

**X-Ray Tube Assembly, Maxiray(TM)150
Models 2149520, 2149520-4, 2149522,
2149522-2, Brazed Graphite
Consisting of X-Ray Tube Type MX 150
2142036, 2142036-3 & X-Ray Tube Housing
Type MX 150 2149521, 2149521-3**



OPERATING DOCUMENTATION

2148080-4-1EN
Revision 1

ATTENTION

LES APPAREILS A RAYONS X SONT DANGEREUX A LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti.

Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.

Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles-mêmes.

Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 26 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X-RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x-ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator.

Excessive exposure to x-radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.

Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o incompetentes. Una exposición excesiva a la radiación X puede causar daños al organismo.

Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas incompetentes o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.

Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 26: Recomendaciones de la Comisión Internacional sobre la Protección Radiológica y normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sicherheitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle.

Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.

Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daß unbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen können.

Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 26 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und anderer nationaler Normenbehörden.

Important Information

LANGUAGE

ПРЕДУПРЕЖДЕНИЕ (BG)

Това упътване за работа е налично само на английски език.

- Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод.
- Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа.
- Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациента в резултат на токов удар, механична или друга опасност.

警告 (ZH-CN)

本维修手册仅提供英文版本。

- 如果客户的维修服务人员需要非英文版本，则客户需自行提供翻译服务。
- 未详细阅读和完全理解本维修手册之前，不得进行维修。
- 忽略本警告可能对维修服务人员、操作人员或患者造成电击、机械伤害或其他形式的伤害。

警告 (ZH-HK)

本服務手冊僅提供英文版本。

- 倘若客戶的服務供應商需要英文以外之服務手冊，客戶有責任提供翻譯服務。
- 除非已參閱本服務手冊及明白其內容，否則切勿嘗試維修設備。
- 不遵從本警告或會令服務供應商、網絡供應商或病人受到觸電、機械性或其他危險。

警告 (ZH-TW)

本維修手冊僅有英文版。

- 若客戶的維修廠商需要英文版以外的語言，應由客戶自行提供翻譯服務。
- 請勿試圖維修本設備，除非 您已查閱並瞭解本維修手冊。
- 若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。

UPOZORENJE (HR)

Ovaj servisni priručnik dostupan je na engleskom jeziku.

- Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod.
- Ne pokušavajte servisirati opremu ako niste u potpunosti pročitali i razumjeli ovaj servisni priručnik.
- Zanimarite li ovo upozorenje, može doći do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehaničkih ili drugih rizika.

VÝSTRAHA (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret uden at læse og forstå denne servicemanual. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WAARSCHUWING (NL)	Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar. • Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
WARNING (EN)	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.
HOIATUS (ET)	See teenindusjuhend on saadaval ainult inglise keeles. • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.

VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
ATTENTION (FR)	Ce manuel d'installation et de maintenance est disponible uniquement en anglais. • Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire. • Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance 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 (DE)	Diese Serviceanleitung 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 diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendienst-technikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.
ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται μόνο στα αγγλικά. • Εάν ο τεχνικός σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει τις υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό αν δεν έχετε συμβουλευτεί και κατανοήσει το παρόν εγχειρίδιο σέρβις. • Αν δεν προσέξετε την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στον τεχνικό σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
FIGYELMEZTETÉS (HU)	Ezen karbantartási kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészítése. • Ne próbálja elkezdni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték. • Ezen figyelmeztetés figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.

AÐVÖRUN (IS)	Þessi þjónustuhandbók er aðeins fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálþjónustu. • Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in lingua inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.
警告 (JA)	このサービスマニュアルには英語版しかありません。 • 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ください。 • 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。
경고 (KO)	본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다. • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다. • 본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오. • 본 경고 사항에 유의하지 않으면 전기 쇼크, 기계적 위험, 또는 기타 위험으로 인해 서비스 제공자, 사용자 또는 환자에게 부상을 입힐 수 있습니다.
BRĪDINĀJUMS (LV)	Šī apkopes rokasgrāmata ir pieejama tikai anglu valodā. • Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu. • Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas. • Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.

ĮSPĖJIMAS (LT)	Šis eksploataavimo vadovas yra tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas privalo klientas. • Nemėginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploataavimo vadovo. • Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų.
ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.
OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go. • Niezastosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.
ATENÇÃO (PT-BR)	Este manual de assistência técnica encontra-se disponível unicamente em inglês. • Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.
ATENÇÃO (PT-PT)	Este manual de assistência técnica só se encontra disponível em inglês. • Se qualquer outro serviço de assistência técnica solicitar este manual noutra língua, 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 colocar em perigo a segurança do técnico, do operador ou do paciente devido a choques eléctricos, mecânicos ou outros.

ATENȚIE (RO)	Acest manual de service este disponibil doar în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării și înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ОСТОРОЖНО! (RU)	Данное руководство по техническому обслуживанию представлено только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует самостоятельно обеспечить перевод. • Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.
UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. • Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge. • Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo. • Zanemarivanje ovog upozorenja može dovesti do povređivanja serviser, rukovaoca ili pacijenta usled strujnog udara ili mehaničkih i drugih opasnosti.
UPOZORNENIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkovi poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka. • Nepokúšajte sa o obsluhu zariadenia, kým si neprečítate návod na obsluhu a neporozumiete mu. • Zanedbanie tohto upozornenia môže spôsobiť zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.
ATENCION (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • 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.

**VARNING
(SV)**

Den här servicehandboken finns bara tillgänglig på engelska.

- Om en kunds servicetekniker har behov av ett annat språk än engelska, ansvarar kunden för att tillhandahålla översättningstjänster.
- Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken.
- Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.

**OPOZORILO
(SL)**

Ta servisni priročnik je na voljo samo v angleškem jeziku.

- Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod.
- Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli.
- Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.

**DİKKAT
(TR)**

Bu servis kılavuzunun sadece ingilizcesi mevcuttur.

- Eğer müşteri teknisyeni bu kılavuzu ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer.
- Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz.
- Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

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Revision History

Part/Rev	Date	Reason for Change	Pages
2148080-4-1EN rev 1	December 04, 2014	Initial release of direction 2148080-4-1EN.	60

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Chapter 1 Safety and Regulatory

1 Safety

1.1 X-Ray Protection



WARNING

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.

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

1.2 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.

1.3 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).

2 Regulatory Requirements

This equipment generates, uses, and can radiate radio frequency energy. The equipment may cause radio frequency interference to other medical and non-medical devices and radio communications. To provide reasonable protection against such interference, this product complies with emission limits for Group 1 Class A Medical Devices as stated in EN 60601-1-2.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause interference (which may be determined by switching the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem using one or more of the following measures:

- Reorientate or relocate the affected device(s).
- Increase the separating space between the equipment and the affected device.
- Power the equipment from a source different from that of the affected device.
- Consult the point of purchase or the service representative for further suggestions.

The manufacturer is not responsible for any interference caused either by the use of interconnect cables other than those recommended or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

To comply with the regulations applicable to an electromagnetic interface for a Group 1 Class A Medical Device, all interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio frequency interference in violation of the European Union Medical Device directive and FCC regulations.

This product complies with the regulatory requirements of the following:

- Council Directive 93/42/EEC concerning medical devices when it bears the following CE marking of conformit:

Illustration 1-1:



For a system, the location of the CE marking label is described in the system manual.

European registered place of business (two addresses correspond to the same legal entity)::

Table 1-1:

GE Medical Systems SCS 283 rue de la Minière 78530 Buc France Tel : +33 1 30 70 40 40	GE Medical Systems SCS 283 rue de la Minière BP 34 78533 Buc Cedex Tel : +33 1 30 70 40 40
--	---

- Green QSD 1990 Standard issued by MDA (Medical Devices Agency, Department of Health, UK).
- Medical Device Good Manufacturing Practice Manual issued by the FDA (Food and Drug Administration, Department of Health, USA).

-
- Underwriters' Laboratories, Inc. (UL), an independent testing laboratory.
 - Canadian Standards Association (CSA).
 - International Electrotechnical Commission (IEC), international standards organization, when applicable.



 WARNING

CE MARKING ON X-RAY TUBE ASSEMBLY CONCERNS ONLY THE X-RAY TUBE ASSEMBLY ALONE.

THIS X-RAY TUBE ASSEMBLY IS INTENDED TO BE USED IN A MEDICAL SYSTEM WHICH CAN BE A CE MARKING SYSTEM OR A NON CE MARKING SYSTEM AS GENERALLY INSTALLED BASE.

REFER TO ACCOMPANYING DOCUMENT OF THE SYSTEM FOR COMPATIBILITY OF THE X-RAY TUBE ASSEMBLY AND FOR INFORMATIONS CONCERNING CE MARKING OF THE SYSTEM.

TO SUM UP, INSTALLING A CE MARKED X-RAY TUBE ASSEMBLY IN A NON CE MARKED SYSTEM DOES NOT MAKE THE WHOLE SYSTEM CE MARKED.

ACCOMPANYING DOCUMENT OF THIS PRODUCT ACCORDING TO IEC 601-2-28/1993. TERMINOLOGY USED IN THIS DOCUMENT IS AS USED IN IEC 788/1984.

THIS DOCUMENT MUST BE TRANSMITTED TO THE USER AND ASSEMBLER OF THE X-RAY TUBE ASSEMBLY.

ORIGINAL LANGUAGE OF EDITING: ENGLISH.

GENERAL ELECTRIC MEDICAL SYSTEMS IS ISO 9001 CERTIFIED.

Chapter 2 X-Ray Tube, MX 150, 2142036 and 2142036-3

1 Description

1.1 General

The MX 150 2142036, 2142036-3 X-Ray tube is equipped with tube housing MX 150 2149521, 2149521-3.



The main characteristics of this tube are given in [Section 1.2](#).

