GE Healthcare

Technical Publications

Direction 2173224–100

Revision 8

AMX–4+ Functional Check (Model 2169360, 2236420 & 2275938 Series)

Operating Documentation

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WARNING

- THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.
- IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.
- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

AVERTISSEMENT

- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
- SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.
- NE PAS TENTER D'INTERVENTION SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS.
- LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L'OPÉRATEUR OU LE PATIENT DES BLESSURES DUES À DES DANGERS ÉLECTRIQUES, MÉCANIQUES OU AUTRES.

WARNUNG

- DIESES KUNDENDIENST−HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.
- FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.
- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST−HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
- WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

AVISO

- ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.
- SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
- NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
- LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

ATENÇÃO

- ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.
- SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.
- NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.
- O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A' CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

AVVERTENZA

- IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

警告

・このサービスマニュアルには英語版しかありません。
・ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
・このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。
・この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

Direction 2173224–100

Revision 8

AMX–4+ Functional Check (Model 2169360, 2236420 & 2275938 Series)

IMPORTANT! . . . X-RAY PROTECTION

X-ray equipment if not properly used may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood by everyone who will use the equipment before you attempt to place this equipment in operation. The General Electric Company, Medical Systems Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.

It is important that everyone having anything to do with x-radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take adequate steps to protect against injury.

The equipment is sold with the understanding that the General Electric Company, Medical Systems Group, its agents, and representatives have no responsibility for injury or damage which may result from improper use of the equipment.

Various protective material and devices are available. It is urged that such materials or devices be used.

CAUTION: United States Federal law restricts this device to use by or on the order of a physician.

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If you have any comments, suggestions or corrections to the information in this document, please write them down, include the document title and document number, and send them to:

GENERAL ELECTRIC COMPANY
MEDICAL SYSTEMS

MANAGER − INFORMATION INTEGRATION, AMERICAS W−622
P.O. BOX 414
MILWAUKEE, WI 53201−0414

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT

All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing shall be performed by qualified GE Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation "damage in shipment" written on all copies of the freight or express bill before delivery is accepted or "signed for" by a General Electric representative or a hospital receiving agent. Whether noted or concealed, damage MUST be reported to the carrier immediately upon discovery, or in any event, within 14 days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this 14 day period.

Call Traffic and Transportation, Milwaukee, WI (414) 827–3449 / 8*285–3449 immediately after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extent of damage.

Complete instructions regarding claim procedure are found in Section "S" of the Policy & Procedure Bulletins.

6/17/94

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE
A	Oct. 30 1996	Initial Draft.
0	Dec. 13, 1996	Initial release.
1	Mar. 7, 1997	Corrected Tube Column rotation to 270 degrees (Section 3–3).
2	Aug. 14, 1997	High Impact Inspection.
3	Apr. 12, 1999	Added AMX4+ model 2236420–x series.
4	May 6, 1999	Added Yoke Mounting Screws inspection to section 3.
5	July 14, 1999	Removed Yoke Mounting Screws inspection from section 3.
6	Nov. 8, 2000	Added AMX–4+ Model 2275938 Series.
7	01JUN2010	Updated Section 3–4 to verify collimator mounting screw tightness. Reference GEHC Am Service CAPA #5.
8	10APR2019	Added new method FLUKE ESA 612 to Section 4 (Modified changes due to ECR2252536).

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SECTION 1
INTRODUCTION

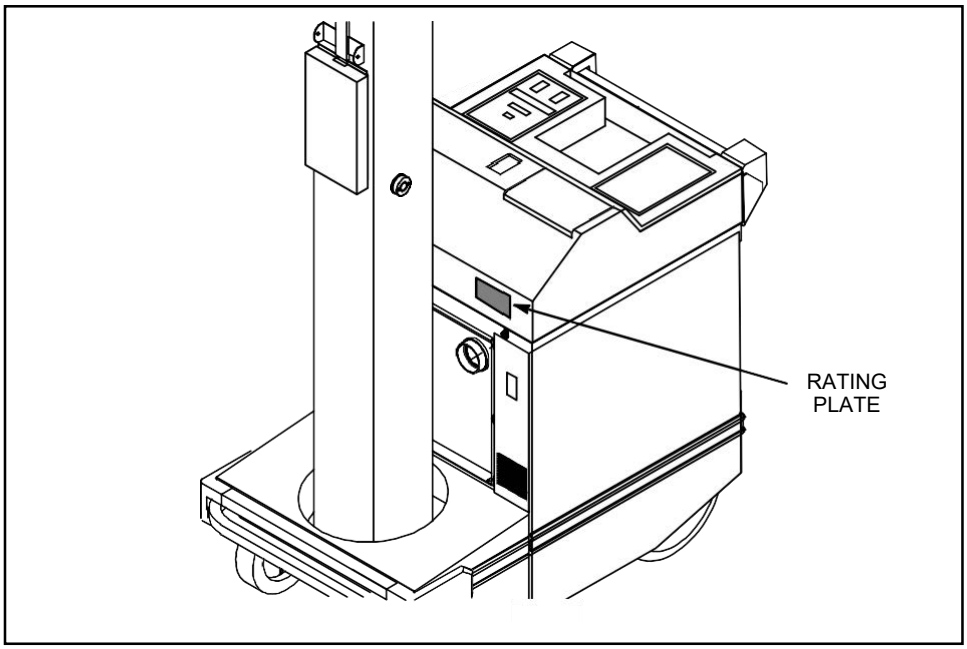
1-1 Identification

See Illustration 1–1. The AMX–4+ is identified by Model Number on the rating plate located on the top cover. Model part and catalog numbers are identified in Table 1–1.

