

RADIOLOGY = M.R.I.

**TECHNICAL SPECIFICATIONS OF STATE OF THE ART SUPERCONDUCTING MAGNETIC  
RESONANCE IMAGING SYSTEM (MRI)**

S.N.	Description of function	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	MRI provides an unparalleled view inside the human body. The level of detail we can see is extraordinary compared with any other imaging modality. MRI is the method of choice for the <b>diagnosis</b> of many types of injuries and conditions because of the incredible ability to <b>tailor</b> the exam to the particular medical question being asked. By changing exam parameters, the MRI system can cause tissues in the body to take on different appearances. This is very helpful to the radiologist (who reads the MRI) in determining if something seen is normal or not		

S.N.	Operational requirements	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	Whole Body 1.5 Tesla Magnetic Resonance Imaging system optimized for higher performance in Cardiac and Neuro-radiological examinations with short superconducting magnet, high performance gradients and digital Radio Frequency. All capabilities as detailed below should be integral part of the quotation and none of these essential requirements should be quoted as optional. If a supplier has any additional advanced applications or technique available with them, the same may be quotes as options.		

S.N.	Technical Specifications	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	<p><b><u>Magnet System</u></b></p> <p>a) 1.5 or more Tesla active shielded super conductive magnet.</p> <p>b) The magnet length should be short.</p> <p>c) It should have at least 60 cm patient bore with flared opening. The magnet should have facilities of better illumination, ventilation and designed to avoid patient claustrophobia.</p> <p>d) The magnet should be shielded from the external interferences.</p> <p>e) The homogeneity of the magnet should be mentioned in relation to 10,20,30,40 cm D5Y. Give details of the number of the planes plots and number of measurement per plane to measure the homogeneity.</p> <p>f) Global and local auto shimming should be available. Automated patient specific on line shimming should be available. 2nd /High Order shimming should be quoted to correct patient induced homogeneity.</p> <p>g) Specify the weight of the magnet including the gradient and covers etc.</p> <p>h) The front panel display at the magnet should display coil table position and also remote selection of coil elements,</p>		

**GRADIENT SYSTEM**

1. Actively shielded Gradient system with strength of at least 40 mT / m or more with the slew rate of 150 mT / m/ sec or more. This slew rate of 150 at 40 mT should be available in each axis independent, for overall better duty cycle performance of the gradient.
2. The duty cycle should be 100 percent. Please give details.
3. The Gradient system should have provision for eddy current compensation.
4. The Gradient should be capable of delivering the following clinical performance.
5. Largest Field of View should be at least 40 cm in all three axis. Higher available FOV will be preferred.
6. Minimum TE in Gradient Echo 2D / 3D should be specified for all sequences.
7. Minimum Slice Thickness in 2D should be specified.
8. Minimum Slice Thickness in 3D should be specified.
9. Maximum Echo Train Length in both Spin Echo and Gradient Echo should be at least 256 or more.
10. The measurement matrix should be from 128x128 to 1024x1024 in both 2D and 3D imaging as well.

	<p><b><u>RF SYSTEM</u></b></p> <p><b>1</b>RF system should be fully digital with transmit power of at least 15 Kw</p> <p><b>2</b>RF system should have at least minimum of 16 independent RF receiving channels with each having bandwidth of 1MHz or more.</p> <p><b>3</b>Should have necessary hardware to support Phased array coils.</p> <p><b>4</b>Specify frequency stability and amplifier resolution.</p> <p><b>5</b>RF system should be compatible with parallel imaging techniques. It should be able to support time reductions with compatible coils in 2D/3D imaging in Body /Neuro imaging upto factor of 4.Higher PAT factors will be preferred.</p> <p><b>6</b>RF amplifier should be solid state for overall better performance.</p>		
	<p><b><u>RF COILS</u></b></p> <p><b>1</b>The main body coil integrated to the magnet must be Quadrature/ CP. In addition to this coil following coils should be quoted.</p> <p><b>2</b>Phased Array Head coil with mirror. It should be at least 8 Elements or more. Higher element coil will be preferred.</p> <p><b>3</b>Phased Array Neck Coil.</p> <p><b>4</b>In case above two coils do not suffice in combination for complete Neuro-vascular study from Aortic arch to Circle of Willis, please quote separate coil in addition to above two coil for this study. Please specify the max parallel imaging time reduction</p> <p><b>5</b>Phased Array Spine Coil for thoracic and Lumber spine imaging. Mention the number of coil elements available.</p>		

