TOSHIBA

No. 2Y730-012E

MAINTENANCE MANUAL
FOR
DIAGNOSTIC ULTRASOUND SYSTEM

PowerVision 6000

SSA-370A
(2Y730-012E)

TOSHIBA CORPORATION

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REVISION RECORD

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1. OUTLINE

1.1 Introduction

This manual describes the maintenance and inspection procedures for the following diagnostic ultrasound system.

- SSA-370A

1.2 Tools and Measuring Devices Required

1.2.1 Phantoms and measuring devices

Product name	Type	Manufacturer	Specifications/ standards
Phantom for checking axial and lateral resolution	000021	CARDIFF	Specified type only allowed
Phantom for checking contrast and spatial resolution	539	ATS	Specified type only allowed
Sensitivity phantom	BF23-0387	Toshiba	Specified type only allowed
Doppler phantom	BF23-756*A	Toshiba	Specified type only allowed
Function synthesizer	YHP-33120A	YHP	Specified type only allowed
Oscilloscope	Not specified	Not specified	
Coaxial cable	Not specified	Not specified	BNC/BNC, 75 Ω, 1 m in length

1.2.2 Documents

Product name	Type	Manufacturer	Specifications/ standards
Maintenance manual	2Y730-012E	Toshiba	
Service manual	2D730-142E	Toshiba	

1.2.3 Tools, measuring devices, and consumables for the diagnostic ultrasound system

Tool/measuring device	Q'ty	Remarks
Testing device for electrical safety check, type ESA-1	1 set	Toshiba-specified type
Ground circuit tester	1 set	Toshiba-specified type
Resin container or stainless container	1	Large enough to accommodate two transducer heads.
Insulation resistance tester	1	500 VDC
Transducer connector (receptacle)		
DL-type connector 156 PIN Connector for pencil transducer 12 PIN	1	All receptacle pins must be short-circuited.
Vinyl bags	1	Approx. 2 m x 2 m (0.3 mm thick)
Vacuum cleaner	1	
Blower (600W 0 to 16000 mm/min)	1	Makita 4014NV
Cleaner		
Thermal head cleaner	1	859C425000 (Mitsubishi)
Brush	1	As small as a toothbrush
Air spray or blower brush	1	For cleaning the lens

Consumable parts	Q'ty	Remarks
Aluminum foil	1	
Physiological saline solution (0.85 to 0.95% saline solution)	—	The saline container should be filled.
Albon	1	Yagi Kenma (cover, panel cleaning)
E cleaner	1	Toray (for the Braun tube and filter)
Neutral detergent		
Thermal head cleaning sheet	1	859D01501 (Mitsubishi)
Polaroid film TYPE 667	1 box	
Color film FUJI FI-800	1 roll	
Rag		

1.2.4 Standard set of tools, consumables

Tool	Type	Manufacturer	Specifications/ standards
Screwdriver (various sizes and types)			(Not specified)
Stubby Phillips screwdriver (large)			(Not specified)
Wire nipper			(Not specified)
Needle nose pliers			(Not specified)
Diagonal pliers			(Not specified)
Soldering iron, stand			(Not specified)
Desoldering tool			(Not specified)
Wrench set			(Not specified)
Adjustable wrench			(Not specified)
Tweezers			(Not specified)
Hammer			(Not specified)
Metric Allen wrench set			(Not specified)
File (various types)			(Not specified)
Cutter			(Not specified)
Extension PWB	PM30-23864	Toshiba	

Consumables	Type	Manufacturer	Specifications/ standards
Insulation tape			(Not specified)
Hishilite tube, Empire tube (various types)			(Not specified)
Wiring material (various types)			(Not specified)
Screws, nuts, washers (various types)			(Not specified)
Solder			
Paper file (various types)			
Ethanol for cleaning and disinfection			

1.3 Inspection Schedule

The prescribed inspection schedule for the first year after installation is shown below.

Model	Inspection schedule			Remarks
	3 months after installation	6 months after installation	12 months after installation	
SSA-370A	O	O	O	

The contents of contract-based inspections made subsequent to the first year after installation differ depending on the maintenance contract. The relevant service company must determine the contents of such inspections.

1.4 Check Before Inspection

1.4.1 Checking the system conditions

Check the items below with the user or in the log book to understand the system conditions.

(1) The occurrence of anything out of the ordinary while the system is in operation

(2) Abnormalities occurring intermittently

(3) History of problems

(4) Requests from the user

1.4.2 Checking the operating environment

Check the temperature and humidity in the examination room. Measurements related to electric safety are particularly sensitive to the humidity. These measurements are also sensitive to the measurement location and measurement circuit.