TABLE 1–1
AMX–4+ MODELS

DESCRIPTION	PART NUMBER	CATALOG NUMBER	PART NUMBER	CATALOG NUMBER
DOMESTIC	2169360–7	A0659F	2236420–7 & 2275938–7	A0659JF
DOMESTIC, AEC	2169360–8	A0659FA	2236420–8 & 2275938–8	A0659JG
DOMESTIC, TECH SWITCH	2169360–9	A0659FC	2236420–9 & 2275938–9	A0659JH
DOMESTIC, AEC, TECH SWITCH	2169360–10	A0659FB	2236420–10 & 2275938–10	A0659JJ
IEC, EMC	2169360	A0659A	2236420 & 2275938	A0659J
IEC, EMC, AEC	2169360–2	A0659AA	2236420–2 & 2275938–2	A0659JA
IEC, EMC, TECH SWITCH	2169360–3	A0659AB	2236420–3 & 2275938–3	A0659JB
IEC, EMC, AEC, TECH SWITCH	2169360–4	A0659AC	2236420–4 & 2275938–4	A0659JC
JAPAN	2169360–5	A0659C	2236420–5 & 2275938–5	A0659JD
JAPAN SHORT COLUMN	2169360–6	A0659D	2236420–6 & 2275938–6	A0659JE

ILLUSTRATION 1–1
AMX–4+ IDENTIFICATION



1-2 General

The AMX–4+ contains operating safeguards to provide maximum safety. Before calling for service, be certain proper operating procedures are being used. Refer to Direction 2166913–100, *AMX–4+ Operating Manual,* or Direction 2166911–100, *AMX–4+ International Operation* for proper operating procedures.

Satisfactory equipment performance requires the use of service personnel specially trained on x–ray apparatus. The General Electric Company, Medical Systems, is responsible for the effects on safety, reliability, and performance only if the following conditions are met:

- The electrical wiring of the relevant rooms complies with all national and local codes.
- All assembly operations, extensions, re–adjustments, modifications or repairs are carried out by General Electric Company, Medical Systems, authorized service representatives.
- The equipment is used in accordance with the instructions for use. Refer to Direction 2166913–100, *AMX–4+ Operating Manual,* or Direction 2166911–100, *AMX–4+ International Operation* for proper operating procedures.

Only trained and qualified personnel should be permitted access to the internal parts of this equipment.

The General Electric Company, Medical Systems, and its associates, maintain a worldwide organization of stations from which one may obtain skilled x–ray service. Arrangements can usually be made to furnish preventive and/or emergency service on a contract basis. A General Electric Medical Systems representative will be glad to discuss this plan.

1-3 Cleaning

The AMX–4+ should be cleaned frequently, particularly if corroding chemicals are present. Use a cloth slightly moistened in warm, soapy water to clean all surfaces. Wipe with a cloth slightly moistened in clean water. Do not use cleaners or solvents of any kind. They may remove markings and could damage the finish and plastic covers.

1-4 Inspection

To assure continued performance of this x–ray equipment, a periodic maintenance program must be established in accordance with 2173227–100 *AMX–4+ Periodic Maintenance*. It is the owner's responsibility to supply or arrange for this service.

Functional Check verifies that the AMX–4+ is functioning correctly, that wear, or damage has not been sustained during use, that diagnostic self–test can be passed, and x–rays can be made. It does not indicate that the unit is performing to specifications. Refer to Direction 2173227–100, *AMX–4+ Periodic Maintenance,* for tests that verify specified performance.

These checks are divided into three parts: Visual Inspection, Functional Check, and Power Cord Check. Visual Inspection confirms legibility of operator indicators, and general safety. Functional Check confirms equipment operation and function. Power Cord Check verifies the integrity of the power cord for safe operation.

At the start of each shift, a Visual Inspection and Functional Check should be performed to verify operation. Functional Check should also be used to verify operation after the AMX–4+ is serviced.