1.2 Characteristics

Subject	Specifications	Reference Standards ¹
Nominal anode input power ²	16/47/115 kW	IEC 60613/2010
Maximum anode heat content	1 430 000 Joules	IEC 60613/2010
Anode maximum cooling rate	4.96 kW	JIS Z 4704
Anode heating and cooling curves	See Section 2.4, Anode Heating and Cooling Curves	IEC 60613/2010
Single load rating	See Section 2.2, Single load rating	IEC 60613/2010
Serial load rating	See Section 2.3, Serial Load rating	IEC 60613/2010
Target material	Tungsten	IEC 60601-2-28/1993 and IEC 6061-2-28/2010
Reference axis	Normal to longitudinal axis to X-Ray tube See Section 1.3	IEC 60601-2-28/1993 and IEC 6061-2-28/2010
Target angle with respect to the specified reference axis	11°15'	IEC 60601-2-28/1993 and IEC 6061-2-28/2010
Nominal focal spot value ⁴	0.3, 0.6, 1.2	IEC 60336/2005
Distance between axes of focal spots 1.2 and 0.6	less than equal +/-0.5 mm	
Distance between axes of focal spots 1.2 and 0.3	less than equal +/-0.6 mm	
Distance between axes of focal spots 0.6 and 0.3	less than equal +/-0.1 mm	
Modulation transfer function	See Section 2.5, Modulation transfer function	IEC 60336/2005
Minimal inherent filtration ³	0.85 mm Al equivalent at 70 kV	
Nominal high voltage	125 kV	IEC 60613/2010
Anode rotation	10 800 rpm, 180 Hz	IEC 60601-2-28/1993 and IEC 6061-2-28/2010
Maximum current filament	6.5 A	IEC 60613/2010
Electron emission curves	See Section 2.1, Electron Emission Curves Voltage	IEC 60613/2010
Disc diameter	140 mm	—
Weight	5.1 kg +/-0.1 kg	

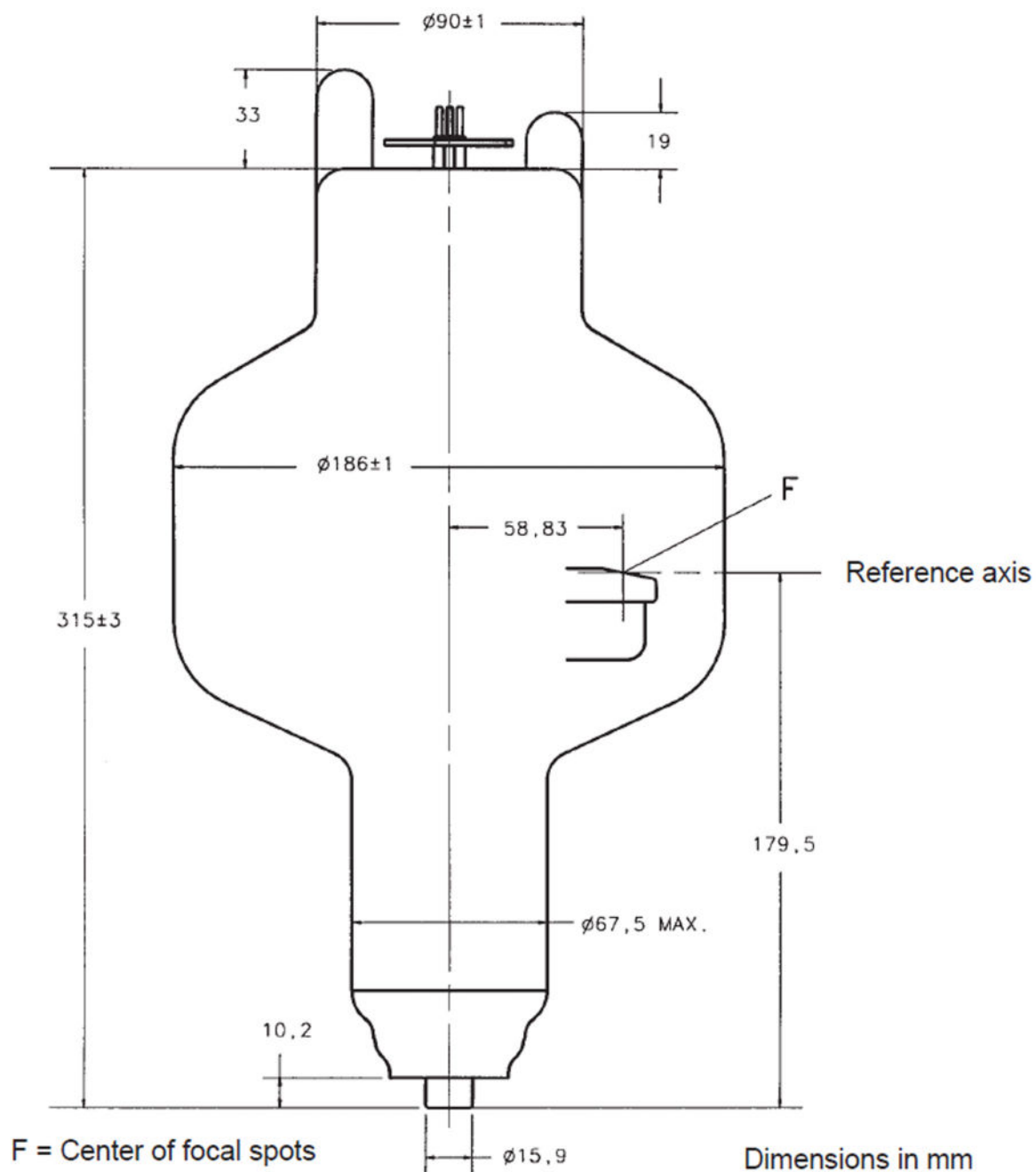
¹ Reference standard means that compliance with this standard is stated.

² For an equivalent anode input power of 100 W.

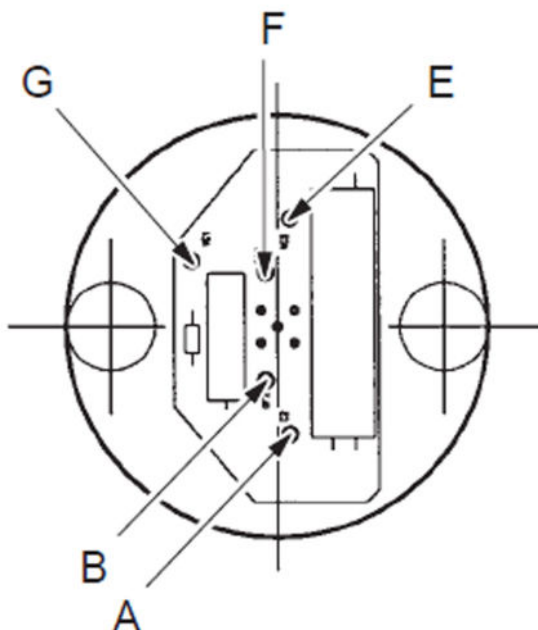
³ Determined according theoretical method of calculating from BIRCH and MARSHALL.

⁴ 0.3 focal spot is obtained by biasing the 0.6 focal spots with one constant potential, $-1900\text{ V} > V_{g2} > -2300\text{ V} \pm 5\%$. Electron emission from the 0.6 focal spot is controlled by grid up to 125 kV at $V_{g1} = -3500\text{ V} \pm 6\%$.

1.3 Dimensions



1.4 Connections



A – Common

B – Large focal spot (1.2)

E – Vg2

F – Small focal spot (0.6 and 0.3)

G – Vg1

1.5 Labelling

X-Ray tube carries identification labels according IEC Standard 601-2-28 which identify Manufacturer, Model and Serial No. of the component.

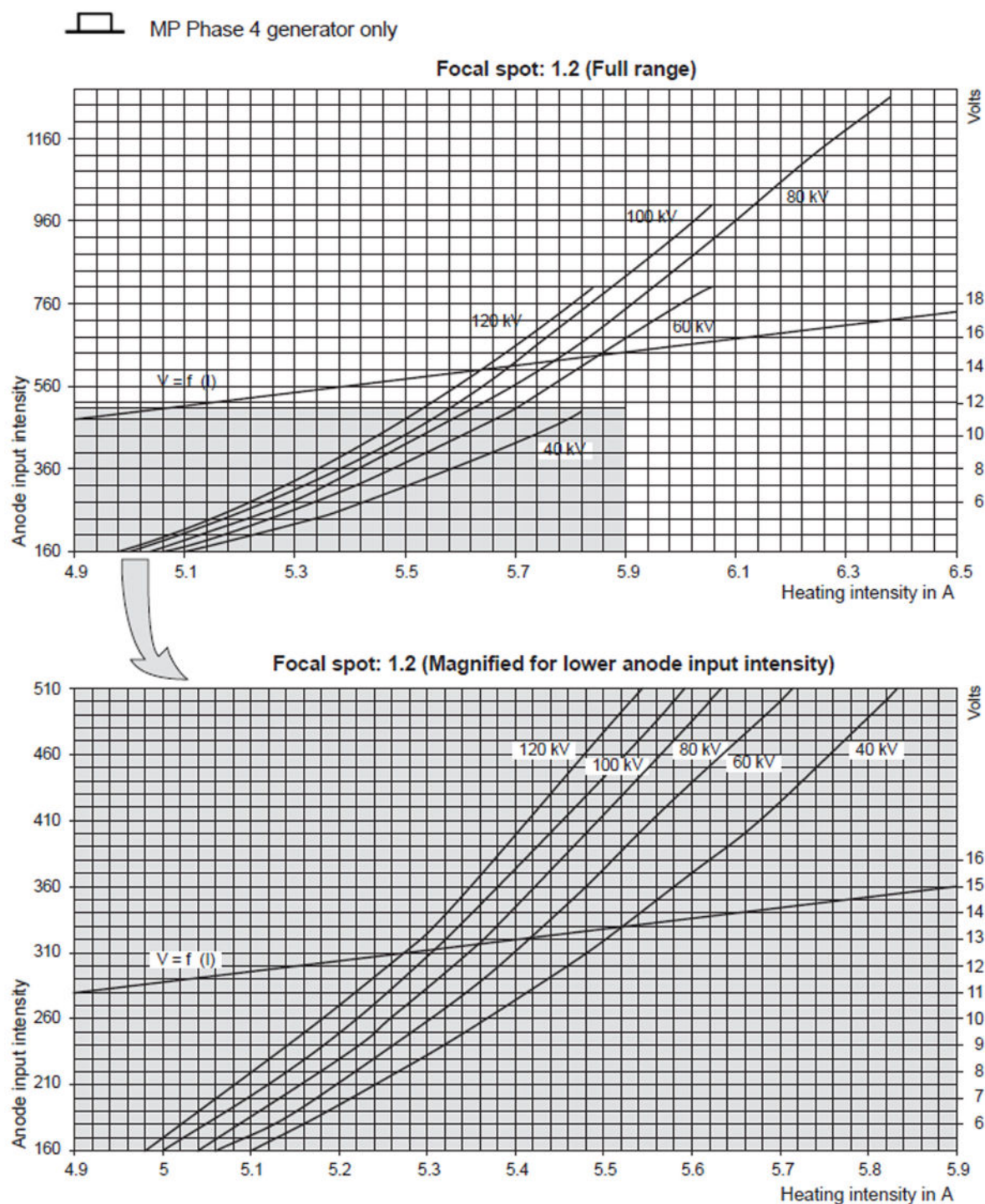
This marking is designed to remain legible when the x-ray tube is dismantled from the X-Ray tube housing after a period of normal use.