If the insulation characteristics deteriorate due to system changes over time or system malfunctions, the measurement fluctuations are likely to increase with the increase in humidity.

1.4.3 Checking the system settings

Check the preset conditions of the system, brightness and contrast of the monitor, and options including the transducer. Make a hard copy of the preset conditions used normally and file it in the log book.

1.4.4 Checking the system version

Refer to the software change record (log book) to check the system version that is displayed when the main system is turned ON.
(For version display, refer to the service manual.)

1.4.5 Checking the system operation

Check the system operation.

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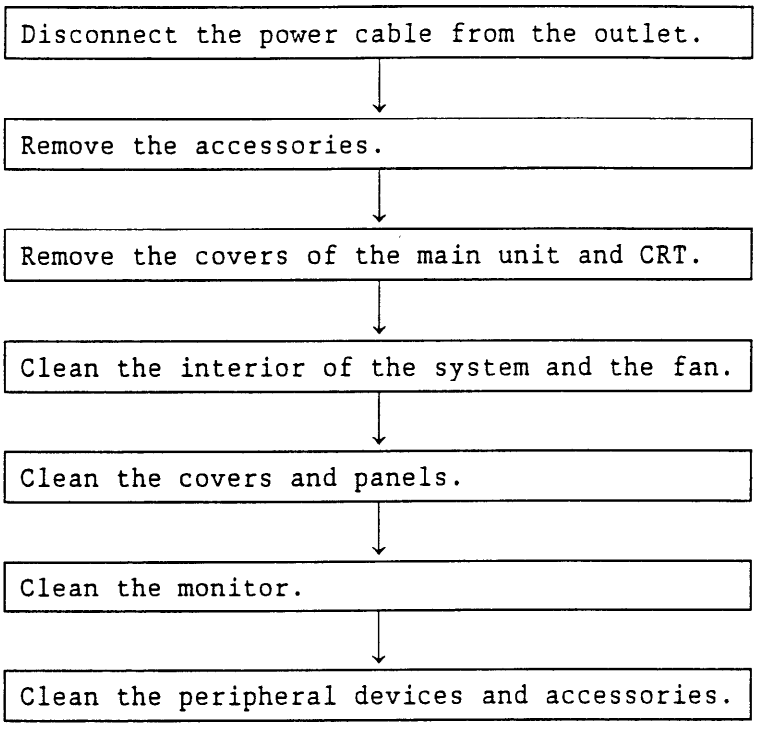
2. CLEANING

- Flowchart of cleaning process



Item	Code	Inspection contents	Procedures	Tools
Cleaning	A01	2.1 Interior of the System and Fan	(1) Disconnect the power cable from the outlet.	Phillips screwdriver
			(2) Remove accessories such as the transducer, transducer holder, printer, and VCR from the main unit.	
			(3) Remove the CRT cover.	
			(4) Remove the covers of the main unit so that all the PWBs and the interior of the power supply are visible. Do not remove any PWBs unless it is abnormal.	
			(5) Cover the main unit with a big vinyl bag.	Vinyl bag Size 2 x 2 m
			(6) Put the vacuum cleaner in the vinyl bag and turn it ON to vacuum dust.	Vacuum cleaner
			(7) On the vinyl bag, make an opening as large as can allow the nozzle of the blower to be inserted and blow out dust on the monitor, fan, PWBs, rack, power supply, etc. from top to bottom.	Blower Makita 4014NV 600W 0 to 16000 mm/min
			(8) Remove the vinyl bag gently, taking care not to spread the dust on the inner surface of the bag.	
			(9) Vacuum all remaining dust with the vacuum cleaner.	Vacuum cleaner

Item	Code	Inspection contents	Procedures	Tools
Cleaning	A02	2.2 Covers/Panels	Wipe off any dirt on the main unit covers and panels using Albon (chemical soap). If it is difficult to clean the main operating panel, remove the switch cover and wash off the dirt using Albon (chemical soap).	Albon (Yagi Kenma)
	A03	2.3 Observation Monitor	Wipe off dirt from the surface of the Braun tube, filter and covers and then remount the filter.	Toray E cleaner, etc.
	A04	2.4 Transducer/ Transducer Holder	Wipe off dirt from the transducer, check it for abnormalities such as cracks, and then connect it to the main unit. Wash the transducer holder with a soft brush to remove dirt. Turn ON the power and check that images are displayed correctly. Check the PWBs for loose contacts by manually moving them to the left and right. Remount all covers such as the side covers and front/rear covers.	Toothbrush-sized small brush Blower brush or air spray Phillips screwdriver