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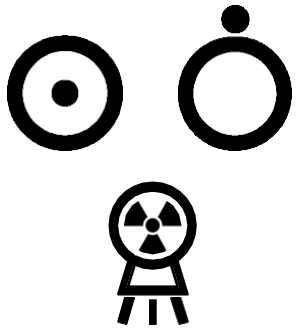
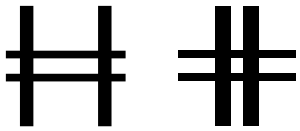
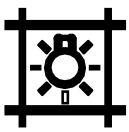
SECTION 2

VISUAL INSPECTION

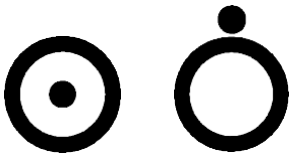
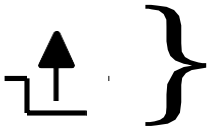
Requirements are pass or fail. Service is required if any Requirement is failed. After each Requirement is verified, place a check in its box. Record notes and comments next to the Requirement.

Inspect	Requirement	Inspector's Notes
2–1 Operator's Console 	☐ Switch and display markings clearly legible. ☐ Covering over kVp Switch, mAs Switch, and Displays free from cuts or punctures ☐ Verify good condition of ON and OFF symbols on console label. ☐ Verify good condition of X–ray emission symbol on console label.	
2–2 Collimator   	☐ Field Light and SID markings clearly legible. ☐ Field Light switch and Field Size knobs not loose or damaged. ☐ Guard Arms perpendicular to collimator bottom. ☐ SID indicating tape attached to left side. ☐ Rating Plate installed on right side of collimator. ☐ Rating Plate legible. ☐ Rotational Detent knob on right side of Collimator. ☐ Must be no movement between collimator and tube unit. ☐ Verify good condition of Transverse (Lateral) AND Longitudinal Collimator Blade symbols on collimator labels. ☐ Verify good condition of Field Light symbol on collimator label. ☐ Verify good condition of Positioning Control Lock symbol on labels, one on EACH collimator handle.	

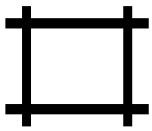
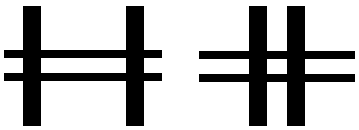
Inspect	Requirement	Inspector's Notes
2–3 Body	☐ Cassette Drawer not dented. ☐ Handle attached to top of Cassette Drawer and is free from sharp edges. ☐ Drive handle is free from sharp edges. ☐ No dents in left and right side covers. ☐ Rubber molding attached to lower sides of body. ☐ Rubber molding attached to front bumper. ☐ Exhaust Fan Port on front lower left clean and free of obstructions. ☐ Tube Support Column tight and solid in its mounting.	
	☐ Verify good condition of Type B Equipment symbol on label on back of AMX.	
	☐ Verify good condition of Brake Release symbol on label next to brake release button.	
	☐ Verify good condition of Hand switch Receptacle symbol on label next to hand switch receptacle on back of AMX.	

SECTION 3
FUNCTIONAL CHECK

Requirements are pass or fail. Service is required if any Requirement is failed. After each Requirement is verified, place a check in its box. Record notes and comments next to the Requirement.

Inspect	Requirement	Inspector's Notes
3–1 Power on  ON OFF	☐ Changing Key Switch position from off to on makes the Operators Display flash, then display **TESTING COMPLETE.** Recharge if display reads **RECHARGE RECOMMENDED** or **RECHARGE IMMEDIATELY.** ☐ Pressing **kVp** UP increases kVp display. ☐ Pressing **kVp** DOWN decreases kVp display. ☐ Pressing **mAs** UP increases mAs display. ☐ Pressing **mAs** DOWN decreases mAs display.	
3–2 Drive 	☐ Drive Enable bar raises and lowers easily. ☐ Drives forward, reverse, left, and right. ☐ Drive speed is easily controlled. ☐ Drives only in reverse when bumper is pushed in. ☐ Drive speed reduced when tube arm is removed from latch. ☐ Drive brakes release when brake release switch is depressed.	
3–3 Tube Column and Arm 	☐ Horizontal Tube Arm Latch operates smoothly and holds arm securely. ☐ Vertical Tube Column rotates 270 degrees from latch position to latch position. ☐ Tube Arm moves smoothly from bottom to top of tube column. ☐ Tube Arm extends and retracts smoothly. ☐ Tube Unit rotates 90 degrees to horizontal in both directions. ☐ Tube Unit rotates back 10 and forward 110 degrees. ☐ Latch holds column in drive position. ☐ Lock prevents vertical travel. ☐ Lock prevents tube extension. ☐ Lock prevents column rotation.	

