GE Healthcare

Discovery LS
System Site Prep Manual

OPERATING DOCUMENTATION

2317947-100
Revision 5

IMPORTANT PRECAUTIONS

LANGUAGE

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 or from mechanical or other hazards.
ПРЕДУПРЕЖДЕНИЕ (BG)	• ТОВА УПЪТВАНЕ ЗА РАБОТА Е НАЛИЧНО САМО НА АНГЛИЙСКИ ЕЗИК. • АКО ДОСТАВЧИКЪТ НА УСЛУГАТА НА КЛИЕНТА ИЗИСКА ЕЗИК, РАЗЛИЧЕН ОТ АНГЛИЙСКИ, 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 ПАЦИЕНТ В РЕЗУЛТАТ НА ТОКОВ УДАР ИЛИ МЕХАНИЧНА ИЛИ ДРУГА ОПАСНОСТ.
警告 (ZH-CN)	• 本维修手册仅提供英文版本。 • 如果维修服务提供商需要非英文版本，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人员，操作员或患者造成触电、机械伤害或其他形式的伤害。
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 medmindre denne servicemanual har været konsulteret og er forstået. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk, 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 voordat 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.
HOIATUS (ET)	• Käesolev 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 de service 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'intervenir 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 (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 Kundendiensttechnikers, des Bedieners oder des Patienten durch stromschläge, Mechanische oder Sonstige gefahren kommen.

ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	• Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο. • Εάν το άτομο παροχής σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό εκτός εαν έχετε συμβουλευτεί και έχετε κατανοήσει το παρόν εγχειρίδιο σέρβις. • Εαν δε λάβετε υπόψη την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στο άτομο παροχής 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 elkészíttetése. • Ne próbálja elkezdeni 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 eingöngu fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • 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 inglese. • Se un addetto alla manutenzione 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 • Il non rispetto 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 (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 지침서는 영어로만 이용하실 수 있습니다 . • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우 , 번역 서비스를 제공하는 것은 고객의 책임입니다 . • 본 서비스 지침서를 참고했고 이해하지 않는 한은 해당 장비를 수리하려고 시도하지 마십시오 . • 이 경고에 유의하지 않으면 전기 쇼크 , 기계상의 혹은 다른 위험으로부터 서비스 제공자 , 운영자 혹은 환자에게 위해를 가할 수 있습니다 .
BRDINJUMS (LV)	• Šī apkalpes rokasgrāmata ir pieejama tikai angļu valodā. • Ja klienta apkalpes sniedzējam nepieciešama informācija citā valodā, nevis angļu, klienta pienākums ir nodrošināt tulkošanu. • Neveiciet aprīkojuma apkalpi bez apkalpes rokasgrāmatas izlasīšanas un saprašanas. • Šī brīdinājuma neievērošana var radīt elektriskās strāvas trieciena, mehānisku vai citu risku izraisītu traumu apkalpes sniedzējam, operatoram vai pacientam.
ĮSPĖJIMAS (LT)	• Šis eksploatavimo vadovas yra prieinamas tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, numatyti vertimo paslaugas yra kliento atsakomybė. • Nemėginkite atlikti įrangos techninės priežiūros, nebent atsižvelgėte į šį eksploatavimo vadovą ir jį supratote. • Jei neatkreipsite dėmesio į šį perspėjimą, galimi sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų paslaugų tiekėjui, operatoriui ar pacientui.
ADVARSEL (NO)	• Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør trenger 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 dostawca usług klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie próbować serwisować wyposażenia bez zapoznania się i zrozumienia niniejszego podręcznika serwisowego. • Niezastosowanie się do tego ostrzeżenia może spowodować urazy dostawcy usług, operatora lub pacjenta w wyniku porażenia elektrycznego, zagrożenia mechanicznego bądź innego.
ATENÇÃO (PT)	• Este manual de assistência técnica só se encontra disponível em inglês. • Se qualquer outro serviço de assistência técnica solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente consertar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode pôr em perigo a segurança do técnico, do operador ou do paciente devido a choques elétricos, mecânicos ou outros.