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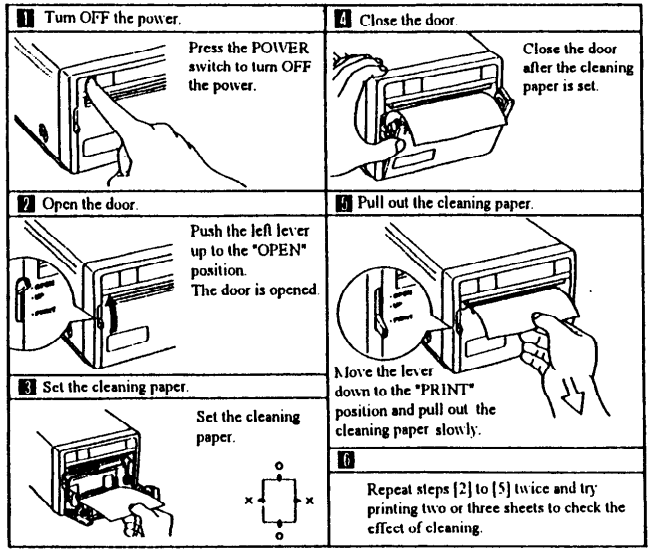
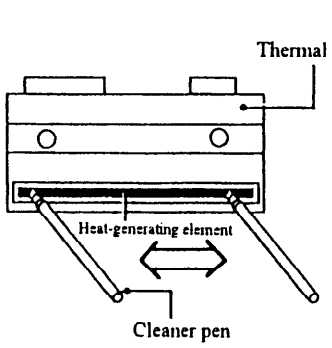
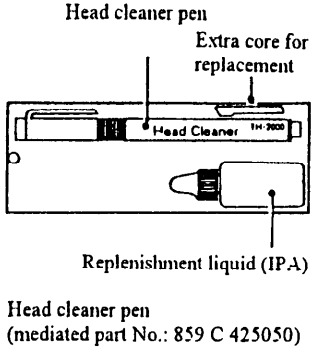
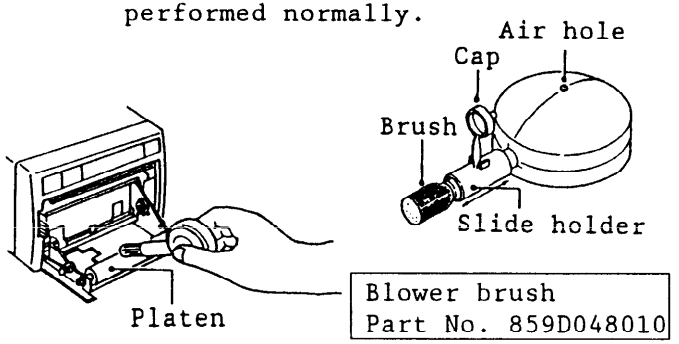
Item	Code	Inspection contents	Procedures	Tools	Repairs and replacement parts
Cleaning	A05	2.5 Sonoprinter (head)	(1) TP-8010 When the thermal head is dirty with foreign particles or dust, random speckles or vertical white lines may appear on the printed image. If this occurs, use the supplied cleaning paper (part No.: 857P002010, etc.) or the thermal head cleaner pen TH-2000 (859C425050) [mediated product] as follows: CAUTION: Do not use the reddish-brown colored cleaning sheet (part No.: 857P001010) because it may damage the thermal head.		

Item	Code	Inspection contents	Procedures	Tools	Repairs and replacement parts
Clean-ing			(2) For the case where cleaning paper is used  (3) For the case where the thermal head cleaner pen is used (a) Pull out the pen core from the main body and pour an appropriate amount of cleaning solution into the main body. * When the pen core is dirty, replace it with the supplied core.		