Functional Check *Continued*

Inspect	Requirement	Inspector's Notes
3–4 Collimator  	☐ Collimator Interface Plate is securely fastened to x–ray tube. If not, **DO NOT USE.** Service is required. ☐ Three screws must be in place to hold the Collimator securely to the Collimator Interface Plate. If screw(s) are missing, DO NOT USE. Service is required. If all three screws are in place, confirm screws are secure by re–tightening according to Service Direction 2173225–100. ☐ SID Tape extends to 6 ft (1830 mm). ☐ SID Tape retracts automatically. ☐ Pressing Field Light Buttons on hand switch or on collimator turns field light on. ☐ Rotational Detent Knob rotates counter clockwise to loosen *(When viewed from the knob side of the collimator).* ☐ Rotational Detent Knob must be pulled out, or unscrewed counter clockwise to rotate collimator. ☐ Tightening Rotational Detent Knob clockwise will secure collimator in any position. ☐ Collimator rotates 90 degrees from center to either side. ☐ Rotational Detent Knob engages at center and at 90 degrees either side from center. ☐ Moving Transverse (Lateral) and Longitudinal Field Sizing Knobs moves the respective collimator blades.	
3–5 X–ray  CAUTION Radiation Hazard • AMX–4+ must be in a location where X–rays can be made safely. • Close collimator blades and move tube arm to its lowest position. • Select lowest kVp and mAs settings.	☐ Pressing X–ray Hand Switch Button to the first position causes the tube anode to rotate. ☐ Pressing X–ray Hand Switch Button to the second position makes an exposure. The X–ray Tone sounds and X–ray on indicator lights.	

SECTION 4

POWER CORD CHECK

Requirements are pass or fail. Service is required if any Requirement is failed. After each Requirement is verified, place a check in its box. Record notes and comments next to the Requirement.

Inspect	Requirement	Inspector's Notes
4–1 Power Cord		
Visual Inspection Ground	☐ Verify good condition of power cord and plug.	
Impedance Test	☐ Use a Dale 600 or Fluke ESA612 Safety Analyzer (or equivalent) to verify the following: Ground impedance shall not exceed 0.15 ohms from the ground pin of the plug to any accessible conductive part which could become live.	

Fluke ESA612 tool

Ground Resistance testing

This procedure is intended for the field engineer and describes the test procedure for the IEC 62353 Planned Maintenance and power plug replacement for the mobile X-ray products.

The IEC 62353: Medical Electrical Equipment - Planned Maintenance and power plug replacement of Medical Electrical Equipment standards ensures the electrical safety of medical electrical equipment.

Perform Ground Resistance testing			
Site Location	**Installation**	**PM**	**Repair**
Within USCAN	Fluke ESA612	Fluke ESA612	Fluke ESA612
Outside USCAN	Hioki Tool Using 25A current source	Fluke ESA612	Fluke ESA612

Perform Leakage Current testing			
Site Location	**Installation**	**PM**	**Repair**
Within USCAN	Fluke ESA612	Fluke ESA612	Fluke ESA612
Outside USCAN	Fluke ESA612	Fluke ESA612	Fluke ESA612

Personnel requirements

Required Persons: 01

Timing: 30mins

PM frequency: 12 months

Preliminary requirements

Tools and test equipment

- **Standard Toolkit**
- **Fluke ESA612 or below equivalent specification**

Specification	
Test Standard Selections	ANSI/AAMI ES-1, IEC62353, IEC60601-1, and AN/NZS3551

Voltage	
Ranges (Mains voltage)	90.0 V to 132.0 V ac rms 180.0 V to 264.0 V ac rms
Range (Point-to-point voltage	
5000 m	0.0 V to ≤150 V ac rms
2000 m	0.0 V to ≤300.0 V ac rms
Accuracy	(2% of reading + 0.2 V)

Earth Resistance	
Modes	2-Wire
Test Current	>200 mA ac
Range	0.000 Ù to 2.000 Ù
Accuracy	(2% of reading + 0.015 Ù)

Equipment Current	
Range	0.0 A to 20.0 A ac rms
Accuracy	(5% of reading + (2 counts or 0.2 A, whichever is greater))

Leakage Current	
Modes*	AC+DC (True-rms)
AC only	
DC only	

* For tests that do not use MAP voltage, AC+DC, AC ONLY, and DC ONLY modes are available for all leakages. MAP voltages are available only in True-rms (shown as AC+DC).

Patient Load Selection	AAMI ES1-1993, IEC 60601
Crest factor	≤3
Range	0.0 µA to 199.9 µA
200 µA to 1999 µA	
2.00 mA to 10.00 mA	

Frequency response/Accuracy	
DC to 1 kHz	(1 % of reading + (1 ⌈A or 1 LSD, whichever is greater))
1 kHz to 100 kHz	(2 % of reading + (1 ⌈A or 1 LSD, whichever is greater))
1 kHz to 5 kHz (current >1.6 mA)	(4 % of reading + (1 µA or 1 LSD, whichever is greater))
100 kHz to 1 MHz	(5 % of reading + (1 ⌈A or 1 LSD, whichever is greater))

Consumables
None

Replacement parts
None

Safety
None

Required conditions
None

Ground Resistance Test using FLUKE ESA612

Note: **Before you start the test, ensure the system is in OFF position and the system input power plug is connected to test socket on the side of Fluke ESA612 meter.**