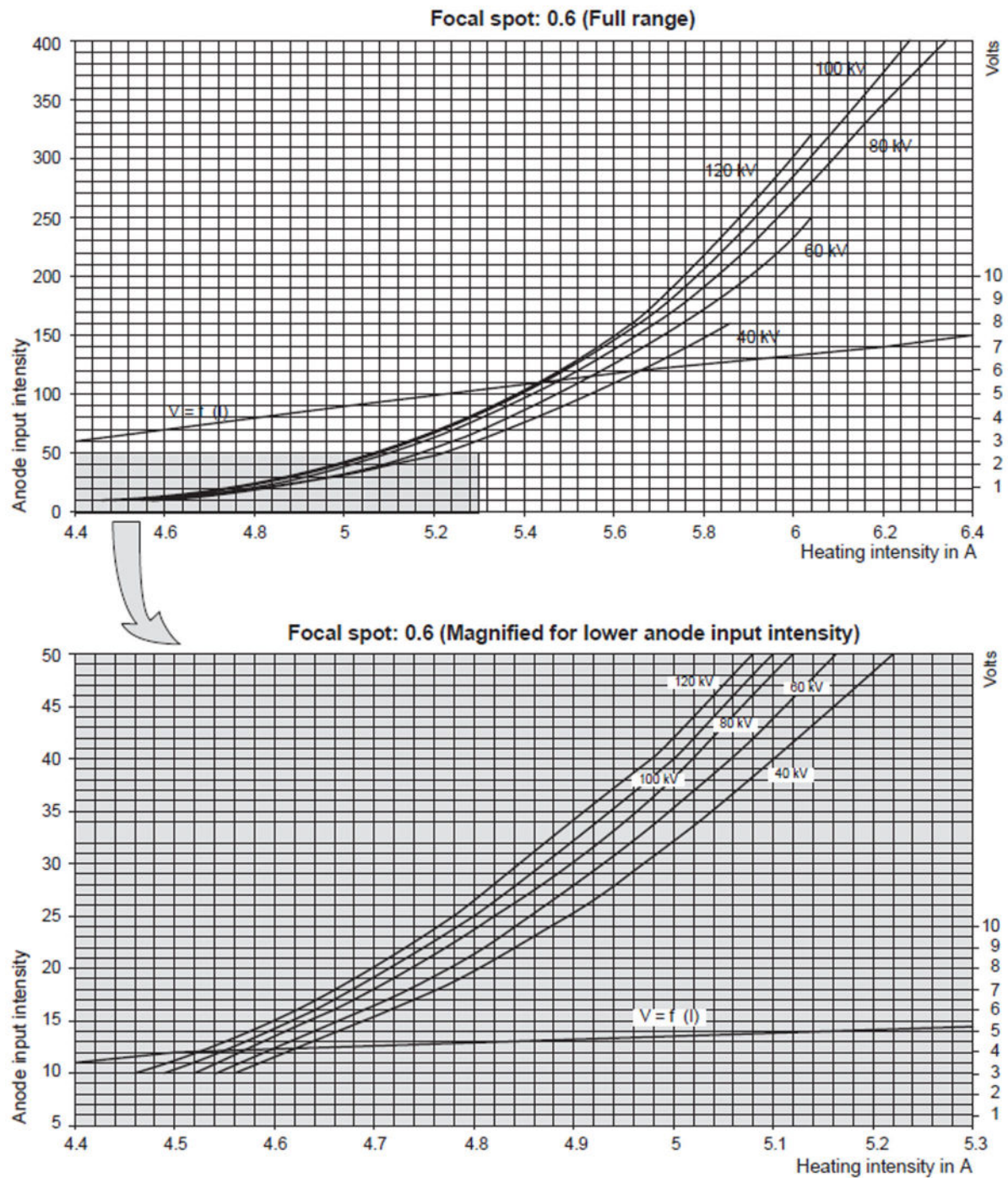
The following table shows the X-ray tube assemblies covered by this document.

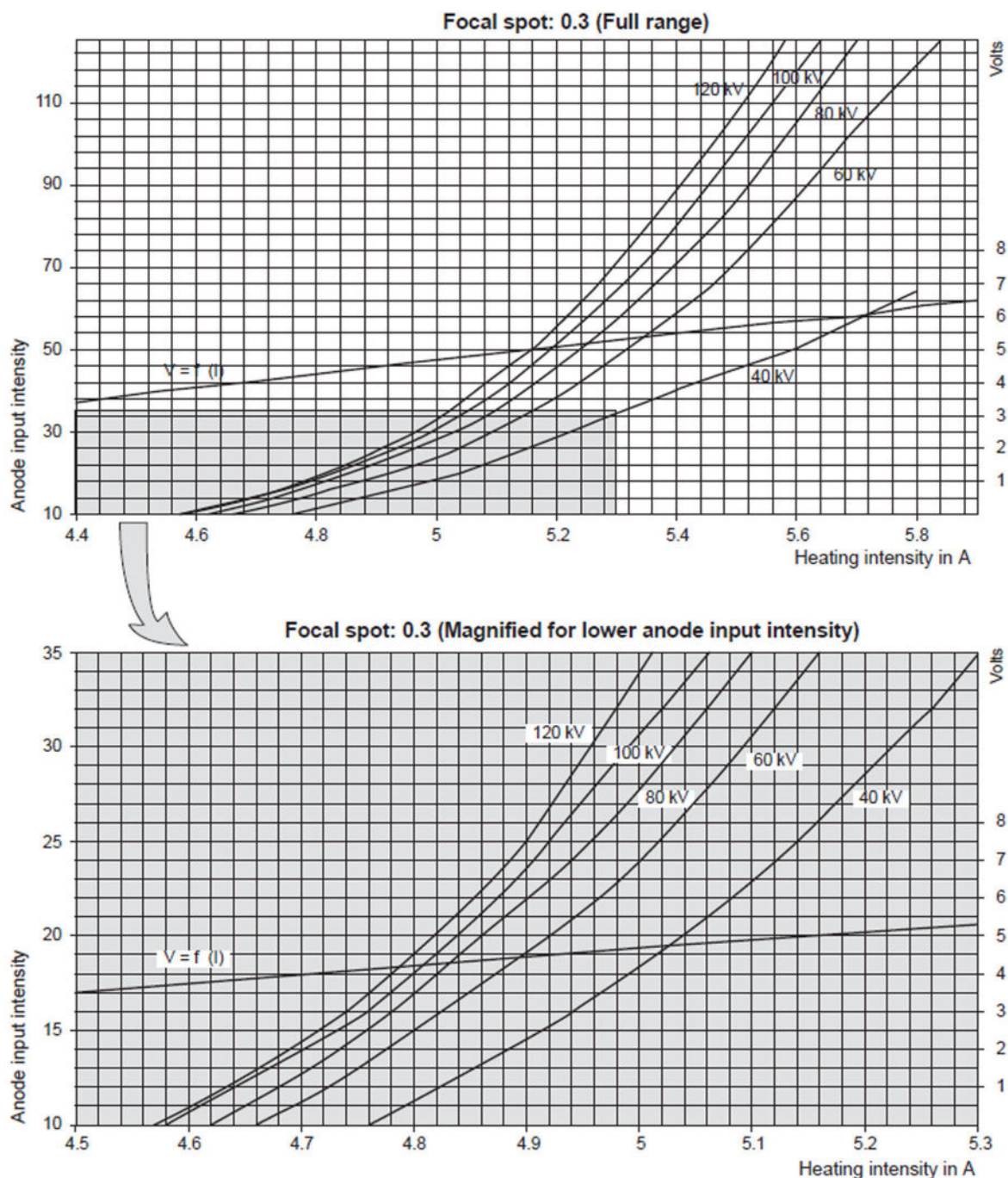
X-ray Tube Assembly Model Number	Casing Model Number	Tube Insert Model Number
2149520	2149521	2142036
2149520-4	2149521	2142036-3
2149522	2149521-3	2142036
2149522-2	2149521-3	2142036-3

2 Curves and Charts

2.1 Electron Emission Curves Voltage







2.2 Single load rating

For an equivalent anode input power of 100 W.

2.2.1 Focal spot: 1.2, Voltage

Voltage .

POWER (kW)	EXPOSURE TIME(s)
132	0.01
115	0.1
92	0.5
80	1
70	2
45	10

2.2.2 Focal spot: 0.6

POWER (kW)	EXPOSURE TIME(s)
50.8	0.01
47.2	0.1
38.5	0.5
34	1
32.4	2
27	10

2.2.3 Focal spot: 0.3

POWER (kW)	EXPOSURE TIME(s)
16	0.01
16	0.1
14.6	0.5
14.3	1
13.8	2
12.7	10

2.3 Serial Load rating

2.3.1 Focal spot: 1.2, Voltage

Voltage .

Maximum series run time (s) assumes series starts with 80% of anode storage available.

Table 2-1: 1 FRAME/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	600	600
0.010	600	600	600	600	600
0.020	600	600	600	600	600
0.040	600	600	600	384	191
0.080	600	268	150	95	59
0.100	275	163	102	65	38
0.200	77	47	26	12	3

Table 2-2: 2 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	600	600
0.010	600	600	600	600	600
0.020	600	600	600	511	220
0.040	600	329	175	113	74
0.080	133	89	59	38	22
0.100	96	63	41	24	13.5
0.200	30	16	7	2.5	1

Table 2-3: 4 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	600	600
0.010	600	600	600	600	231
0.020	600	331	186	120	80
0.040	133	95	65	43	27
0.080	51	33	20	11	4.5
0.100	35	21	12	5	2
0.200	6.5	2.5	1	0.5	0

2.3.2 Focal spot: 1.2

Table 2-4: 6 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	600	496
0.010	600	600	387	192	123
0.020	202	152	101	69	45.5
0.040	81	54	36	23	13
0.080	27	16	8	3.5	1
0.100	17	8.5	3.5	1.5	1

Table 2-5: 8 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	600	238
0.010	600	332	191	124	83
0.020	133	99	68	46	29.5
0.040	54	35	22	13	6.5
0.080	16	7.5	3.5	1.5	1
0.100	8.5	3.5	1.5	1	0.5

Table 2-6: 10 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	60	70	80	90	100
0.005	600	600	600	280	164
0.010	282	212	134	91	61.5
0.020	100	73	50	33	20
0.040	39	25	14	7.5	3
0.080	9	4	2	1	0.5

2.3.3 Focal spot: 0.6, Voltage

Voltage .

Maximum series run time (s) assumes series starts with 80% of anode storage available.

Table 2-7: 1 FRAME/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	600
0.010	600	600	600	600	600
0.020	600	600	600	600	600
0.040	600	600	600	384	397
0.080	600	600	600	277	0
0.100	600	600	600	168	0
0.200	600	246	92	35	0

Table 2-8: 2 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	600
0.010	600	600	600	600	600
0.020	600	600	600	600	468
0.040	600	600	600	327	115
0.080	600	600	188	75	0
0.100	600	314	117	47	0
0.200	153	60	26	13	0

Table 2-9: 4 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	600
0.010	600	600	600	600	501
0.020	600	600	600	350	121
0.040	600	600	203	83	34
0.080	247	111	46	22	0
0.100	169	68	30	15	0
0.200	35	17	8.5	3.5	0

2.3.4 Focal spot: 0.6

Table 2-10: 6 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	600
0.010	600	600	600	600	209
0.020	600	600	460	153	61
0.040	600	215	91	38	18
0.080	115	47	23	12	0
0.100	70	30	16	8	0

Table 2-11: 8 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	520
0.010	600	600	600	362	125
0.020	600	600	211	88	36
0.040	248	117	49	24	12
0.080	62	27	15	7	0
0.100	38	19	10	4.5	0

Table 2-12: 10 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	20	25	30	35	40
0.005	600	600	600	600	303
0.010	600	600	600	222	87
0.020	600	395	134	56	25
0.040	172	73	32	17	8
0.080	38	19	10	4.5	0

2.3.5 Focal spot: 0.3, Voltage

Voltage .