Item	Code	Inspection contents	Procedures	Tools	Repairs and replacement parts
Clean-ing			CAUTION: 1. Move the cleaner pen parallel to the element (brown portion). 2. The cleaning solution is flammable. Mount the cap tightly after use and take special precautions to prevent it from igniting. 3. Store the thermal head cleaner pen in a cool dark place, away from direct sunlight.   Head cleaner pen (mediated part No.: 859 C 425050)	Supplier Mitsubishi service center	

Item	Code	Inspection contents	Procedures	Tools	Repairs and replacement parts
Cleaning			(4) If the platen is accumulated large amounts of dust and foreign particles from the thermal paper, characters may not be printed correctly on the printed image. If this is the case, follow the procedures below to clean the platen. (a) Open the door so that the platen can be cleaned. (b) If there are foreign particles or dust on the platen, use the blower brush to clean the platen. (c) If the platen is extremely dirty, use alcohol and brush it gently with a toothbrush taking care to avoid damaging the surface. (d) After completion of cleaning, confirm that printing can be performed normally. 	Supplier Mitsubishi service center	

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3. CHECK OF B/M MODES

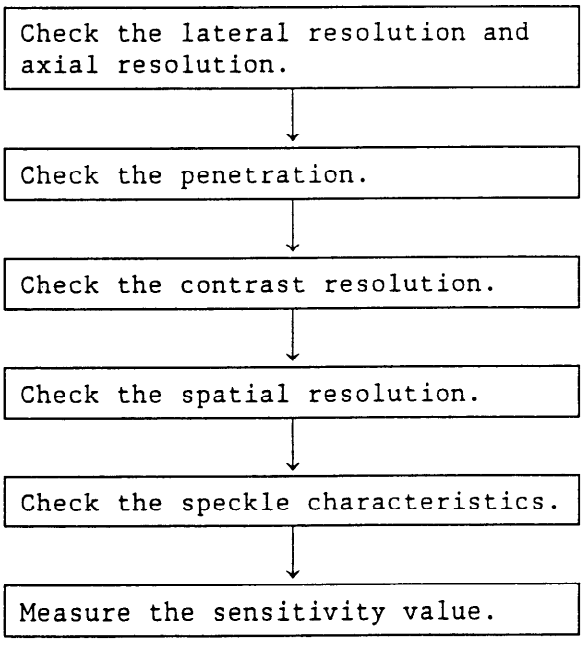
(1) System settings

Use the factory settings for items other than those described in this manual. If any settings are changed for special reasons, record the settings as supplementary information.

(2) Recording and filing images

Print images and file them together with the recorded data.

(3) Flowchart of check procedures



Item	Code	Inspection contents	Procedures	Tools
Checking B/M modes	B01	3.1 Lateral Resolution/Axial Resolution	(1) Spread ultrasound gel on the phantom and apply the transducer to it. (2) Display a 1-cm^2 histogram at a depth of 5 cm. (3) Set the GAIN so that the MAX of the histogram is 65% ±5% of the maximum of the parenchyma. (4) Apply the transducer to the phantom so that the resolution of the wire target is optimal. (5) When the optimal image is obtained, freeze the image and record it. (In DUAL-display mode, print out the image together with the penetration image, which is obtained as described below.)	
	B02	3.2 Penetration	(1) Spread ultrasound gel on the phantom and apply the transducer to it. (2) Adjust the GAIN and STC so that the speckle for the parenchyma is displayed at the deepest position. (3) Measure the depth at the border between the noise and parenchyma and record an image on which the measured depth is displayed.	
	B03	3.3 Contrast Resolution	(1) Spread ultrasound gel on the phantom and apply the transducer to it. (2) Set the FOCUS to the center of the Gray Scale Target with HypoEchoic to the right and HyperEchoic to the left. (3) Record the image with DEPTH=10 cm. (In DUAL-display mode, print the image together with the spatial resolution image, which is obtained as described below.)	

Item	Code	Inspection contents	Procedures	Tools
Checking B/M modes	B04	3.4 Spatial Resolution	(1) Spread ultrasound gel on the phantom and apply the transducer to it. (2) Set the transducer so that the 5-mm diameter hole is located at the center of the image. (3) Set the FOCUS to the center of the image. (4) Record the image with DEPTH=15 cm.	
	B05	3.5 Speckle Characteristics	Evaluate the changes over time by periodically recording the images as described above.	
	B06	3.6 Sensitivity Value	Sensitivity value (S/N) • Measurement method (1) Set the conditions for the diagnostic ultrasound system as follows: IP : 5 NORMAL FREQ. DEPTH : 20 FOCUS : 1 step	