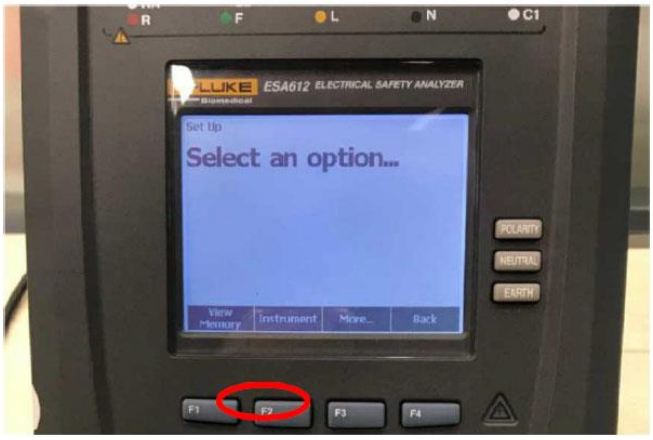
It is recommended to use Fluke ESA612 to set up the test conditions. The nominal AC Mains should be 120VAC or 220VAC to match the standard system plug. Refer to Appendix 1: Test Point Locations for AMX series for earth resistance test points of AMX series 120VAC or 220VAC AC Mains (site-specific input source).

Test Procedure

Note: **It is important to 'Zero/Null' leads to eliminate resistance in test leads as follows.**

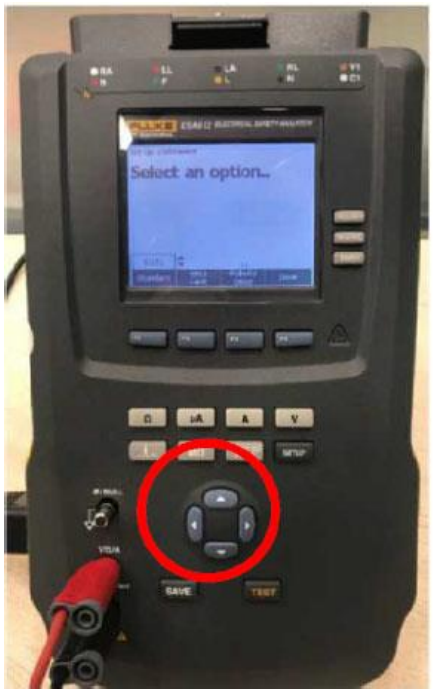
1. Make sure the power cord from the DUT is connected into outlet of the Fluke ESA612.
2. From the setup menu, press **F4** button, on the blue screen press **More** to reveal additional menu selections.

3. Press **F2** button, on the blue screen press **Instrument** to select the instrument setup.

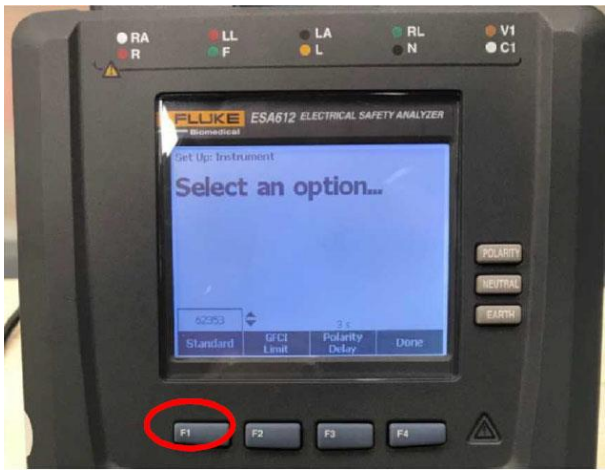


4. Press **F1** button, on the blue screen press **Standard** to open scroll box.

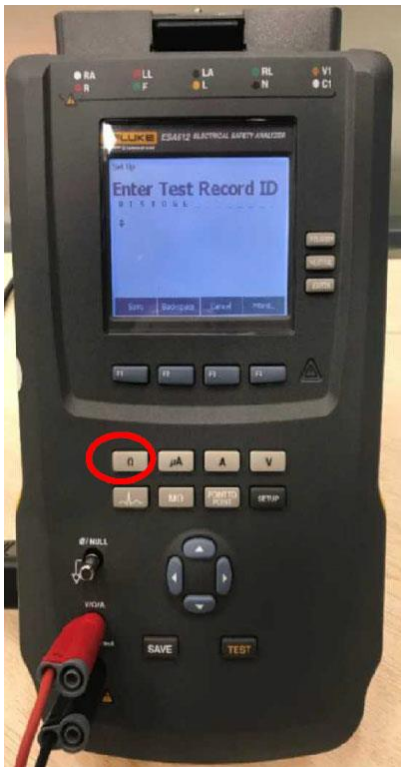
5. Press up or down to scroll through the standard selections.



6. Select IEC62353 standard is displayed, press **F1** button, on the blue screen press **Standard** to confirm the standard.



7. Press **F4** button, on the blue screen press **Done** to complete the standard setup.
8. Push [Ω] to reveal the resistance function menu.



