **SpO2**
   1. Should have option for both Nellcor as well as Masimo SET technology with respective sensors
   2. Should display digital value and Plethysmograph
   iv. **NIBP**
   1. By oscillometric principle of measurement with step wise deflation.
   2. Suitable for adult, pediatric, neonatal patients
   3. Should display Systolic, diastolic, mean pressure in large easy to read display
4. Should have manual/stat mode or automatic mode with adjustable time intervals from 2 – 240 minutes and adjustable alarm limits

v. Temperature: two temperature one core and second skin.
   i. IBP: 2 nos.
      Display of systolic, diastolic and mean pressure
(8) Possibility for both wired and wireless networking
(9) Network ready for wired networking
(10) Agent Monitoring to include agent analysis, N2O, MAC value with color coding of agents.
(11) Scope of supply for patient monitor:
   a. Basic unit with battery
   b. 5/6 lead ECG Cable
   c. SpO2 finger sensor with cable
   d. Skin temperature Probe
   e. Rectal/Esophageal temperature probe
   f. NIBP Hose set with Adult, Pediatric and Neonatal Cuff – 2 sizes each
   g. Anaesthetic gas module with 100 sampling lines and 12 water traps
   h. Mountings (Arms, Plates) for Monitor, power supply and modules on anaesthesia unit
   i. Instruction for Use
   j. Clinical training should be provided

m) Scope of supply for anaesthesia workstation
   i. 3 gas Anaesthesia machine
   ii. Trolley
   iii. Pin Index yokes for O2 and N2O
   iv. Pipeline connections for all three gases
   v. Ventilator and patient monitor
   vi. Semiclosed breathing system
   vii. MRI compatible disposable adult and neonatal breathing circuits – 25 nos.
   viii. Vaporisers for Isoflourane and Sevoflourane
   ix. Central gas supply hoses (Color coded)

15) MRI Compatible Patient Trolleys: 2 Nos. to be supplied

16) MRI compatible Pressure Injector (Mederad or Tyco) to be supplied

17) Dry Chemistry Imager, with resolution of 650 DPI or more. DICOM ready and online for film size of 14”x17” and one more additional size film, to be supplied

18) Documentation Devices:
   iMac Computer with 3.1 GHz quad-core Intel Core i 7 Processor, 16 GB RAM, 1 TB HDD, keyboard, mouse, 27” monitor, Color Laser Printer. Qty. 2 each.

19) X-RAY VIEW BOX:

The View Box should be wall mounted, slim design, light-weight, with high luminous density uniform light. It should have daylight fluorescent lamps. It should have scratch-proof clear glass pane and an internal acrylic milk glass pane.
It should have sharp edge collimation of small image areas.
The X-ray view boxes should be supplied in the following sizes:
   To view 8 Films of 14”x17” size: 4 Nos
   To view 4 Films of 14”x17” size: 4 Nos
20) GENERAL REQUIREMENTS:

1. This is a turnkey project for supply, installation, testing and commissioning of MRI system described in the specifications. The scope of work includes civil, mechanical and electrical works in the room/s provided by the hospital. The bidders are advised to make a site visit. Turnkey details as per Annexure I.
2. Any civil, mechanical and electrical alteration pertaining to installation of equipment will be to the supplier's account.
3. The supplier must include the cost of interior works and give the details of work.
4. Only original documents printed by the manufacturer will be considered for evaluating specifications. Photocopies will not be accepted in lieu of the originals. Any changes/alterations/clarifications in comparison to the original printed document should be submitted on the letterheads of the original manufacturer duly signed by manufacturer's representative competent to do so.
5. All parts and components used in the equipment which will be supplied as a part of this tender shall be virgin and should not have been used previously as a part of equipment or for any purpose other than pre installation testing. All the equipments shall be new. All the requirements of this supply shall be sourced from the original equipment manufacturer of the model quoted. In case the machine is imported one, no import substitution is permitted neither before the award nor after the award for any part or accessory.
6. Equipments shall operate on 230 V, single phase or 440 V, three phase, 50 Hz electric supply. The necessary protective relaying/circuitry shall be there with the machines. The mains supply voltage variation may be maximum 10% and frequency variation maximum 3%.
7. All the major equipments viz. the MRI system, anaesthesia workstation with ventilator and patient monitor, pressure injector, Dry Chemistry Imager, etc. shall be having valid CE marking / US FDA approval and documentary evidence to that effect shall be submitted in envelope A.
8. The equipments shall be having warranty of three years as described in the tender document elsewhere.
9. After the warranty period is over, five years annual Comprehensive Maintenance Contract (CMC) will have to be entered into with the terms and conditions mentioned in the tender specifications. The successful bidder has to ensure that all the required spares and services are available during the period of CMC and 2 years after that period.
10. All the equipments should be provided with one hard copy in original of the detailed service manual and operation manual. Further a soft copy is also required.
11. Training on use of the equipments shall be imparted to the user staff. A full time Application Specialist should be available on-site during day-time for demonstration of the working of the equipment for a minimum period of 2 months.
12. The equipment must be tropicalized as below:
   - Working temperature : Max. 35°C
   - Storage temperature : Max. 50°C
   - Relative humidity for Working : 40 - 60%
   - Relative humidity for Storage : Max. 90%
14. The license for the softwares shall be valid for the warranty period and for the CMC period without any extra charge to the purchaser i.e. MCGM.
15. Bidder should submit all technical details in the form of technical brochures / leaflets for all the equipments proposed for supply and mentioned in the technical offer.
16. Demonstration is compulsory for all the equipments offered.
17. The Clause no. (18) of the Instructions to the Tenderers shall be applicable with a change that a penalty for not observing 96% up time, on yearly basis, will be charged @ Rs.50,000/- per day.
18. The successful bidder must supply all image enhancement softwares that may be launched in future and may be available at the time of supply of the equipments.

1. POST QUALIFICATION CRITERIA:
   i) Technical:
   The bidder/manufacturer of the quoted MRI system shall have supplied, installed and commissioned at least 5 nos. of 1.5T MRI systems in India. A list with complete address and contact telephone number of the installations shall be appended with, in envelope A.
   ii) Financial:
   The average annual turnover of the bidder during last three financial years shall be minimum Rs. 2.10 Crore. Evidence in the form of CA certified documents or IT returns shall be enclosed in the envelope A.

SD/-
E.E.(M.E.C)

SD/-
SD/-
SD/-
Prof. & Head,
Prof. & Head,
Prof. & Head,
Dept. of Radiology,
Dept. of Radiology,
Dept. of Radiology,
KEM Hospital,
B.Y.L. Nair Hospital
L.T.M.G Hospital
Parel, Mumbai - 12
Mumbai 400 008
Sion Mumbai 400 022
## Cost Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Basic Capital Cost</td>
<td>Rs. 8,25,00,000/- (Plus Octroi)</td>
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<tr>
<td>Frozen cost of consumables</td>
<td>Included in Basic Cost</td>
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<tr>
<td>Cost of 3 year warrantee</td>
<td>Included in Basic Cost</td>
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<tr>
<td>Cost of 5 years of CMC</td>
<td>Rs. 2,50,00,000/- (Plus Taxes)</td>
</tr>
<tr>
<td>Cost of erection of turnkey project at infrastructure</td>
<td>Rs. 75,00,000/-</td>
</tr>
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Disclaimer

The Corporation retains the liberty to change the specifications of the items to be supplied and the terms of supply and installations, maintenance and other conditions prior to issue of the tender.

The suggestion / objections received may or may not be considered if the same is not in consonance with the requirements of the project, MCGM reserves it right to reject the same.