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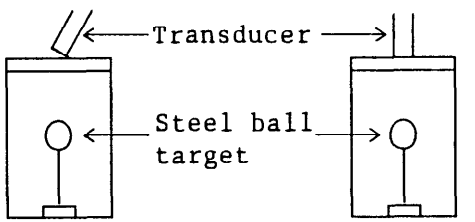
Item	Code	Inspection contents	Procedures	Tools
Checking B/M modes			(2) Apply ultrasound gel on the surface of the transducer lens and set it as shown in the figure below. The transducer should be set so that the target image is displayed optimally.  (3) Set the STC VR to the left (MIN) and the GAIN VR also to MIN (62 dB). (4) Adjust the STC VR so that the target echo image at a depth of approximately 16 cm starts to be displayed. (5) Leave the transducer in air and determine the position at which the echo of the steel ball target in (4) above is displayed to find the GAIN value at which white noise (including interference noise generated in the system, but not including external noise) starts to appear. This value is the sensitivity value. Sensitivity value (reference value) .....Refer to table 3-2.	If degradation is noticed, change the transducer and check if there is any improvement.

Table 3-1 System setting condition table
(for measuring the sensitivity value)

Item \ System name	SSA-370A
DEPTH	20
FOCUS	All ON
DR	30
EE	0
ECHO FILTER	RESO
ACOUSTIC POWER	MAX
PRE STC	OFF

Table 3-2 References for sensitivity value (S/N)

Model name		Transducer frequency (MHz)			
	Transducer type	2.5 to 2.75	3.5 to 3.75	5.0 to 6.0	7.5
SSA-370A	Linear				30 dB or more
	Convex		60 dB or more	35 dB or more	
	Sector	60 dB or more	60 dB or more	45 dB or more	

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4. CHECKING THE DOPPLER SENSITIVITY AND PRECISION

(1) Evaluation

Evaluation is performed by comparing with the data at the time of shipment from the factory.

(2) System settings

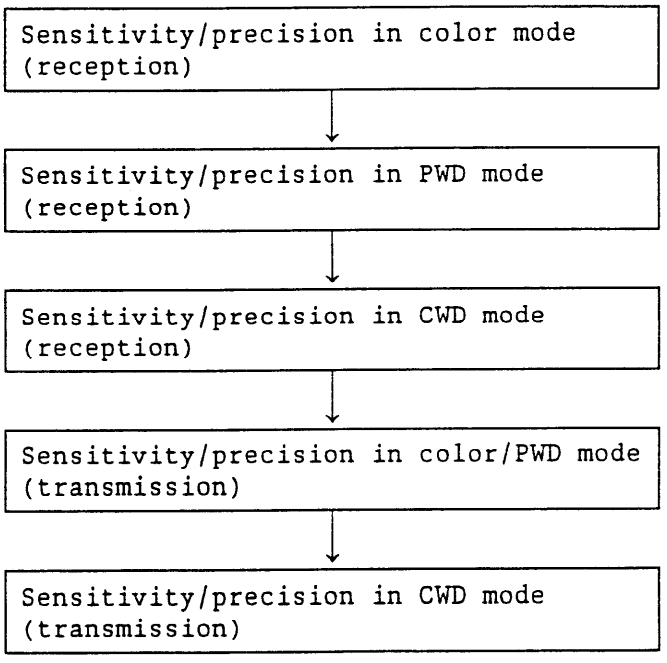
Refer to the operation manual for the Doppler sensitivity phantom.

If any settings are changed for special reasons, record the settings as supplementary information.

(3) Recording and filing images

Print images and file them together with the recorded data.

(4) Flowchart of check procedures



Item	Code	Inspection contents	Procedures	Tools
Doppler sensitivity/ precision	C01	4.1 Sensitivity/ Precision in Color Mode (reception)	(1) Refer to the operation manual for the phantom to perform measurements in color Doppler mode. (2) Attach the printed data to the log book. (3) Write down the voltage values of the function generator in the log book and make a graph.	
	C02	4.2 Sensitivity/ Precision in PWD Mode (reception)	(1) Refer to the operation manual for the phantom to perform measurements in PW Doppler mode. (2) Attach the printed data to the log book. (3) Compare the printed data with the previous data to check the spectrum illuminance for deterioration.	
	C03	4.3 Sensitivity/ Precision in CWD Mode (reception)	(1) Refer to the operation manual for the phantom to perform measurements in CW Doppler mode. (2) Attach the printed data to the log book. (3) Compare the printed data with the previous data to check the spectrum illuminance for deterioration.	
	C04	4.4 Sensitivity/ Precision in Color/PWD Mode (transmission)	(1) Refer to the operation manual for the phantom to perform measurements in color/PWD mode. (2) Attach the printed data to the log book. (3) Write down the oscilloscope measurements in the log book and make a graph.	