9. Connect one end of a test lead to the V/ Ω /A jack.
10. If you use an accessories probe, connect it to the other end of the test lead and put the probe tip into the Ø/Null jack. If you use an alligator clip accessory, connect it to the other end of the test lead, put the null post adapter in the Ø/Null jack, and clamp the alligator clip to the null post adapter.

Note: **The Ø/Null jack does not accept the test leads supplied with the Product.**

⚠ CAUTION

To avoid electric shock, remove the null post adapter from the Null jack after a test lead zero is performed. The Null jack becomes potentially hazardous during some of the other test conditions.

11. Push **ZERO LEADS** button until the display shows 0.000 Ω
12. Now connect one end of the test lead between the V/Ω/A jack of the test meter and other end to an exposed conductive surface of the DUT ensuring that the input power plug of the DUT remains in the test socket on the side on the Fluke ESA612. Refer to Table 1: Conductive surface test points for AMX for the list of conductive surfaces (accessible dead metal parts) of the AMX system.

NOTICE

When a current of 200mA from the current source with a no-load voltage not exceeding 24V at a frequency of 50/60Hz is applied between conductor terminals for 5 to 10 seconds, the voltage drops between the terminals. The resistance determined using the current and voltage drop should not be greater than 0.2 Ohm (200 mΩ).
The resistance value will be displayed on the Fluke. Record the test results in Table 2: Results of the Protective Earth Resistance Test for AMX series.

13. Using steps 10 - 12 above, take measurements for each test point identified in Table 1: Conductive surface test points for AMX Record test results in Table 2: Results of the Protective Earth Resistance Test for AMX series as appropriate. (Appendix 1: Test Point Locations for AMX series for images of test points for respective systems).

NOTICE

Manufacturer recommendation is to perform Null test before testing each test point.

Test Point	Component	Test Point Description
1	Collimator	Collimator Skin Spacers
2	Tube	X-ray Tube (On the HV Cable Cathode Ring)
3	Column	Rivets on the top column cover (Applicable only for AMX4+)
4	Bin	M4 Screw inserted into PEM nut on receptor bin
5	Tube latch	Park Latch Assembly on the Chassis

Table 1: Conductive surface test points for AMX

Expected Test Results

The resistance, when measured, should **NOT** be greater than 0.3 Ohm (300mOhm).

Test Point	Units	Expected Value	Measured Value	Result (Pass/Fail)
Collimator Skin Spacers	Ω	≤ 0.3		
X-ray Tube (On the HV Cable Cathode Ring)	Ω	≤ 0.3		
Rivets on the top column cover (Applicable only for AMX4+)	Ω	≤ 0.3		
M4 Screw inserted into PEM nut on receptor bin	Ω	≤ 0.3		
Park Latch Assembly on the Chassis	Ω	≤ 0.3		

Table 2: Results of the Protective Earth Resistance Test for AMX series

⚠ CAUTION

If the measured value exceeds the expected value, then refer to Appendix 3: AC Power plug troubleshooting for power plug troubleshooting procedure to fix the grounding issues.

Leakage Current Test using FLUKE ESA612

TEST DESCRIPTION

It is recommended to use Fluke ESA612 or equivalent meter (Refer to Appendix 3: AC Power plug troubleshooting) to establish the test conditions. The nominal AC Mains should be 120VAC or 220VAC, to match the standard system plug.

Note: **Before you start the test, ensure the Equipment input power plug is connected to test socket on the side of Fluke ESA612 meter and the system is in ON condition. If ground testing is required for this system, verify that all ground testing results passed (see Table 1: Conductive surface test points for AMX) are ≤ 0.3 Ohms before conducting leakage testing. Leakage testing must be performed if the AC power plug has been replaced or disturbed. The leakage current must not exceed 300 uA.**

TEST PROCEDURE

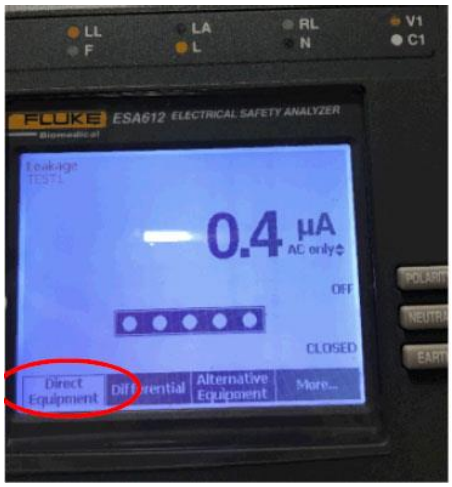
The Equipment Leakage Current test must be conducted under both normal condition and Single Fault Condition. The test procedures for both the conditions are described below.