Maximum series run time (s) assumes series starts with 80% of anode storage available.

Table 2-13: 1 FRAME/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	0
0.020	600	600	600	600	0
0.040	600	600	600	600	0
0.080	600	600	600	600	0
0.100	600	600	600	600	0
0.200	600	600	487	125	0

Table 2-14: 2 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	0
0.020	600	600	600	600	0
0.040	600	600	600	600	0
0.080	600	600	600	305	0
0.100	600	600	600	169	0
0.200	600	266	82	24	0

Table 2-15: 4 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	0
0.020	600	600	600	600	0
0.040	600	600	600	344	0
0.080	600	600	181	61	0
0.100	600	313	100	31	0
0.200	138	40	15	6	0

2.3.6 Focal spot: 0.3

Table 2-16: 6 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	0
0.020	600	600	600	600	0
0.040	600	600	444	129	0
0.080	600	192	63	21	0
0.100	384	106	33	13	0

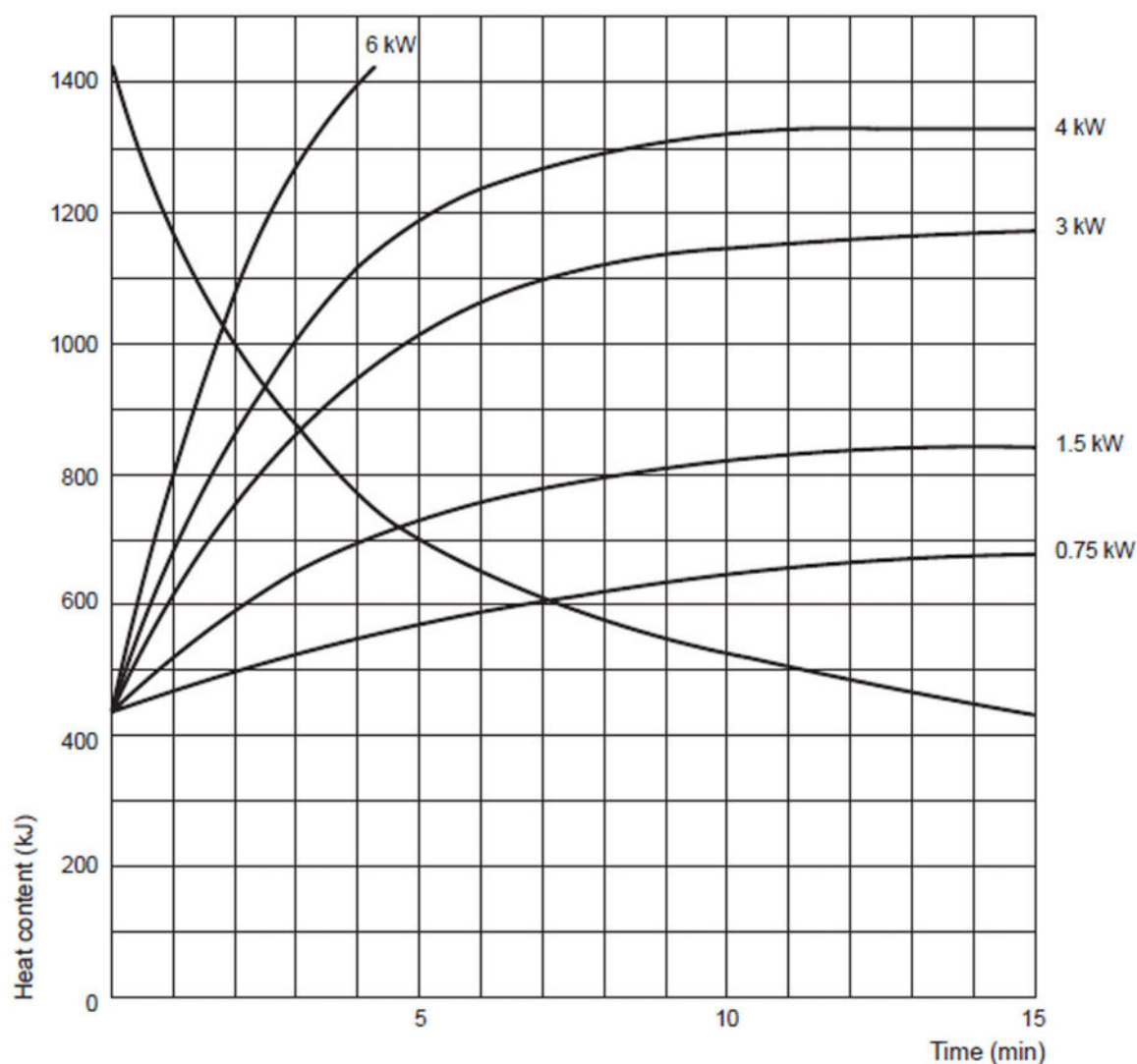
Table 2-17: 8 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	0
0.020	600	600	600	367	0
0.040	600	600	194	67	0
0.080	297	91	29	12	0
0.100	150	45	17	7.5	0

Table 2-18: 10 FRAMES/S

EXPOSURE TIME (s)	POWER (kW)				
	8	10	12	14	16
0.005	600	600	600	600	600
0.010	600	600	600	600	600
0.020	600	600	600	209	0
0.040	600	350	112	36	0
0.080	153	46	17	8	0

2.4 Anode Heating and Cooling Curves



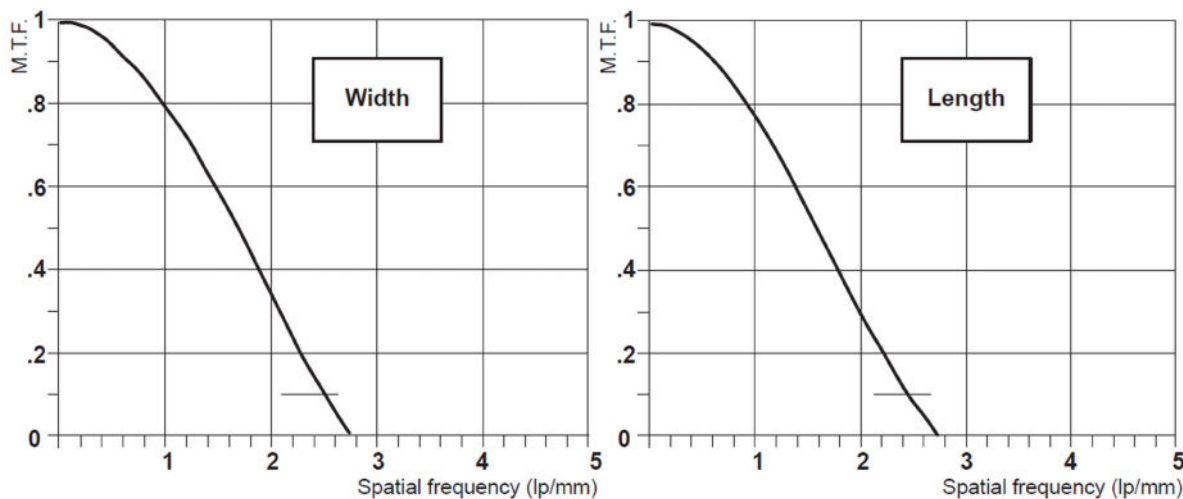
NOTE: X-Ray performances can be limited by associated systems.

2.5 Modulation transfer function

These curves show typical performances.

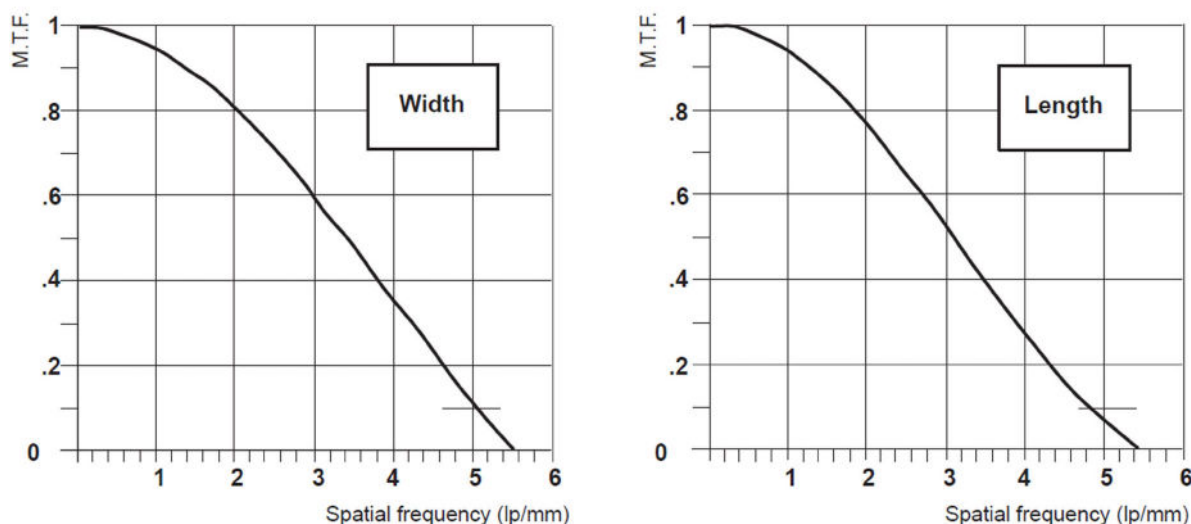
2.5.1 Focal spot: 1.2

To get minimum values (according to IEC Standard 60336/2005), multiply the frequency by 0.93 (width) or 0.92 (length). Standard magnification: 1.3.