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Item	Code	Inspection contents	Procedures	Tools
Doppler sensitivity/ precision	C05	4.5 Sensitivity/ Precision in CWD Mode (transmission)	(1) Refer to the operation manual for the phantom to perform measurements in CW Doppler mode. (2) Attach the printed data to the log book. (3) Write down the oscilloscope measurements in the log book and make a graph.	

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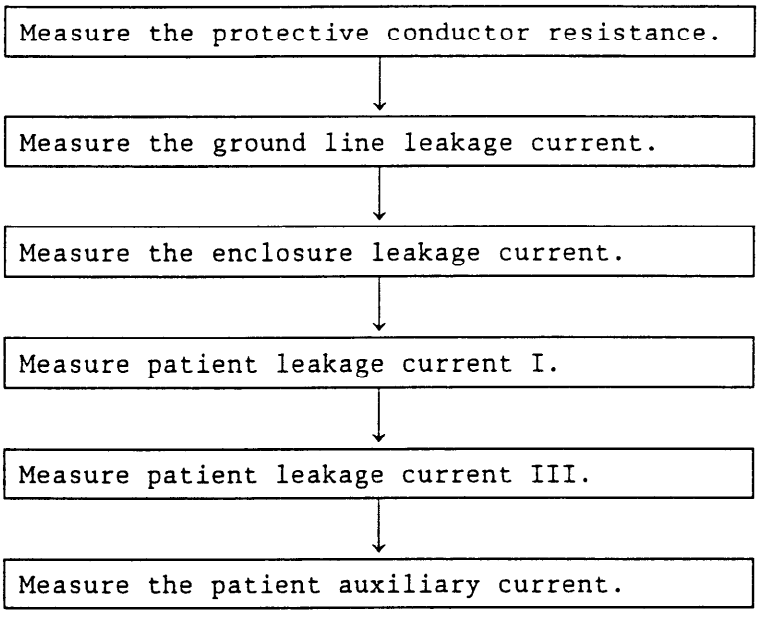
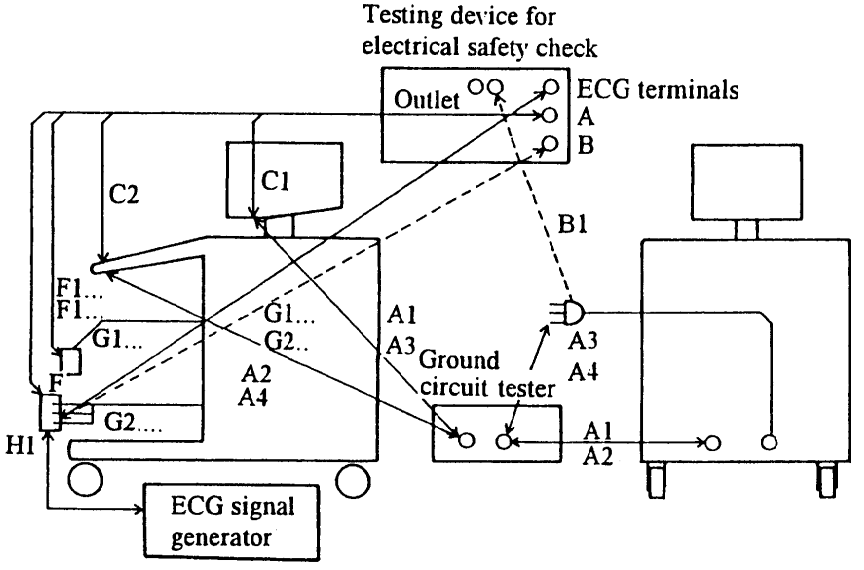
5. CHECK OF ELECTRICAL SAFETY

(1) Check procedures

For the measurements below, use the Toshiba-specified measuring devices such as the testing device for electrical safety check, type ESA-1.

(2) Flowchart of check procedures



Item	Code	Inspection contents	Procedures	Tools
Electrical safety			<<Measuring points>>  	

Item	Code	Inspection contents	Procedures	Tools
Electrical safety	D01	5.1 Protective Conductor Resistance	Perform measurements while the system is not in operation. (1) From the protective grounding terminal to the cover-retaining screw at the lower section of the monitor (A1). (2) From the protective grounding terminal to the retaining screw near the release lever on the operating panel (A2). (3) From the cover-retaining screw at the lower section of the monitor to the ground pin of the 3-pin power plug of the system (A3). (4) From the retaining screw near the release lever on the operating panel to the ground pin of the 3-pin power plug of the system (A4).	0.2 Ω or less
	D02	5.2 Ground Line Leakage Current	Perform measurements while the system is in operation. (1) Connect the 3-pin power plug of the system to the outlet on the testing device for the electric safety check (referred to hereinafter as testing device) (B1).	Normal: 0.5 mA or less Single failure: 1 mA or less