**6**It should be possible to do Head and Spine imaging together without changing the coil and the patient" It should be possible to do the same either with combination-of coils or a

dedicated coil to achieve the same should be quoted

**7**Phased Array Body coil, capable of doing abdomen, pelvic, MRCP and peripheralimaging. It should have at least 12 elements and 50 cm FOV should be achievable. Please specify the time reduction factor with parallel acquisition techniques.

**8**Flexible Coil -Large for imaging of large regions such as shoulder, hip and knee etc.

**9**Flexible Coil -small for imaging of small regions such as shoulders, wrist, elbow and ankle.

**10**Quadrature Extremity Coil for Knee Imaging

**11**Endorectal coil for higher resolution imaging of prostate, colon, rectum and cervix Imagingg.

**12**Dedicated ! Shoulder Phased Array coil.

**13**Coil for Cardiac Imaging with 8 channel or more Please specify the time reduction factor with parallel acquisition techniques.

**14**Dedicated 8 channel Brain Coil for High resolution Brain Images. Please specify the time reduction factor with parallel acquisition techniques. It should be possible to do thespectroscopy Imaging with this Coil.

**15**Peripheral Angio. Coil: Specify, type and no. of elements used.

**16**Eye / Ear Coil

**17**TMJ Coil - Specify type and channel

**18** Bilateral Breast Coil, specify type and channel. Please mention coils with reference to the above which are compatible with parallel imaging technique.

**19**A coil for Neurovascular Application.

<p><b><u>PATIENT HANDLING SYSTEM:</u></b></p> <p><b>1.</b> Please specify the table type whether it's conventional trolley type or incorporates new design principles.</p> <p><b>2.</b> The table should be fully motorized, computer controlled table movements in vertical and horizontal directions. The position accuracy should be at least <math>\pm 1</math> mm or better for higher reproducibility in advanced applications like ceMRA, pMRA with stepping table.</p> <p><b>3.</b> The patient table should be able to withstand patient load of 180Kg</p> <p><b>4.</b> The table should have facility for emergency manual traction in case of emergency. The table should have patient auto alarm system.</p> <p><b>5.</b> The CCTV system with LCD display to observe the patient.</p> <p><b>6.</b> The table should deliver the protocols for automatic bolus chasing in peripheral angio with the automatic table movement.</p>		
<p><b><u>Host Computer /Main Console and Image Processor</u></b></p> <p><b>1.</b> Computer system should be latest in the industry, fast and efficient. It should have at least 2GB RAM.</p> <p><b>2.</b> The system should have image storage capacity of 50 GB for at least 95000 images in 256x256 matrix</p> <p><b>3.</b> The reconstruction speed should be at least 800 images per sec or more for full FOV 256 matrix and the image processor should have high RAM capacity of at least 6 GB for faster processing for advanced applications.</p> <p><b>4.</b> The main Host computer should have at least 18inch TFT type Color monitor. The main console should have integrated music system for the patient</p> <p><b>5.</b> <b>The system should have</b> DVD and CD archiving facility on the main console for storage of 50,000 images or more in 256 x 256 matrix. Additionally 500 high storage DVD's to be provided.</p> <p><b>6.</b> One additional workstation with Color monitor to be provided for the applications as listed under item 8.</p>		
<p><b><u>APPLICATION SOFTWARE / HARDWARE</u></b></p> <p><b>1.</b> The system should have basic sequences package with Spin Echo, Inversion Recovery, Turbo Spin Echo with high turbo factor of 256 or more, Gradient Echo with echo train length of 256 or more</p> <p><b>2.</b> The application software for image smoothing and edge sharpness etc for improvement in image resolution should be quoted and it should apply for major imaging applications.</p> <p><b>3.</b> Single and Multi shot EPI imaging techniques with ET1 factor of 256 or more</p> <p><b>4.</b> MR Angio Imaging: Should have 2D/3D TOF, 2D/3D PC, MTS and TONE, ceMRA to be quoted. MR Spectroscopy, 4 D CEMRA ( Real time DSA like) with parallel imaging for dynamic 3D CEMRA.</p> <p><b>5.</b> Fat and water excitation, please specify the application package</p> <p><b>6.</b> Diffusion Weighted Imaging, with at least b value of 7000 or more. The system should have facility for ON Line automated calculation of ADC maps.</p>		