TEST UNDER NORMAL CONDITIONS

To perform the Equipment Leakage Current Test under normal conditions, follow the steps listed below:

Note: **Refer to Table 5: Results of the leakage current test under normal conditions for AMX series for normal test conditions and Appendix 2: Test Equipment for the test equipment used. Refer to Table 4: Test Points for AMX series for the leakage current test points of the AMX system for 120VAC or 220VAC AC Mains (site-specific input source).**

1. Push µA to access the leakage current main menu.
2. Push the 'Direct Equipment button on the Fluke.



3. Push the Polarity button to select NORMAL.
4. Now connect one end of the test lead between the V/ Ω /A jack of the test meter and other end to an exposed conductive surface of the DUT (Refer Table 4: Test Points for AMX series for test points) ensuring that the input power plug of the DUT remains in the test socket on the side on the Fluke ESA612.
5. The leakage current value will be displayed. Record the test results in Table 5: Results of the leakage current test under normal conditions for AMX series for AMX series.

6. Repeat the above steps for each test point in Table 4: Test Points for AMX series and record the test results in Table 5: Results of the leakage current test under normal conditions for AMX series for each test points.

7. Repeat above steps with test conditions 2 & 3 as per Table 3: Test Condition for AMX series.

AMX Series		
Condition	**Power**	**Test Meter Polarity**
1	ON	Normal

Table 3: Test Condition for AMX series

Test Point	Components	Test Point Description
1	Collimator	Collimator Skin Spacers
2	Tube	X-ray Tube (On the HV Cable Cathode Ring)
3	Column	Rivets on the top column cover (Applicable only for AMX4+)
4	Bin	M4 Screw inserted into PEM nut on receptor bin
5	Tube Latch	Park Latch Assembly on the Chassis

Table 4: Test Points for AMX series

Note: **Refer to Appendix 2 for the locations of the AMX series test points.**

Expected Test Results

Test Point	Units	Expected Value	Measured Value	Result (Pass/Fail)
Collimator Skin Spacers	µA	≤ 300		
X-ray Tube (On the HV Cable Cathode Ring)	µA	≤ 300		
Rivets on the top column cover (Applicable only for AMX4+)	µA	≤ 300		
M4 Screw inserted into PEM nut on receptor bin	µA	≤ 300		
Park Latch Assembly on the Chassis	µA	≤ 300		

Table 5: Results of the leakage current test under normal conditions for AMX series

TEST UNDER SINGLE FAULT CONDITION (SFC)

In SFC, a single fault means of protection against electrical hazard is defective or faulty. To create Single Fault Condition, see Table 6: SFC Test conditions for 120VAC or 220VAC AC Mains.

SFC Conditions

Condition	Power	Test Meter Polarity	X-Ray
1	On	Reversed	No
2	On	Earth Open	No

Table 6: SFC Test conditions for 120VAC or 220VAC AC Mains

To perform the Equipment Leakage Current Test under SFC, follow the steps listed below:

Note: **Refer to Table 6: SFC Test conditions for 120VAC or 220VAC AC Mains for the test conditions and Appendix 3: AC Power plug troubleshooting for the test equipment used. Refer to Table 4: Test Points for AMX series.**

1. Set up test condition 1 listed in Table 6: SFC Test conditions for 120VAC or 220VAC AC Mains, follow step 2 below.

2. Press the '**Polarity**' button to select '**Reversed**' on the Fluke ESA612.
3. Now connect one end of the test lead between the V/ Ω /A jack of the test meter and another end to exposed conductive surface of the DUT ensuring that the input power plug of the DUT remains in the test socket on the side on the Fluke ESA612.
4. The leakage value will be displayed. Record the test results in Table 7: Results of the leakage current test under SFC conditions for AMX systems.
5. Connect the test lead between the V/ Ω /A jack of the test meter and an exposed conductive surface of the DUT ensuring that the input power plug of the DUT remains in the test socket on the side on the Fluke ESA612. Record the test results in Table 7: Results of the leakage current test under SFC conditions for AMX systems.
6. Set up test condition 2 listed in Table 6: SFC Test conditions for 120VAC or 220VAC AC Mains, Press the '**Earth**' button to select '**Open**' on the Fluke ESA612.
7. Connect the test lead between the V/ Ω /A jack of the test meter and an exposed conductive surface of the DUT ensuring that the input power plug of the DUT remains in the test socket on the side on the Fluke ESA612. Record the test results in Table 7: Results of the leakage current test under SFC conditions for AMX systems as appropriate.
8. Repeat the above steps for each leakage current test point mentioned in Table 4: Test Points for AMX series.