ATENȚIE (RO)	• Acest manual de service este disponibil numai 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 şi 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 обслуживанию предлагается 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 обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалист по обслуживанию, оператор или пациент получат удар электрическим током, механическую травму или другое повреждение.
UPOZORNENIE (SK)	• Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednos″ou zákazníka. • Nepokúšajte sa o obsluhu zariadenia skôr, ako si neprečítate návod na obluhu a neporozumiete mu. • Zanedbanie tohto upozornenia môže vyústi″ do zranenia poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, do mechanického alebo iného nebezpečenstva.
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.

DIKKAT (TR)	• Bu servis kilavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kilavuzu ingilizce dişinda bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kilavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyariya uyulmamasi, elektrik, mekanik veya diğer tehlikelerden dolayi teknisyen, operatör veya hastanin yaralanmasina yol açabilir.

DAMAGE IN TRANSPORTATION

Check for damage to property that may have occurred at the site during delivery, such as damage to floors, door frames or walls. If damage is found, notify the installation specialist.

All packages should be closely examined at time of delivery. If damage is apparent, have the notation *Damage in Shipment* written on all copies of the freight or express bill before delivery is accepted or signed for by a GE Healthcare representative or a hospital receiving agent. Whether noted or concealed, damage MUST be reported to the carrier immediately upon discovery or 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.

To file a report: Call 1-800-548-3366, and use option 8.

Fill out a report on http://egems.med.ge.com/edq/home.jsp

Contact the local service coordinator for more information on this process.

Rev. September 17, 2006

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 Healthcare 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 Healthcare uses 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 Healthcare 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.

IMPORTANT...X-RAY PROTECTION

If not properly used, the x-ray equipment may cause injury. Accordingly, the instructions contained herein should be thoroughly read and understood by everyone, who will use the equipment before attempting to place this equipment in operation. The GE Healthcare company will be glad to assist and cooperate in placing this equipment into 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 anyone 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 GE Healthcare, its agents, and representatives have no responsibility for injury or damage which may result from improper use of the equipment. Various protective materials and devices are available. It is urged that such materials or devices be used.

IMPORTANT...RADIOACTIVE MATERIAL HANDLING

Only employees formally trained in radioactive materials handling and this equipment are authorized by the GE Healthcare Radiation Safety Officer to use radioactive materials to service this equipment.

GE Healthcare Services is required to notify the applicable U.S. state agency PRIOR to any source service event involving pin source handling. See NUC/PET Radioactive material guides for specific instruction or contact your EHS Specialist.

A radiation survey must be performed when a pin source has been removed and replaced. See Radiation Survey Form Instructions or contact your EHS Specialist.

Rev 2 (July 21, 2005)

OMISSIONS & ERRORS

Customers, contact your GE Healthcare Sales or Service representatives.

GE personnel, use the GEMS iTrak Process to report all omissions, errors, and defects in this publication.

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Revision History

Revision	Date	Reason for Change
5	8/15/07	IMPORTANT PRECAUTIONS: Revised entire chapter to match current version. **PQR 13089843:** Changed P/N P5050UP to L5050UP in Section 6-3.7 Uninterruptable Power Supply (UPS) on page 82. CH 3: Updated with Notice on page 33 and Figure 3-1 (per Tim Donahugh/ Angela Sterr). Added more information to Note on page 34 (per George Farrington). CH 6 (per George Farrington): Added "A gigabyte Ethernet connection is recommended for optimal network speed" on page 99. Remove former Section 6-3.8, Power Source Monitoring from page 84. CH 7: Revised Conveyance Safety Measures on page 103. CH 8 (per George Farrington): Revised the Pre-Installation Checklists on page 110. Changed "Power Module" or PM to "Power Distribution Unit" and PDU per George Farrington. Changed "Main Disconnect Control" to Main Disconnect Panel per George Farrington. Appendix C: Remove from the manual per George Farrington since the Power and Grounding Audit is performed and recorded after the DLS system is installed.
4	3/05/2007	Updated formatting per current GE Healthcare service documentation standards; Added NGPDU-2 information.
3	6/14/2004	Per PSR 13018348 and PQR 13018082 in Chapter 3, Section 3-2.2 Minimum Room Dimensions, the room dimensions have been changed to reflect a 914 mm (36 inch) service clearance. Changes were made in Figures 3-2 and 3-3.
2	11/9/2002	Global format; seismic information; vibrational specifications; floor loading
1	2/2002	Corrections and Changes (EO-01067)
0	10/14/2001	First Release (EO-00861)