**7** Please specify the motion correction algorithm/package for high-resolution motion free Diffusion weighed imaging with multishot/ segmented EPI techniques. It should be also possible to have PSIF diffusion.

**8** Perfusion Imaging to enable large anatomy coverage of the brain and in line calculation of the resulting hemodynamic data. The perfusion analysis should have capability to calculate color display of reIMTT, reI CBV, reICBF. If the perfusion analysis is not possible on the main console the same should be quoted on the workstation.

**9** BOLD imaging: BOLD technique with automated 3D motion correction, z- score, correlation analysis with color overlay on anatomical images. It should be possible to have Real Time Processing of BOLD imaging data on the main console for the complete reconstruction.

**10** The perfusion and the BOLD imaging should be possible for the whole brain with motion correction techniques. Please specify the application package and the motion correction technique.

**11** Parallel Acquisition Techniques: Please specify the name of the package. It should have applications in abdomen, neuro-imaging including diffusion and perfusion etc., free breathing abdomen imaging and Cardiac imaging. The scan reduction time should be mentioned.

**12** Bolus chasing with automatic moving table should be offered and should be available with fluoro triggered MR angiography for manual and fast switchover in less than 1 sec for ceMRA results.

**13** The system should facility for quantification of the CSF flow data. The same should be preferably on the main console. In case of this application not available on the main console please provide it on the additional workstation as detailed in item 3.8.8

**14** The system should have the Hydrogen, Single Voxel spectroscopy, Multivoxel, multislice 2D, 3D Spectroscopy and also the Chemical shift imaging in 2D/3D.. The complete processing/ post-processing software including color metabolite maps should be available

**15**Advanced Cardiac Applications :Morphology/wall motion; perfusion imaging;Myocardial viability imaging; Cardiac function including EF, ED/ES volume, Cardiac output, wall thickening and wall thickness; Cardiac Tagging Techniques; Coronary arterytechniques; rea

**16** The system should have prospective ECG triggering and retrospective gating with navigator pulses, interactive or automatic definition of the ventricular and myocardial contours, cine imaging, grid tagging etc. Besides this comprehensive set of all post processing

**17** The system should be supplied with ECG Trigger; respiratory trigger, peripheral pulse trigger and external trigger. Electrodes

**18** The system should have facility to do Head to Toe imaging without shifting the patient at one go for metastases study and without any loss of SNR.

**19** It should be possible to have the prostate spectroscopy in conjunction with the endorectal coils to be quotes as item 3.4.13. Please include any other interface, or hardware and software required for this application.

**20**The system should be available to perform Multi Direction Diffusion weighted imaging / Diffusion Tensor Imaging and the same should be possible on the main console.

**21** The system quoted should have image pasting software on the main console for ease of use.

**22**The system should be quoted with motion correction software for uncooperative Head patients , It should be possible to have the same routine in T1, T2 and FLAIR imaging.

**23**The system quoted should have the software for Whole Body Diffusion weighted imaging

**1**The additional workstation with preferably the same user interface as of the main console with the availability of MPR, MIP etc. It should have 18 inch LCD monitor, with hard disk of at least 50 GB for at least 95000 image storage in 256x256 marix, and 2 GB RAM.

**2**,Image documentation should be possible from the main as well as the workstation.

**3**The workstation should have display of Cardiac cine images in movie mode with rapid avi creation.

**4**The workstation should have availability of Cardiac post processingcapabilities: calculation of ventricular area/volume, stroke volume, ejection fraction, relative ejection fraction, calculation of myocardial thickness, Time volume diagram generation.