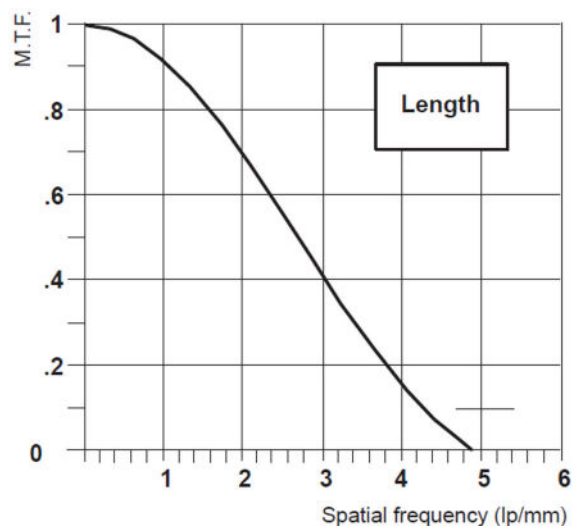
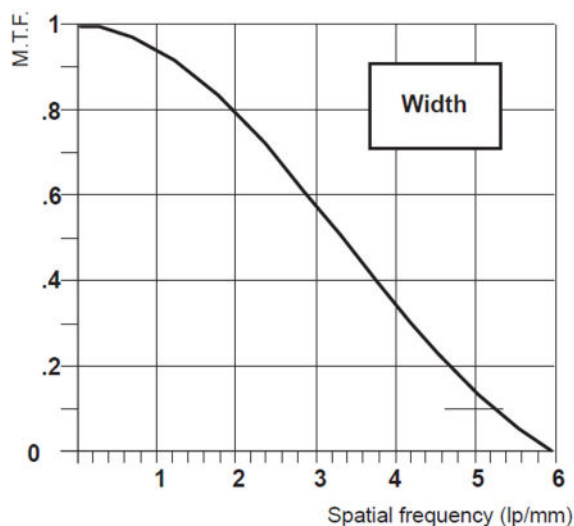
2.5.2 Focal spot: 0.6

To get minimum values (according to IEC Standard 60336/2005), multiply frequency by 0.92 (width) or 0.81 (length) Standard magnification: 1.3.



2.5.3 Focal spot: 0.3

To get minimum values (according to IEC Standard 60336/2005), multiply the frequency by 0.90 (width) or 0.82 (length). Standard magnification: 2.



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Chapter 3 X-Ray Tube Assembly Maxiray 150

1 Description

1.1 General

The Maxiray 150 Brazed Graphite X-Ray Tube Assembly is configured mechanically and electrically with the associated systems: Tilt-C, LCA, LCV+, LC+, LCN+, LCLP+.

Illustration 3-1: D2711C and D2712C

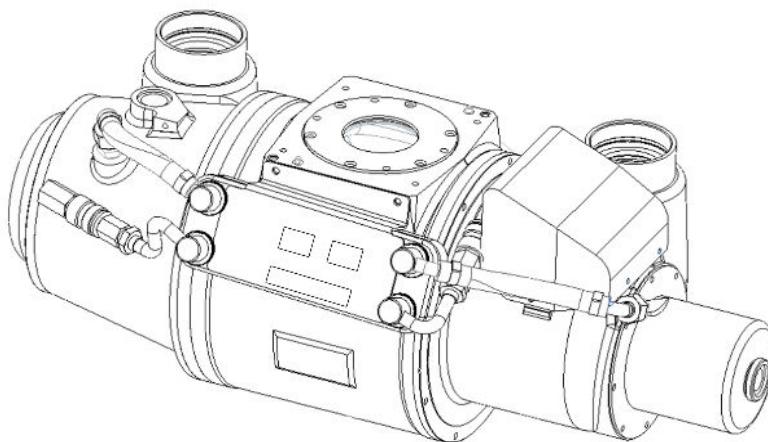
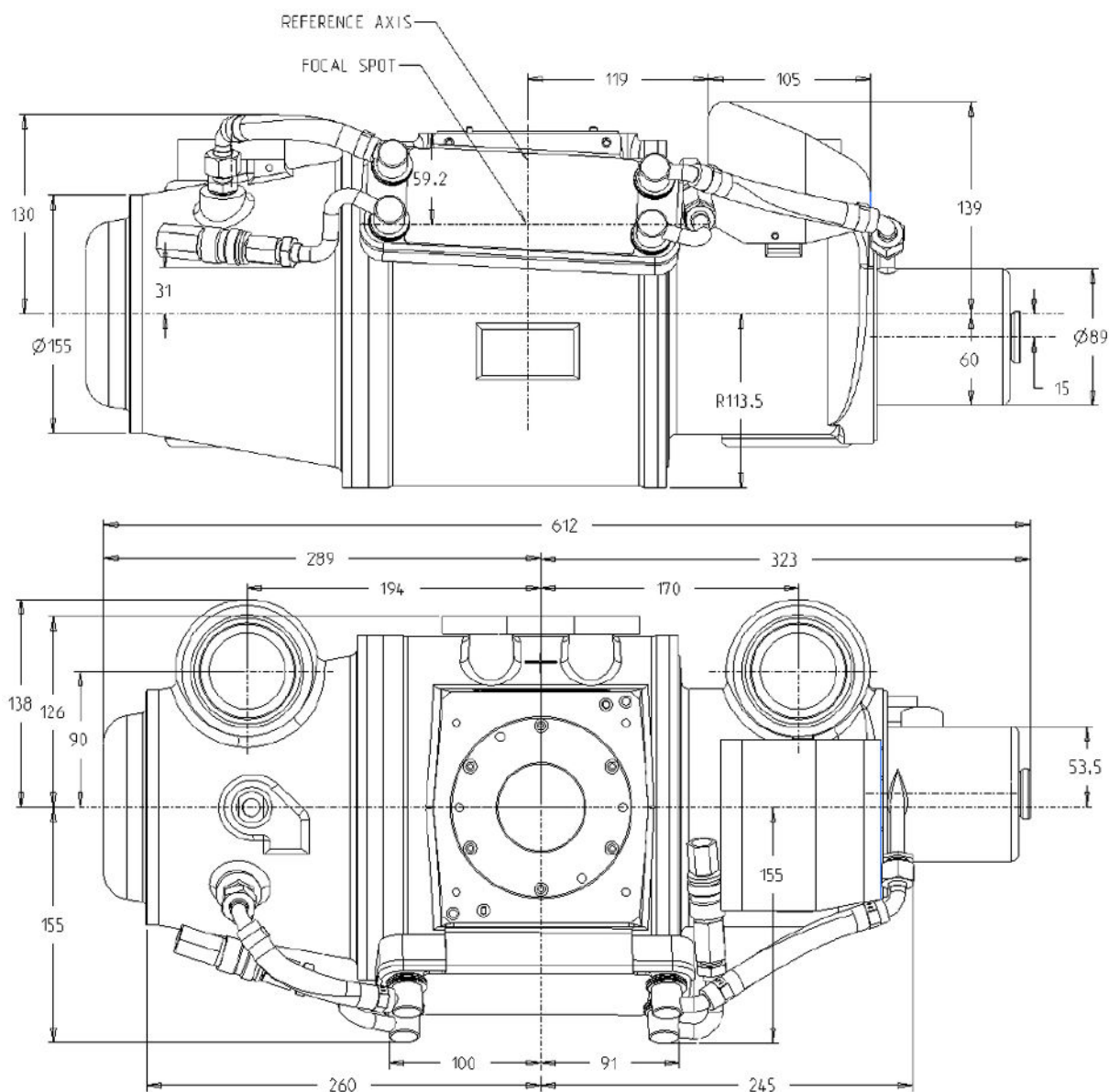
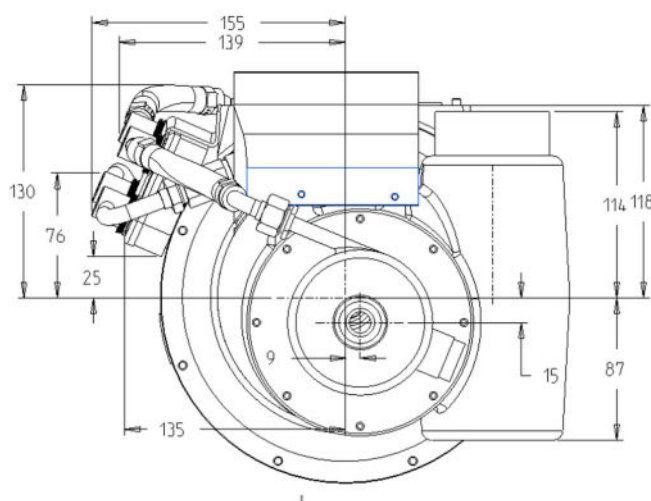
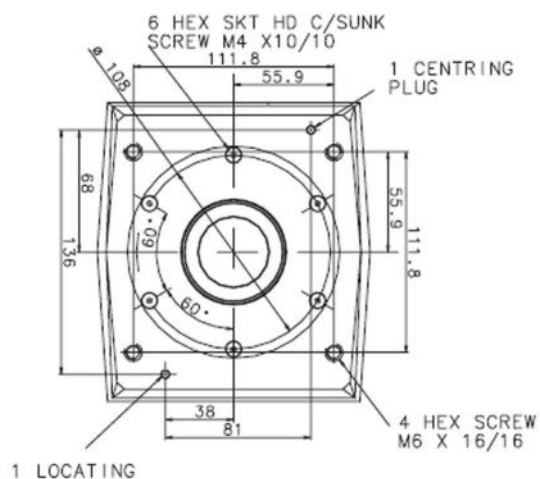


Illustration 3-2: X-Ray Tube Housing Dimensions





BEAM LIMITING DEVICE FIXATION



FIXATION PLATE

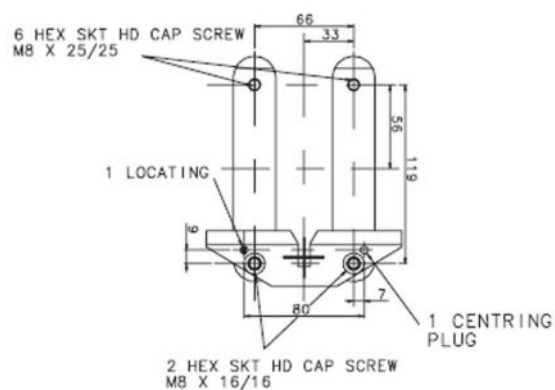
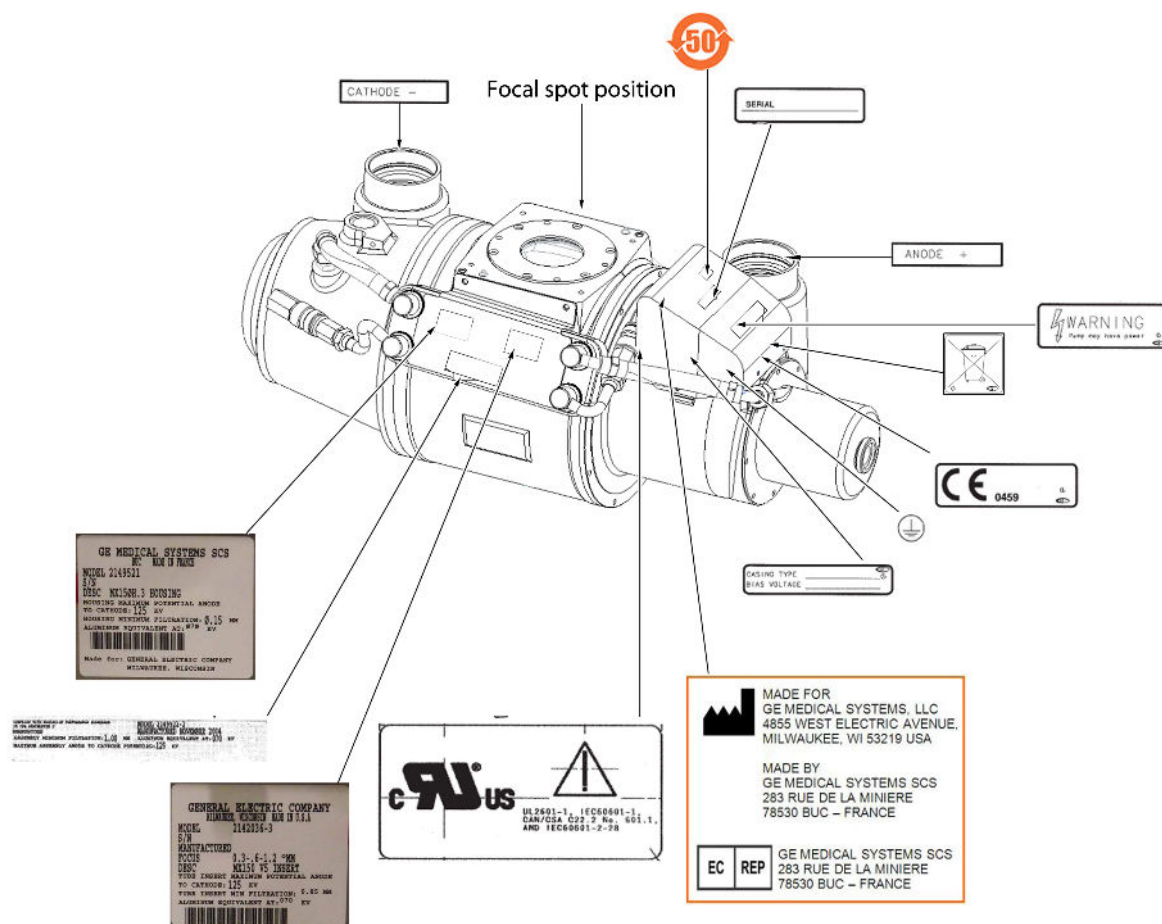