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Chapter 1 Introduction

Section 1-1: Overview

This manual contains information on such topics as physical dimensions, power, environmental requirements and room sizes. The purpose of this document is to simplify the site preparation process to the fullest extent possible.

The material is not intended to be a substitute for a qualified site planner or Project Manager of Installation. Nevertheless, it does provide some of the guidelines needed to successfully plan the suite.

NOTICE **This manual does not cover site pre-installation concerns, such as the installation of mounting pads and GE-supplied cables, nor does it discuss cyclotron site preparation.**

1-1.1 Purpose

This manual is a site preparation document and is intended for use as a guide and reference for site planning personnel. It contains data for preparing a site where the Discovery LS System will be installed, and is designed to be used by the purchaser, or purchaser's contractor. The data found herein represents the accumulation of detailed information that is necessary in the suite planning process. The information will be useful to architectural and suite planners, construction engineers, contractors, trade personnel and others.

Good site preparation is essential for a smooth and efficient installation. Poor site planning may result in compromising operator use or patient comfort. The results of good planning will benefit the project.

Be sure of the desired site configuration before construction is started. Once the site is completely prepared, it will be difficult and costly to make revisions.

Workers with experience in medical suite installations should be used. Personnel with experience in "general" construction only, may not be able to complete the required tasks within the designated time frame.

NOTICE **Since this equipment involves the use of radioactive isotopes, compliance with Nuclear Regulatory Commission regulations, or similar regulatory requirements, depending on the site location, must be demonstrated. In most situations, this must be done prior to acquiring any sources. This includes calibration sources which may have fairly long delivery lead times. These calibration sources may also have a short half life. It may not be advisable to store them over long periods of time. Regulatory compliance should be arranged for, as an early step in the site planning process. This will make it much easier to manage the sources.**

1-1.2 Project Manager of Installation

A great amount of detail is involved in the planning and construction of a Discovery LS suite. A recommended method to help ensure a successful installation is to have one person manage the entire project. The Project Manager should be involved in every phase, from the concept of the suite to installation and start up. Ideally he/she should be thoroughly familiar with construction. If possible, the Project Manager should have a background in medical suite construction. If such a person is not available on the staff, it is recommended that the services of a local Site Planner or Construction Manager be secured. In any case, this person would be the primary contact and liaison between the purchaser and GE Healthcare. The purchaser is responsible for assigning this post and providing GE with contact information.

The Project Manager should keep in close contact with all of the contractors, sub-contractors, GE Healthcare and administrative personnel, as well as planners and architects. Keeping a schedule and adjusting that schedule as needed is the responsibility of the Project Manager.

GE Healthcare can provide a site planing service to assist the purchaser / Project Manager with site planning. Contact the local GE Healthcare representative should any such assistance be required. GE personnel are willing and well qualified to help ensure that the installation is a successful one.

1-1.3 Regulatory Requirements

PET technology uses radioisotopes that are regulated by various governing agencies. All pertinent permits and licenses will have to be obtained to comply with local regulations.

Every effort must be made to assure safe and efficient installation, and proper operation of the Discovery LS suite. Prepare the site, and install the equipment in close compliance with all regulatory requirements that apply in the location of the site.