EXCEPTED TEST RESULTS

Condition 1

Test Point (SEE APPENDIX FOR TEST POINT LOCATIONS)	Units	Expected Value	Measured Value	Result (Pass/Fail)
Collimator Skin Spacers	µA	≤ 300		
X-ray Tube (On the HV Cable Cathode Ring)	µA	≤ 300		
Rivets on the top column cover (Applicable only for AMX4+)	µA	≤ 300		
M4 Screw inserted into PEM nut on receptor bin	µA	≤ 300		
Park Latch Assembly on the Chassis	µA	≤ 300		

Condition 2

Test Point	Units	Expected Value	Measured Value	Result (Pass/Fail)
Tube endcap screws or HV cable nuts	µA	≤ 300		
Collimator Skin guards	µA	≤ 300		
Scroll support rivets	µA	≤ 300		
Screw used for mounting strain relief of wired Hand switch1 cable	µA	≤ 300		
Tube latch on top-cover	µA	≤ 300		

Table 7: Results of the leakage current test under SFC conditions for AMX systems

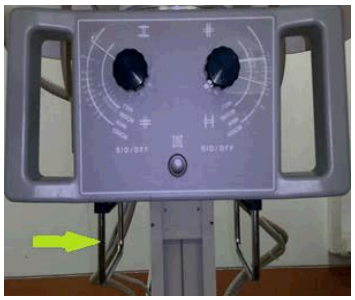
⚠ CAUTION

If the measured value exceeds the expected value, then refer to Appendix 3: AC Power plug troubleshooting procedure to fix the Leakage current.

Appendix 1: Test Point Locations for AMX series

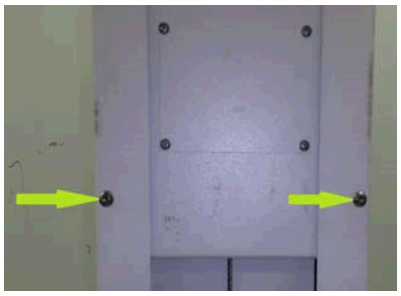
This section contains the illustrations of the test points listed in Table 1: Conductive surface test points for AMX.

Test Point 1: Collimator Skin Spacer

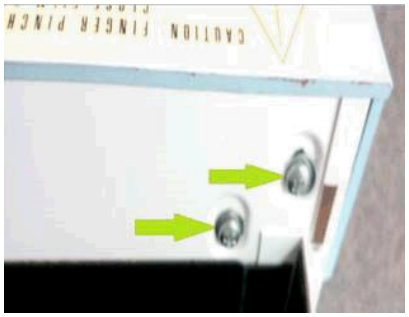


Test Point 2: X-ray Tube (On the HV Cable Cathode Ring)

Test Point 3: Rivets on the top column cover (Applicable only for AMX4+)



Test Point 4: M4 Screw inserted into PEM nut on receptor bin



Test Point 5: Park Latch Assembly on the Chassis

Appendix 2: Test Equipment

This section contains the illustrations of the meters used in the IEC 62353 tests.

Fluke ESA612 or equivalent (For more details refer the product manuals and video explanation at http://www.flukebiomedical.com/)

Fluke ESA612

Appendix 3: AC Power plug troubleshooting

Tools and Test Equipment

- Standard tool kit

Required Conditions

- Perform LOTO on the system. Leave the AC Plug (E1) exposed.

Procedure

- Remove screws on the top of plug marked
- Check the cable core if any open strands or broken wires, connect properly into plug
- Ensure all ground connections are properly tightened.
- Inspect cord reel box and termination of ground cables.

Note: If system using molded power cord type then check ground connection, Cord reel box and termination of ground cables.

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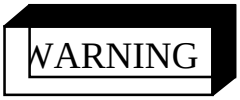
APPENDIX – SYMBOLS

All symbols used on the equipment and in its accompanying documents are shown and explained in this appendix.

Caution advises of an avoidable condition that could cause minor physical injury, or damage to equipment or data.



Warning advises of an avoidable condition that may allow or cause a personal injury or the catastrophic destruction of equipment or data.

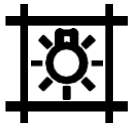
Danger advises of an avoidable condition that will cause serious or fatal injury.

Type B Equipment. Internal electrical power source provides an adequate degree of protection against electrical shock.

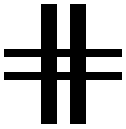
X–ray emission. X–ray tube head is emitting x–rays. Take adequate precautions to prevent the possibility of any persons carelessly, unwisely, or unknowingly exposing themselves or others to radiation.

Battery power on. This does not apply mains voltage.

Battery power off. This does not remove mains voltage.



Control for indicating radiation field by using light.



Collimator blades closed. The controlled blades are shown in thicker lines.

Collimator Blades open. The controlled blades are shown in thicker lines.

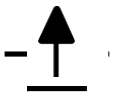
Functional Earth (ground) Terminal. Terminal directly connected to a point of a measuring supply or control circuit or to a screening part which is intended to be earthed for functional purposes.

Alternating Current. Indicates equipment that is suitable for alternating current only.

Direct Current. Indicates equipment that is suitable for direct current only.

Equipotentiality. Identifies terminals that bring the various parts of equipment or systems to the same potential when connected together. These terminals are not necessarily at earth (ground) potential. The value of the potential may be indicated next to the symbol.

Indicates lock release or brake release.



Indicates receptacle location for hand–held radiographic prep/expose and field–light control cable.

GE Healthcare

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