Illustration 3-3: Labeling and Marking for D2711C and D2712C



1.1.1 Tube housing/tube configuration

The MaxiRay 150 Brazed Graphite X-Ray Tube Assembly is equipped with an MX150 (2142036, 2142036-3) rotating anode X-Ray Tube having a diameter of 140 mm.

The assembly is specially designed to equip:

- Vascular Systems,
- Cardiac Systems,
- Angio Systems.

1.1.2 HV Connection

The high voltage cables are connected to the X-Ray Tube Assembly; cable terminals are fitted in the two Federal Standard type connectors, with 3 conductors on the anode side and 5 conductors on the cathode side. Pour 10 ml maximum of dielectric oil provided in the packaging and also in the FRU (see [Chapter 4](#),) into both Federal Standard receptacles. Refer also to the filling procedure provided with the oil container.

The accessible metal parts of the X-Ray Tube Assembly body and flexible conductive housing of high-voltage cables must be connected to the conductive enclosure of the high-voltage generator.

1.2 Construction

The X-Ray Tube Housing is made of lead-lined light alloy. It is filled under vacuum with specially processed insulating oil.

Internal expansion volume compensates for oil dilation at permissible temperatures.

X-Ray Tube Housing dimensions are shown on [Illustration 3-2](#).

The weight of the X-Ray Tube Assembly, equipped with the X-Ray Tube and without HV cables, is 43 +/-1 kg.

1.3 Marking

The X-Ray Tube Assembly carries markings required by IEC 601-2-28 in the form of a combined description as shown in [Illustration 3-3](#) Labeling and Marking for D2711C and D2712C.

When applicable, the X-Ray Tube Assembly also carries labels to certify compliance with regulation of addressee states (US Federal Regulation CFR Sub-Chapter J, UL, CSA and CE Marking).

A second set of labels is supplied in a separate bag with each shipment of an X-Ray Tube Assembly. This second set is for use when the tube assembly is either partially or totally covered by the configuring system.

To comply with current marking visibility requirements, instructions for affixing the two sets of labels are supplied in the assembler manual of the configured system.

2 Characteristics

2.1 Technical characteristics

Subject	Specifications	Reference Standard ¹
Model name	RX125-16/47/115	JIS Z 4704
Maximum X-Ray Tube Assembly heat content	2 300 000 Joules	IEC 60613/2010
X-Ray Tube Assembly heating and cooling curves	See Illustration 3-4	IEC 60613/2010
Maximum continuous heat dissipation of X-Ray Tube Assembly	1700 W	IEC 60613/2010
Maximum symmetrical radiation field	370 x 400 mm at 1 m	IEC 608061/1984
Reference axis	See Section 1.1, Illustration 3-2: X-Ray Tube Housing Dimensions . Normal to longitudinal axis of X-Ray Tube Assembly	IEC 60601-2-28/1993 and IEC 60601-2-28/2010
Target angle with respect to the specified reference axis	11 degrees ^{15'}	IEC 60601-2-28/1993 and IEC 60601-2-28/2010
Nominal focal spot value with respect to the specified reference axis ²	0.3, 0.6, 1.2	IEC 60336/2005
Modulation transfer function	See specification of configured X-Ray Tube (Chapter 2, Section 2.5, Modulation transfer function)	IEC 60336/2005
Minimum inherent filtration ³	1 mm Al equivalent at 70 kV	
Nominal Permanent Filtration (HVL)	1.7 mm Al at 75 kV	JIS Z 4704
Nominal high voltage	125 kV	IEC 60613/2010
Maximum nominal anode–earth voltage	62.5 kV	JIS Z 4704
Maximum nominal cathode–earth voltage	62.5 kV	JIS Z 4704
Leakage dose	0.5 mGy per hour	JIS Z 4704
Loading factors concerning leakage radiation	125 kV, 12 mA	IEC60601-1-3/1994 and IEC60601-1-3/2008 IEC60601-2-28/1993 and IEC 201601-2-28/2010
Classification	Class 1, Type B	IEC 60601-1/1988 and IEC 60601-1/2005
High voltage connections	Receptacle socket Positive side: 3 conductors Negative side: 5 conductors	IEC 60526/1978
Weight of tube housing (without HV cables)	43 kg +/-1 kg	
Temperature range for transportation and storage	-20 degrees C thru +70 degrees C	IEC 60601-1/1988 and IEC 60601-1/2005
Added filter cannot be disassembled without tool	1 mm Al	IEC60601-1-3/1994 and IEC60601-1-3/2008

¹ i.e., compliance to the standard is declared.

² Measured by slit camera (JIS Z 4704).

³ Determined according to the theoretical method of calculating of Birch and Marshall.

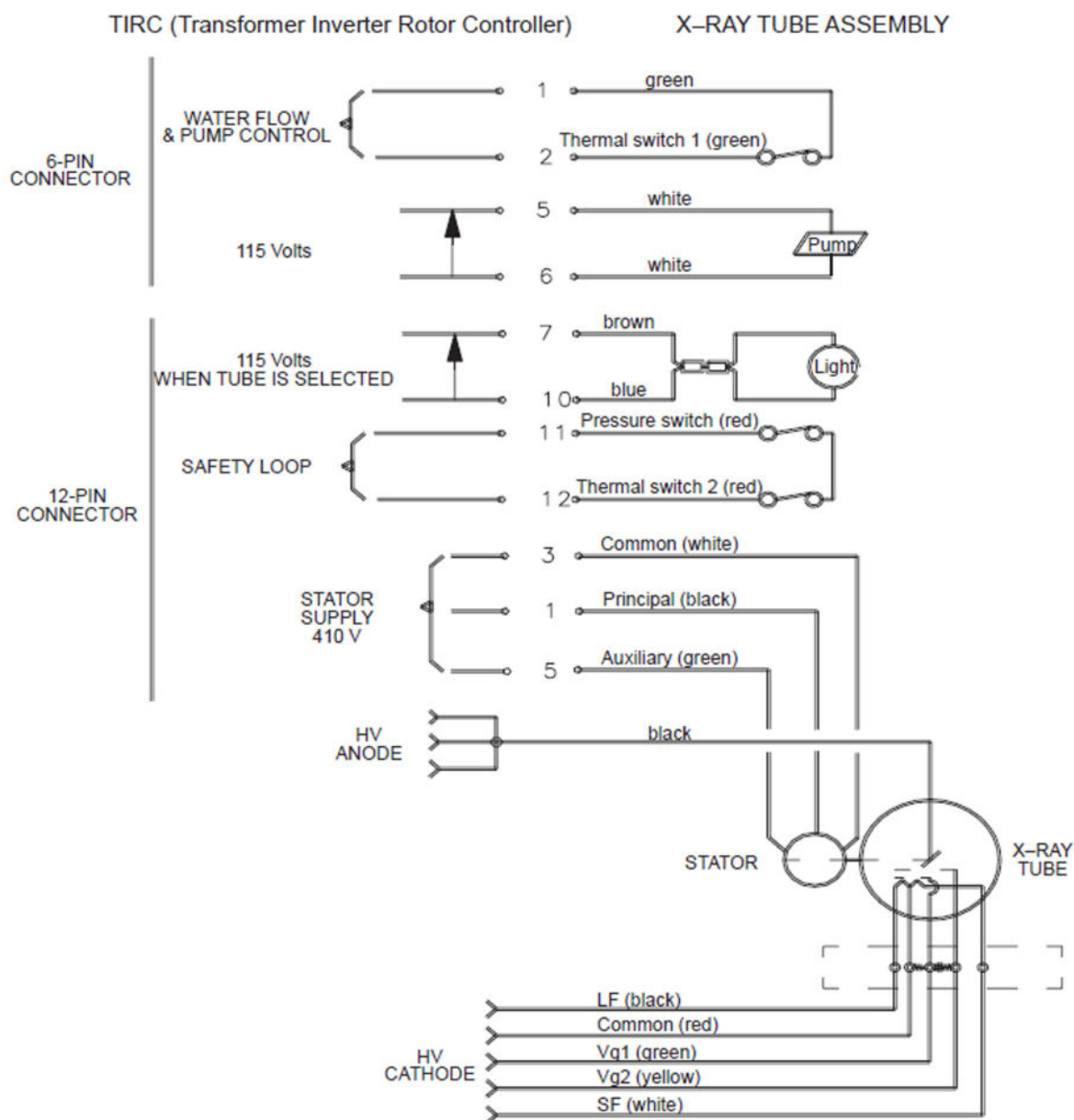
2.2 Electrical characteristics

2.2.1 General

The Maxiray 150 Brazed Graphite is a bipolar X-Ray Tube Assembly.

The maximum tube voltage, between poles is 125 kV peak value, on a rectified or constant voltage generator balanced relative to ground.

2.2.2 Electrical connections and wiring



2.2.3 Stator-Rotation anode

The X-Ray Tube Assembly Maxiray 150 Brazed Graphite is compatible with the following General Electric rotor controllers: TIRC Part No. 46-904650G2

Winding resistance at 25 degrees C:

- Main phase: 25.3 ohms +/- 5%.
- Auxiliary phase: 25.3 ohms +/- 5%.