Very definite laws and standards apply to the installation and operation of any equipment that involves the use of radioactive isotopes. This section has been designed to alert the responsible personnel to the need for regulatory compliance. The purchaser is solely responsible for keeping the Discovery LS facility in compliance during preparation, installation and operation.

It is not practical to include all of the regulatory information that might apply in all situations. The purpose of this chapter is to serve as a guideline only, and is not intended to be used as a regulatory standard in any manner. Government agencies are charged with the responsibility of protecting the general public from hazardous materials. For radioactive sources in the United States of America, that agency is the Nuclear Regulatory Commission (NRC)

The NRC monitors the activity of all industries that are engaged in the use and handling of hazardous, radioactive materials. The NRC licenses organizations to make use of such material. The installation of a PET imaging system falls into the category of a facility that must be regulated and monitored by this agency.

Some states have signed agreements with the NRC, allowing that state to regulate the use of radioactive material within the confines of their borders. The NRC can supply a list of the agreement states with addresses. Installation of projects in those states, which have not signed such an agreement, require an application to the NRC for licensing. Request for application should be made to:

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Section 1-2: Purchaser Responsibilities

1-2.1 Purchaser Responsibility

The purchaser is responsible for all site preparation, except by another agreement with GE Healthcare. Such preparation may include, but is not limited to the following work:

- Cost analysis, construction, renovation or alterations and modifications when not specifically provided for in the contract.
- Procurement of all the material required to carry out the work.
- Storage of the system equipment prior to installation.
- Installation of cable trays and troughs.
- Installation of lighting.
- Plumbing.
- Installation of adequate air-conditioning and ventilation for the Discovery LS suite.
- Installation of adequate thermal protection devices.
- Installation of electrical conduit, junction boxes, ducting and outlets as required.
- Installation of special leaded wall covering.
- Installation of facility input power supplies and wiring.
- Demolition, removal and cleaning of existing construction.
- Fire control devices as may be required by local codes.
- Permits, inspections, radiation licensing etc.
- Installation of any required networking materials that are external to the system's internal subnetwork.
- Removal of packing and shipping material.
- Floor tile removal and replacement in area of table and gantry pads.

1-2.2 Required Skills in Personnel

It is best to screen workers and determine skill levels before making work assignments. To ensure the work is done properly, it is recommended that only master tradesmen or qualified project managers are used to supervise the installation. It is advisable to obtain certificates of insurance from the contractor's insurance carriers. It is also advisable to secure performance bonds for some work. Check to see that licenses are in good standing.

This type of project should not be used as a training exercise. Be sure that all people are well qualified to do the work. All work must be carried out by trained, qualified people, and conform to all applicable codes and regulations.

1-2.3 Cleaning

The computer hardware is cooled with small cooling fans mounted in various locations in the equipment. Therefore, special attention should be given to the matter of cleaning the room. The equipment is sensitive to dust and dirt that may be drawn into the electronics by the cooling fans. All such residue should be removed, as an ongoing activity and as a last step of the preparation process, before bringing any of the equipment into the suite area. All such debris must be removed as it accumulates. The best cleaning method for removing dust and dirt, particularly fine dust, is the use of a vacuum cleaner.

Just before the equipment is set in place is a good time to perform a thorough cleaning and sanitizing of the site. There may never again be an opportunity to execute such a detailed cleaning of exposed areas.

Section 1-3: Scheduling

The preparation of a Discovery LS Suite is much like that of other modalities that involve the installation of a gantry, table, and electronic cabinets. The major difference in the Discovery LS suite as in other PET installations is the radioactive materials used. Discovery LS suites have issues associated with the presence of radioactive isotopes. This calls for attention to detail, especially in the area of safety.

One way to tackle a construction project of this complexity is to partition it off into smaller, more easily managed tasks. Each task, now becomes a smaller project. At this point, the primary challenge is to coordinate all of these small projects in such a way as to have the entire project completed properly, and on time.