Item	Code	Inspection contents	Procedures	Tools
Electrical safety	D03	5.3 Enclosure Leakage Current	Perform measurements while the system is in operation. (1) Connect the cover-retaining screw at the lower section of the monitor to the testing device with the supplied cable and connect the 3-pin power plug of the system to the outlet on the testing device (C1). (2) Connect the retaining screw near the release lever on the operating panel to the testing device with the supplied cable and connect the 3-pin power plug of the system to the outlet on the testing device (C2).	Normal: 0.1 mA or less Single failure: 0.5 mA or less
	D04	5.4 Patient Leakage Current I	Perform the following measurements while the system is in operation. (1) Wrap the transducer with aluminum foil and place it in a container filled with physiological saline solution. Connect the aluminum foil to measuring point A on the testing device with the supplied cable and connect the 3-pin power plug of the system to the outlet on the testing device (E1). CAUTION: There must be some physiological saline solution between the transducer and the aluminum foil.	Normal: 0.1 mA or less Single failure: 0.5 mA or less

Item	Code	Inspection contents	Procedures	Tools
Electrical safety	D05	5.5 Patient Leakage Current III	Perform the following measurements while the system is in operation. (1) Wrap the transducer with aluminum foil and place it in a container filled with physiological saline solution. Connect the aluminum foil to measuring point A on the testing device with the supplied cable and connect the 3-pin power plug of the system to the outlet on the testing device (F1). In addition, wrap the electrodes of the ECG with aluminum foil, connect the aluminum foil to measuring point A on the testing device with the supplied cable, and then connect the 3-pin power plug of the system to the outlet on the testing device. CAUTION: 1. There must be some physiological saline solution between the transducer and the aluminum foil. 2. Perform measurements with great care because a voltage that is 10% greater than the line voltage must be applied.	Single failure: 5 mA or less

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Item	Code	Inspection contents	Procedures	Tools
Electrical safety	D06	5.6 Patient Auxiliary Current	Perform the following measurements while the system is in operation. (1) Wrap the transducer with aluminum foil and connect the aluminum foil to measuring point A on the testing device with the supplied cable. In addition, wrap each electrode of the ECG with aluminum foil and further wrap them together with aluminum foil. Then, connect the aluminum foil to measuring point B on the testing device with the supplied cable (G1). Connect the 3-pin power plug of the system to the outlet on the testing device. (2) Wrap the electrodes of the ECG with aluminum foil and connect one electrode to measuring point A and the other to measuring point B on the testing device (G2). Connect the 3-pin power plug of the system to the outlet on the testing device.	Normal: 0.01 mA or less Single failure: 0.05 mA or less

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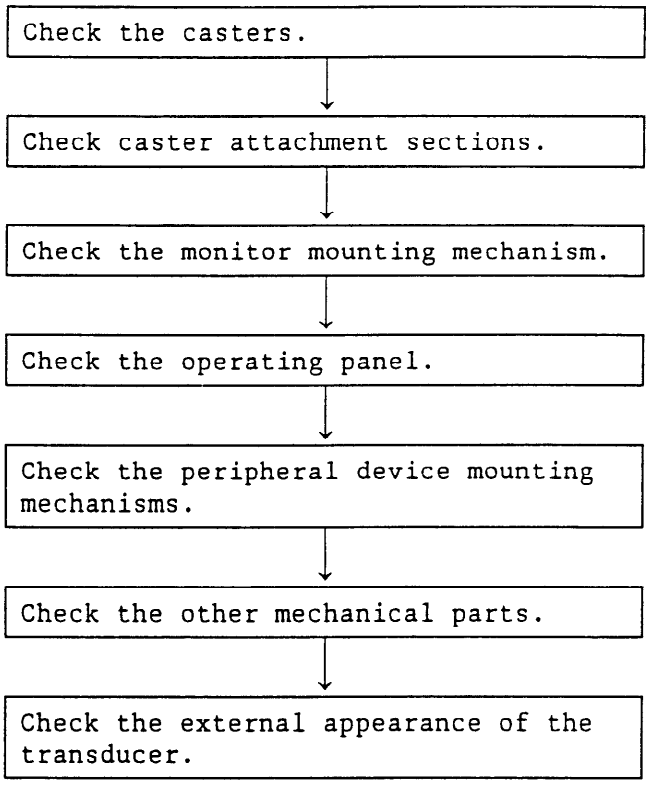
6. CHECK OF MECHANICAL SAFETY

(1) Evaluation

Evaluation is performed by visual and operational checks.