**5**The perfusion analysis should have capability to calculate color display of reIMTT, rel CBV, rel CBF. If the same not possible on main console as mentioned in point 3.7.08, than software to have the same should be quoted.

**6**Processing of 2D/3D CSI data with color metabolite mapping, if not offered/available on the main console as mentioned in point 3.7.14 should be quoted here.

<p><u>7</u>Processing of Real Time BOLD imaging data sets for color overlay of functional and anatomic data, if not available on the main console should be quoted here. It should be possible to have Real Time BOLD image processing for the complete brain.</p> <p><u>8</u>The system should facility for quantification of the CSF flow data on the main console, if not offered/available on the main console as mentioned in point 3.7.13 should be quoted here.</p> <p><u>9</u>The post processing workstation should have software package for analysis of the vessel disease with the possibility of detection of vessel segments and to quantify the changes in vessel size.</p> <p><u>10</u>.Volume Rendering Techniques software for visualization of complex anatomy.</p>		
<p><b>Dry View Imaging Camera with the following specifications:</b></p> <p><u>1</u>. Dry Laser Technology</p> <p><u>2</u>.Resolution :16 bits/ 600 dpi</p> <p><u>3</u> Supports 5 Multiple Film Sizes: one of which must be 17”x14”</p> <p><u>4</u>. Must have 3 or more online film sizes.</p> <p><u>5</u>.Throughput of 180 films or more per hour.</p> <p><u>6</u> DICOM Compatible Attach conformance statement.</p>		
<p><b>State of the art Laser color printer:</b></p> <p><u>1</u>Color Dry Printer for printing Film Quality Images on plain paper.</p> <p><u>2</u>.DICOM Compliant</p> <p><u>3</u>.Laser/Thermal Dye Sublimation Technology for B/W or Color Printing</p> <p><u>4</u>.Resolution- 1200x1200 dpi.</p> <p><u>5</u>.More than 20 ppm.</p>		
<p><b>MR Compatible Pressure Injector:</b></p> <p>Must have Independent dual Syringe powerhead and console must have full color touch screen with user-defined protocols with programmable interscan delay.</p> <p>Powerhead Must have following features;</p> <p>Non –ferrous, automatic syringe size detection, perform single/dual phase contrast injections, provides saline flush delivery, allows timed contrast delivery. Must be compatible with 10, 15, 20 &amp;30ml prefilled contrast syringes beside 50 ml syringes for both saline &amp; contrast.</p> <p>Must be able to observe progress of injection and view actuarial injection results.</p>		

**MRI Compatible Servo Ventilator will have the following specifications:**

**Ventilation operating modes:**

Volume Control, Pressure Control  
Synchronized Intermittent Mandatory Ventilation (SIMV);

Pressure Support with Apnea Backup ventilation

**Ventilator parameter ranges**

Tidal volume: 20 to 1500 mL  
Minute volume: 0 to 100 L/min  
Pressure (insp):: 5 to 60 cm H<sub>2</sub>O  
Pressure (limit): up to 100 cm H<sub>2</sub>O  
Pressure Support: OFF, 2 to 40 cm H<sub>2</sub>O  
Rate: 5 to 100 breaths per minute for Volume Control and Pressure Control; 5 to 50 breaths per minute for others.  
I:E ratio: 2:1 to 1:8  
Inspiratory time: up to 5 seconds  
Trigger window: 0 to 80% (for SIMV and pressure support)  
Flow trigger: 0.2 to 10 LPM  
Positive End Expiratory Pressure (PEEP): Integrated, electronically controlled Range: OFF, 4 to 30 cm H<sub>2</sub>O.