The essential characteristics of X-Ray Tube Assembly/Rotor Controller configuration are the following:

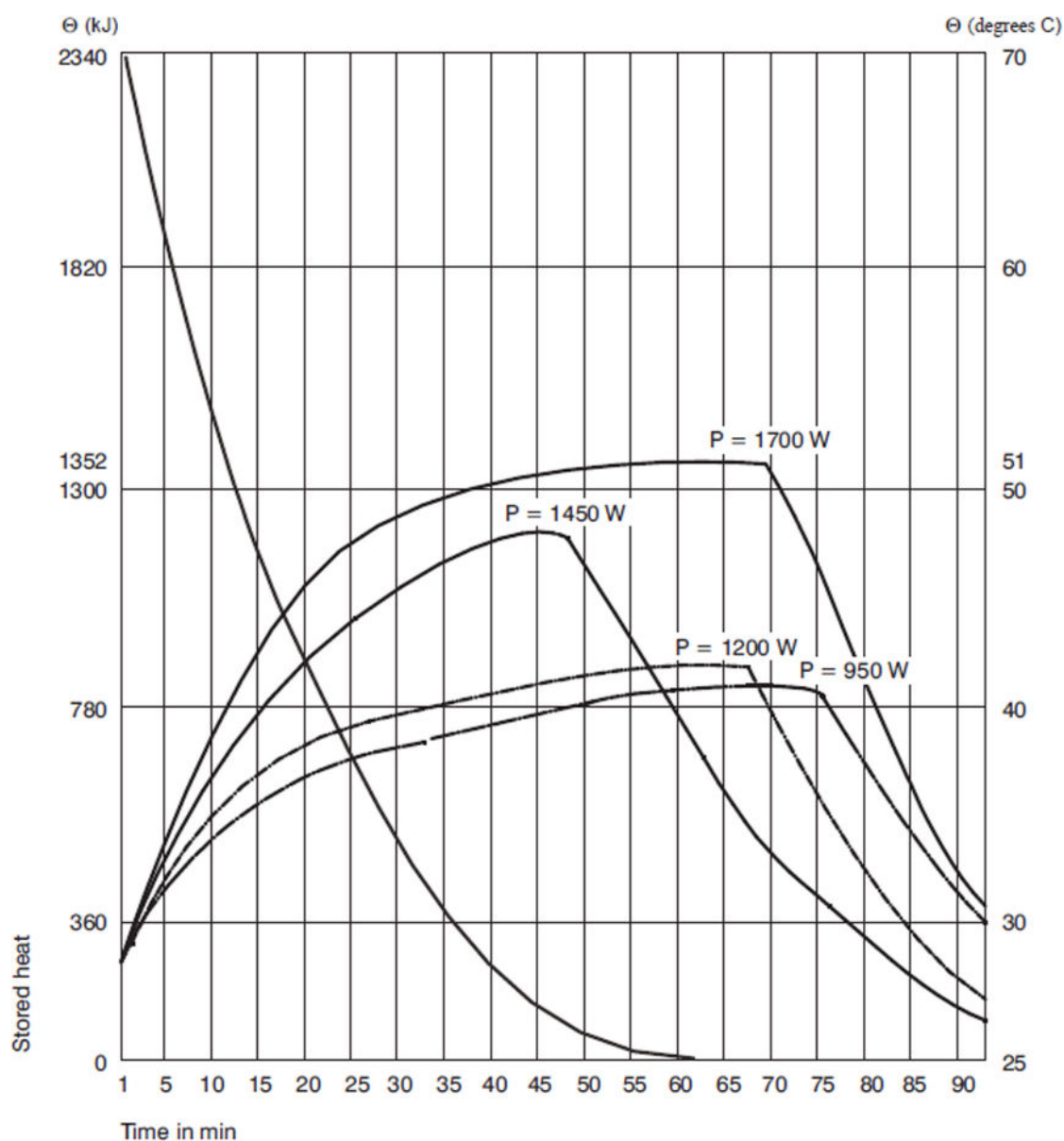
Table 3-1:

Mode of operation	Speed (rpm)	Time(s)	I common (A) RMS	Energy (J)	Power (W)
Acceleration	0 - 10000	8	11	25400	3175
	0 - 6900	7	9.25	22300	3186
	6900 - 10000	2	11.35	8756	4378
Run	6900	-	3.05	-	175
	10000	-	3.1	-	225
Braking	10000 - 6900	0.9	9	155	172
	10000 - 0	9	10.6	12780	1420
	6900 - 0	4	10	6050	1512

2.2.4 Classification

- Type of protection against electric shock: CLASS 1.
- Degree of protection against electric shock: TYPE B.

Illustration 3-4: Heating and Cooling Curves



The heating curves take account of all power dissipated in the X-Ray Tube Assembly (anode, cathode, stator and oil-circulating pump).

2.3 Thermal characteristics

2.3.1 Heat Storage Capacity and Continuous Dissipation

See [Illustration 3-4](#).

Heat storage capacity of X-Ray Tube Assembly: 2 300 000 Joules.

Continuous heat dissipation of X-Ray Tube Assembly: 1700 W with cooler in operation.

2.3.2 Cooling

An insulated oil circuit cools the X-Ray Tube Assembly.

A controlling thermostat device, with a normally closed (nc) contact, triggers the water-cooling system into operation when the X-Ray Tube Assembly temperature reaches 40 degrees C.

The cooling system stops operating when the X-Ray Tube Assembly temperature falls to 30 degrees C.

The cooling system is composed of the following:

1. Plate Heat Exchanger

This is located outside the X-Ray Tube Assembly and consists of several stainless steel plates brazed together with copper.

The principle is based on two independent sealed circuits each carrying a different fluid in opposite directions. In the Maxiray 150 Brazed Graphite, one fluid is oil from the X-Ray Tube Assembly to be cooled while the other fluid is water from an external cooling source maintained at stable temperature.

Minimum requested flow rate: 2 liters/min. Maximum allowable temperature: 20 degrees C.

2. Oil-Circulating Pump

A centrifugal pump circulates the oil.

- Electrical characteristics: 115 V, 0.9 A.
- No-load flow rate: 12 liters/min.
- Flow rate when connected to the X-Ray Tube Assembly with two hoses of 8-mm dia. and 300 mm long, and heat exchanger of 8 liters/min.



CAUTION

Potential for Electrical Shock.

The pump will remain powered even if another tube is selected. Take the necessary precautions before doing any work on the X-Ray Tube Assembly. As a result of heavy use the X-Ray Tube Assembly may reach a high temperature and may cause burns. Before working on the X-Ray Tube Assembly for maintenance, ensure that the cooling system has stopped automatically, and then switch off the power and remove the decorative cover.

NOTE: The heat exchanger and oil pump form an assembly which cannot be disassociated from the X-Ray Tube Assembly. It is strictly prohibited to interfere with the oil circuit.



NOTICE

Potential for Equipment Damage.

When you have finished using the system, ensure that the cooling system has stopped automatically, and then remove the power.

2.3.3 Thermal and Pressure Safety Devices

The X-Ray Tube Assembly is equipped with a safety loop and a pressure sensitive switch connected in series with a normally closed (nc) contact.

The thermostat actuates at 70 degrees C +/-2.7 degrees C.

The pressure-sensitive switch actuates at 5 psi +/-1 psi.

The function of each switch is to prevent load being applied to the X-Ray Tube Assembly when the specified limits are reached.

Refer to [Section 4.4, Replacement of Thermostats](#).

2.3.4 Climatic Environment

- Temperature: 5 degrees thru 40 degrees C.
- Relative humidity: 80%

3 Radiation and Electrical Protection

3.1 Filtration

The Quality equivalent filtration of the Maxiray 150 Brazed Graphite X-Ray Tube Assembly is 1 mm of Al equivalent at 70 kV.

The Maxiray 150 Brazed Graphite X-Ray Tube Assembly is delivered with an additional filter of 1 mm of Al, removable with the use of tool.

The additional filter present initially in the Maxiray 150 Brazed Graphite X-Ray Tube Assembly can be removed provided that total filter in the X-Ray equipment is not less than 2.5 mm of Al, and that the X-Ray equipment complies with the requirement for half-value layer specified in the table below.

X-Ray TUBE VOLTAGE		Minimum permissible first half-value (HVL) (mm of Al)
Operating range for Normal Use (kV)	Selected value* (kV)	
From 30 upward	less than 50	(Linear extrapolation to be used)
	50	1.5
	60	1.8
	70	2.1
	80	2.3
	90	2.5
	100	2.7
	110	3.0
	120	3.2
	130	3.5
	140	3.8
	150	4.1
	greater than 150	(Linear extrapolation to be used)

* Half-value layers for intermediate selected voltages are to be obtained by linear interpolation.

Compliance is verified by HVL measurement under narrow-beam conditions.

3.2 Beam Limiting Devices

The Maxiray 150 Brazed Graphite X-Ray Tube Assembly must be equipped with beam-limiting devices.

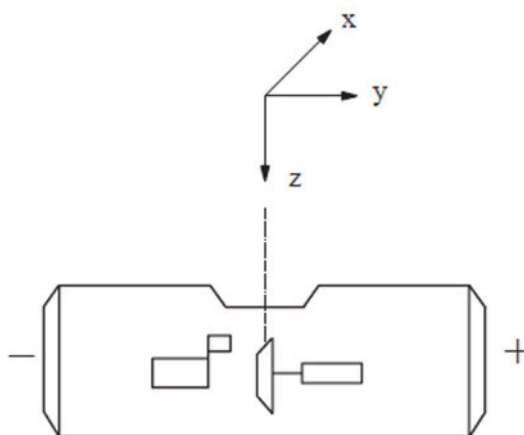
The Maxiray 150 Brazed Graphite X-Ray Tube Assembly must not be used as X-Ray source assembly. Always use with the appropriate beam-limiting device in order to meet requirements for the largest X-Ray beam required for its specified applications.

The beam-limiting devices compatible with the Maxiray 150 Brazed Graphite are:

- ULTRANET SRI+ Cardio, Part No. 2131105,
- ULTRANET SRI/ADX Angio, Part No. 45297029 + 0 degree intermediate component, Part No. 2111695, or +1 degree intermediate part, Part No. 2111911,
- ULTRANET SRI/ADX TCA, Part No. 45297028,
- ULTRANET SRI + Angio, Part No. 2131099 + 0 degree intermediate component, Part No. 2111695, or +1 degree intermediate component, Part No. 2111911.

Any Maxiray 150 Brazed Graphite X-Ray Tube Assembly having beam limiting devices other than those listed above is obliged to be checked for compliance examination for beam quality and leakage radiation according to the requirements of IEC Standard 601-1-3.

3.3 Focal Spot Location



Y axis: The X-Ray Tube is centered in the X-Ray Tube Housing on the 1.2 focal spot and is centered at $-0.1/+0.5$ mm in the cold state to compensate for drifts of $+/-0.3$ mm in the hot state.