(2) Flowchart of check procedures



Item	Code	Inspection contents	Procedures	Tools
Mechanical safety	E01	6.1 Check of the Casters	Confirm that the four casters are straight and free from excess play.	
	E02	6.2 Check of Caster Attachment Sections	When the system is used at a site in which the system is moved frequently or moved over a route with many differences in level, confirm that the caster attachment sections of the chassis are not distorted or cracked. * If the system cannot be moved smoothly in the straight direction, there is possibility of an abnormality such as distortion or cracks in casters or caster attachment sections.	
	E03	6.3 Monitor Mounting Mechanism	(1) Confirm that the monitor is not tilted and does not show excessive play. (2) Confirm that the monitor can be moved and swiveled normally.	
	E04	6.4 Operating Panel	(1) Confirm that the panel is not tilted and does not show excessive play.	
	E05	6.5 Mounting Mechanism for Peripheral Devices	Confirm that the peripheral devices are mounted correctly.	
	E06	6.6 Other Mechanical Parts	Confirm that the suspension mechanism and the external panels are free from abnormalities.	
	E07	6.7 External Appearance of the Transducer	Confirm that each transducer is free from abnormalities.	

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7. IMAGE RECORDING

(1) Evaluation

The same person should record the same region under the same conditions to determine image deterioration (as far as possible).

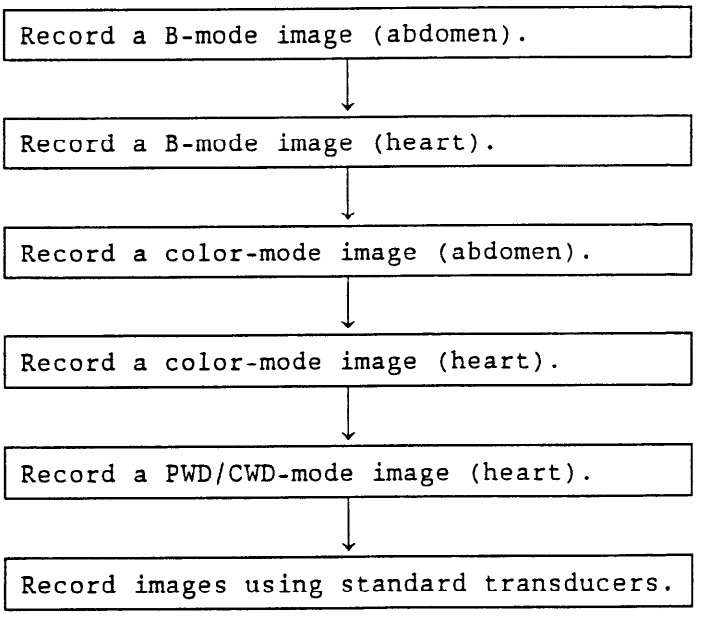
(2) System settings

Use typical settings which produce high-quality images. For the other items, the factory settings must be used. If any settings are changed for special reasons, record the settings as supplementary information.

(3) Recording and filing images

Print images and the preset menus used when the images are recorded and file them together with the recorded data.

(4) Flowchart of check procedures



Item	Code	Inspection contents	Procedures	Tools
Image recording	F01	7.1 B-mode Image (abdomen)	Perform right subcostal scanning to record a typical cross-sectional image of a region in which the hepatic vein is visible.	
	F02	7.2 B-mode Image (heart)	Record a typical cross-sectional image such as the long axis left ventricular image.	
	F03	7.3 Color-mode Image (abdomen)	Perform right subcostal scanning to record a typical cross-sectional image of a region in which the hepatic vein is visible.	
	F04	7.4 Color-mode Image (heart)	Record a typical image such as a four-chamber view from the left margin of the sternum.	
	F05	7.5 PWD/CWD-mode Image (heart)	Record a typical image such as a four-chamber view from the left margin of the sternum.	
	F06	7.6 Recording Images Using Standard Transducers	Record an image of the typical examination region for each transducer. * Intracorporeal transducers should be tested on the body surface rather than by insertion into the body.	

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1385,SHIMOISHIGAMI,OTAWARA-SHI,TOCHIGI-KEN 324-8550,JAPAN