**Ventilator performance**

Inlet Pressure: 40 psig to 100 psig  
Flow range: 1 to 120 L/min

**Ventilator monitoring- of**

Expiratory minute volume, Peak pressure, Mean pressure Plateau pressure  
Alarm settings for  
Tidal volume, Minute volume  
Inspired oxygen, Apnea alarm  
Mechanical ventilation Low airway pressure: High pressure

**Anesthetic agent delivery**

Two vaporizers Mounting: Tool-free installation manifold interlocks and isolates vaporizers interface:

**Pneumatic specifications**

fittings available for O<sub>2</sub>, N<sub>2</sub>O and Air, and contain pipeline filter and check valve. Cylinder input: Pin indexed in accordance with CGA-V-1 or DIN (nut and gland); contains input filter and check valve

S.N.	System Configuration Accessories, spares and consumables	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	DICOM 3.0 Dry View Imaging Camera - <u>01</u>		
	MR Compatible Pressure Injector (FDA/CE Certified) - <u>01</u>		
	Laser Color Printer -01		
	Paradigm Generator for audiovisual Simulation 01		
	MRI Compatible Servo Ventilator with Anaesthesia attachments 01		
	MRI Compatible O2 Cylinder-2		
	MRI Compatible N2O Cylinder 2		
	MRI Compatible Pulse Oximeter 01		
	Patient Comfort Kit 01		
	HIS/RIS Integration Software		
	Hand Held Metal Detectors 02		
	PC With 17" monitor and Laser Printer for report generation 01		
	Main Body Coil -01		
	Phased Array Head Coil -01		
	Phased Array Neck Coil - 01		
	Phased Array SpineCoil -01		
	Phased Array combined Head and Spine coil- -01		
	Phased array Body Coil -01		
	Flexible Large Coil -01		
	Flexible small coil. -01		
	Quadrature Extrimity Knee Coil- -01		

	<b>Endorectal Coil</b>	<b>-01</b>		
	<b>Shoulder Phased Array Coil</b>	<b>-01</b>		
	<b>Cardiac Imaging (minimum 8 channels) coil</b>	<b>-01</b>		
	<b>Brain Coil (minimum 8 channels)</b>	<b>-01</b>		
	<b>Peripheral Angio Coil</b>	<b>-01</b>		
	<b>Eye / Ear Coil</b>	<b>- 01</b>		
	<b>TMJ Coil</b>	<b>-01</b>		
	<b>Bilateral Breast Coil</b>	<b>-01</b>		
	<b>Neurovascular Coil</b>	<b>-01</b>		
	<b>Patient Trolley</b>	<b>-01</b>		
	<b>Main Console</b>	<b>-01</b>		
	<b>Application Software/hardware</b>			
	<b>Additional Console</b>	<b>-01</b>		

The system should contains all the above accessories in Integrated or as separate accessories.

S.N.	Environmental factors	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	The unit shall be capable of operating continuously in ambient temperature of 30 <sup>0</sup> C and relative humidity of 80%		
	Chiller System - 01 <b>(Should be imported from the same country as that of MRI manufacturing country).</b>		
	RF Cabin: The system should be supplied with the imported RF cabin <del>and interiors for the same should be carried out suitably by the</del>		
	All the shielding requirements of the room will have to be done by the supplier.		

S.N.	Power supply	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	Power input to be 220-240VAC, 50Hz,/440 V 3 Phase as appropriate fitted with Indian plug		
	Resettable overcurrent breaker shall be fitted for protection		
	Suitable Servo controlled Stabilizer/CVT		
	UPS of suitable rating shall be supplied for complete system with minimum 30 minutes backup		

S.N.	Standards and safety	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	Should be FDA or CE approved product		
	Electrical safety conforms to standards for electrical safety IEC-60601 / IS-13450		
	User Training Abroad for two radiologist and one technician.. Radiologists to be trained for clinicals whereas the technician to be trained for operation and day to day maintenance of the unit.		

S.N.	Documentation	Technical Specification Quoted by Bidder	Bidder's Deviation (if any)
	User manual in English		
	Service manual in English		
	List of important spare parts and accessories with their part number and costing.		
	Certificate of calibration and inspection from factory.		
	Log book with instruction for daily , weekly, monthly and quarterly maintenance checklist. The job description of the hospital technician and company service engineer should be clearly spelt out		
	Comprehensive guarantee for 5 years of complete system including helium refill and all other parts for which order will be placed with uptime warranty of 98%. Comprehensive Guarantee period will be extended by double the downtime if it exceeds more than 2% in a year.		
	Rates of comprehensive AMC for complete system including helium refill and all parts for which order will be placed with an undertaking of 98% uptime and extension of AMC period by double the downtime if it exceeds more than 2%.		