X axis: The X-Ray Tube is centered in the X-Ray Tube Housing on the 1.2 focal spot which is centered at $+/-0.3$ mm.

Z axis: The depth of the three focal spots is 59.2 mm $+/-1$ mm.

4 Using the X-Ray Tube Assembly

4.1 Introduction

Before applying the first loading, refer to the documentation concerning the use of Maxiray 150 Brazed Graphite X-Ray Tube Assembly and the tube rating charts for related X-Ray Tubes.

Take the following into account in determining operating factors:

- Electrical characteristics:
 - High voltage rating and waveform,
 - High voltage exposure time,
 - Filament heating current rating.
 - Anode rotation speed,
 - Power supply of oil-circulating pump.
- Thermal characteristics:
 - Heat storage capacity,
 - Cooling and heating curves for X-Ray Tube Assembly and X-Ray Tube,
 - X-Ray Tube rating charts.

The above parameters are checked by the system.

The overvoltage value which may be produced by the HV generator should not exceed the maximum acceptable voltage for the X-Ray Tube and X-Ray Tube Assembly.

For longer life of the rotating-anode tube and satisfactory operating results, it is essential that calibration or recalibration of the HV generator be correct. If not, make a new calibration.

Before the first startup of the X-Ray Tube Assembly, apply the X-Ray Tube conditioning procedure in [Section 4.2](#).

4.2 X-Ray Tube Conditioning

4.2.1 Introduction

On-site X-Ray Tube conditioning is a method of improving the high voltage stability of this one. X-Ray Tube conditioning is carried out by Field Service at the installation of a new X-Ray Tube Assembly and also during the normal lifespan of the X-Ray Tube.

X-Ray Tube conditioning reestablishes a good distribution of electric fields and electrostatic stress in the insulation, improving X-Ray Tube electric stability.

Tube-forming procedure:

- Bring the anode to high temperature at a low kV value (80 kV approx.). At a low kV value, the risk of arcing is considerably reduced. When the tube reaches this temperature, the ion pumps are “reactivated”.
- Check the high-voltage stability up to the maximum kV of the X-Ray Tube.



NOTICE

Potential for Equipment Damage

Do not start X-Ray Tube conditioning before reaching about 0% on the anode (approximately three hours).

4.2.2 Temperature Rise

Use the following parameters: 80 kV, large focal spot, high speed, exposure time of 2 s, one exposure every 3 s, 200 mA, 32 exposures.

Standby: 10 min.

4.2.3 Checking High-Voltage Stability

Use the following parameters: large focal spot, high speed, exposure time of 0.1 s, one exposure every 5 seconds.

At each level of kV in the table below, make the exposures indicated:

kV	mA	Number of exposures	Standby between kV levels
80	400	10	2 min
90	400	10	2 min
100	400	10	2 min
110	400	10	2 min
120	400	10	3 min
125	400	10	3 min

NOTE: If arcing or waveform faults appear at whatever kV level, reduce the kV values to the preceding kV level until the 10 exposures can be made without any fault. Then, continue the procedure.

Checking is complete when 10 faultless exposures have been made at each kV level up to the maximum kV. If three complete checks do not give a stable result, replace the X-Ray Tube Assembly.

4.3 Tube Warm-up

Tube warm-up is suggested but not required for the MX150 Brazed Graphite. When warming-up the tube, take adequate means in protecting personnel against ionizing radiation. The warm-up procedure follows:

1. Warm up the X-Ray Tube at the beginning of each work day or if the X-Ray Tube has not been used within two hours.
2. Select the large focal spot and perform the following protocol:

kV	mA	t	Number of exposures	Time between exposures	Cooling time
75	320	500 ms	32	250 ms	30 s

NOTE: To preserve filament life, do not allow high mA to be selected for long periods.

4.4 Replacement of Thermostats

1. Loosen the three screws securing the bracket, and disconnect the plug.
2. Install the new thermostat assemblies, without grease or thermo-mechanical pulp.

-
3. Tighten the three screws and torque to 0.3 N-m (mandatory).

5 Maintenance and Shipping

For all shipment:

- Empty the water contained in the heat exchanger.
- Use only the shipping crate designed for the Maxiray 150 Brazed Graphite.
- Max./min. temperature for transportation and storage: -20 degrees C and +70 degrees C.

6 Environmental Health and Safety (EHS) information

The Maxiray 150 Brazed Graphite X-Ray Tube Assembly contains potentially dangerous materials but does not present any danger as long as it is neither opened nor disassembled.



WARNING

**POTENTIAL ENVIRONMENTAL HAZARD DO NOT DISCARD THE X-RAY
TUBE ASSEMBLY AMONG INDUSTRIAL WASTE OR DOMESTIC GARBAGE.**

A damaged X-Ray Tube Assembly should not be dispatched through the national postal service.
Your local GEMS field service will advise you on the suitable means of disposal.

The X-Ray Tube Assembly to be discarded should be forwarded to the GEMS Service network,
and it will be disposed of in a GEMS recycling center.

6.1 Dangerous Materials

The X-Ray Tube Assembly contains the following potentially dangerous materials:

- **Lead:** Lead salts are toxic and their ingestion may cause serious problems. The working of lead is subject to regulations.
- **Oil:** Transformer mineral oil is not toxic, but the prevailing environmental regulations should be observed for its disposal or recuperation. For example, it is forbidden to dispose of this oil in the waste water or sewage system or in the natural environment.

6.2 Precautions

Take all the necessary precautions for the personnel handling the recovery or destruction of X-Ray Tube Assemblies, and in particular against the risks due to lead, or vacuum X-Ray Tube implosion.

These personnel must be informed of the danger involved and of the necessity to observe the safety measures.

Chapter 4 Renewal Parts

1 Description of Abbreviations and Symbols Used

1.1 Item Number (NO.)

- Not illustrated in drawings
- 6 Not illustrated in drawings

ITEM NO.
–
– 6

1.2 FRU (Field Replaceable Unit)

- 1 Replacement part available
- 2 Replacement part available
- 3 No replacement part available. Locate higher level assembly

FRU
1
2
N

1.3 REP (Repairable Item)

- Y Yes, it's repairable.

REP
Y

1.4 Quantity (QTY)

- PL Previously listed as an assembly or subassembly.
- AR As required.

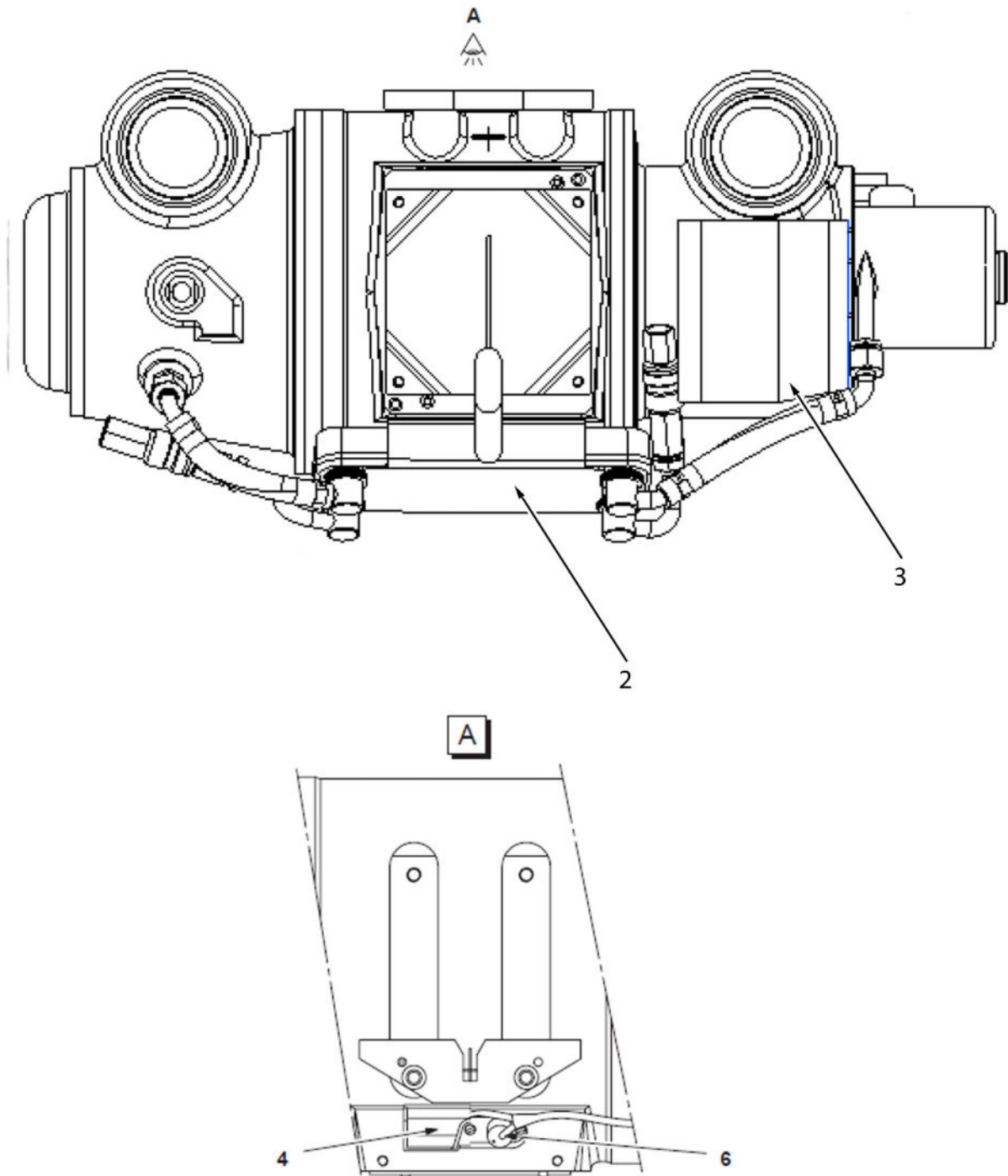
QTY
PL
AR

1.5 Miscellaneous

- APP Applies to
-  Viewing direction

2 Assembly Drawing

Illustration 4-1: MAXIRAY 150 – 2149520 / 2149520-4 / 2149522 / 2149522-2



3 Parts List (2149520/2149520-4/2149522/2149522-2)

Item No.	Part No.	FRU REP	Description	Qty	APP
–	2149520	2	MaxiRay 150 Brazed Graphite, new	1	A
–	2149520-4	2	MaxiRay 150, Brazed Graphite, new	1	A
–	2149522	1	MaxiRay 150, brazed graphite, reload	1	
–	2149522-2	1	MaxiRay 150, brazed graphite, reload	1	
–1	2134946	N	+ X-Ray tube housing, assembly	1	G
2	2139275	N	++ center section assembly'	1	E
3	2136039	2	++ cover	1	
4	45290785	2	++ thermostat protective cover	1	
–5	2150429	2	++ harness	1	
6	2133581-2	1	++ KIT of THERMOSTATS 70 & 40 deg. C	1	
–7	2164148/2134946	1	+ Oil container for HV receptacles	1	G

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