This document will help the Project Manager focus on often overlooked details. It will also simplify the task of site preparation for the first time Discovery LS Project Manager of Installation. Checklists are provided in Chapter 8 to ensure that nothing is overlooked.

1-3.1 Timing

Time is a very important dimension for a project of this sort. If specific tasks are not completed in a timely manner, other tasks can be slowed, or even halted. It is important to allow the appropriate amount of time to accomplish each task.

Some of the tasks can be started at the same time, others must be executed in a succession of orderly steps. Table 1-1 shows how a project can be divided into several phases. Note that it would not be sensible to have Phase 1 and Phase 2 going on at the same time. Fig shows a method for plotting and monitoring the progress of site preparation. This is an excellent tool for graphically tracking the progress of a project.

It is advisable to secure commitments from contractors with respect to time requirements. This should be done before any work is started.

1-3.2 Job Progression

It is rarely advisable to have several trades working together at the same time. Generally speaking, the work should progress in the following manner:

1.) Application to Regulatory Agencies for Site License.
2.) Planning and preliminary design work.
3.) Review of plans.
4.) Revision of plans.
5.) Drafting of final plans.
6.) Application for construction permits.
7.) Demolition (if required).
8.) Structural revisions and framing.
9.) Plumbing rough-in.
10.) Heating Ventilation and Air Conditioning (HVAC) rough-in.
11.) Electrical rough-in.
12.) Rough-in inspection.
13.) Dry wall and wall covering.
14.) Plumbing trim.
15.) Heating Ventilation and Air Conditioning (HVAC) trim.
16.) Electrical trim.
17.) Flooring, trim and painting.
18.) Cleaning.
19.) Final inspection.
20.) Equipment installation.

Table 1-1: Time Line Examples

	WEEK																						
Preparation Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Application (6 weeks)																							
Planning (2 weeks)																							
Review (1 week)																							
Final Drafting (2 weeks)																							
Jobs Out for Bid																							
Permits																							
Demolition																							
Framing							‘																
Plumbing Rough-In							‘																
HVAC Rough-In							‘																
Electrical Rough-In							‘																
Inspection							‘																
Finishing							‘																
Flooring and Painting							‘																
Cleaning																							
Final Inspection																							
Pre-installation																							
Delivery of Equipment																							
Installation (5 weeks)																							
Training (1 week)																							
Application (6 weeks)																							

Chapter 2 System Components

Section 2-1: Overview

This chapter describes the critical dimensions and other physical characteristics of the equipment included in the Discovery LS system.

The standard system consists of the following major elements:

- Two Gantries: CT Scanner and PET Imager
- Patient Table
- CT PDU
- PET Electronics Cabinet

Note: Typically the electronics cabinet is located in a separate room, away from both the Acquisition Station and the Operator Room. (The acquisition station consists of the operator's console including computers and monitors.)

Other standard equipment includes:

- NEMA Phantom
- Table Extension
- Table Patient Arm Boards
- Table Head Holder
- VQC Phantom

Section 2-2: DLS Gantry and Patient Table

The DLS gantry contains the CT scanner and the PET Advance imager.

2-2.1 DLS Gantry Dimensions

Table 2-1 shows the relative positions of the gantry and the patient table. This illustration also shows the overall dimensions of these components.

Table 2-1: DLS Gantry Dimensions (during normal operation)

Length		Width		Height	
in.	mm	in.	mm	in.	mm
78.03	1,982	92.52	2,350	81.89*	2,080*

* With covers

2-2.2 Patient Table

Refer to Table 2-2 and Table 2-3. The table can be raised and lowered. At its lowest position, the table is at its longest length. During normal operation the patient cradle passes through the bore of the DLS gantry.

Table 2-2: DLS Table Dimensions

Table Position	Length		Width	
	in.	mm	in.	mm
CT Position (Cradle not extended.)	110.2	2,800	29.1	740
PET Position (Cradle fully extended.)	236.5*	6,006*	29.1	740

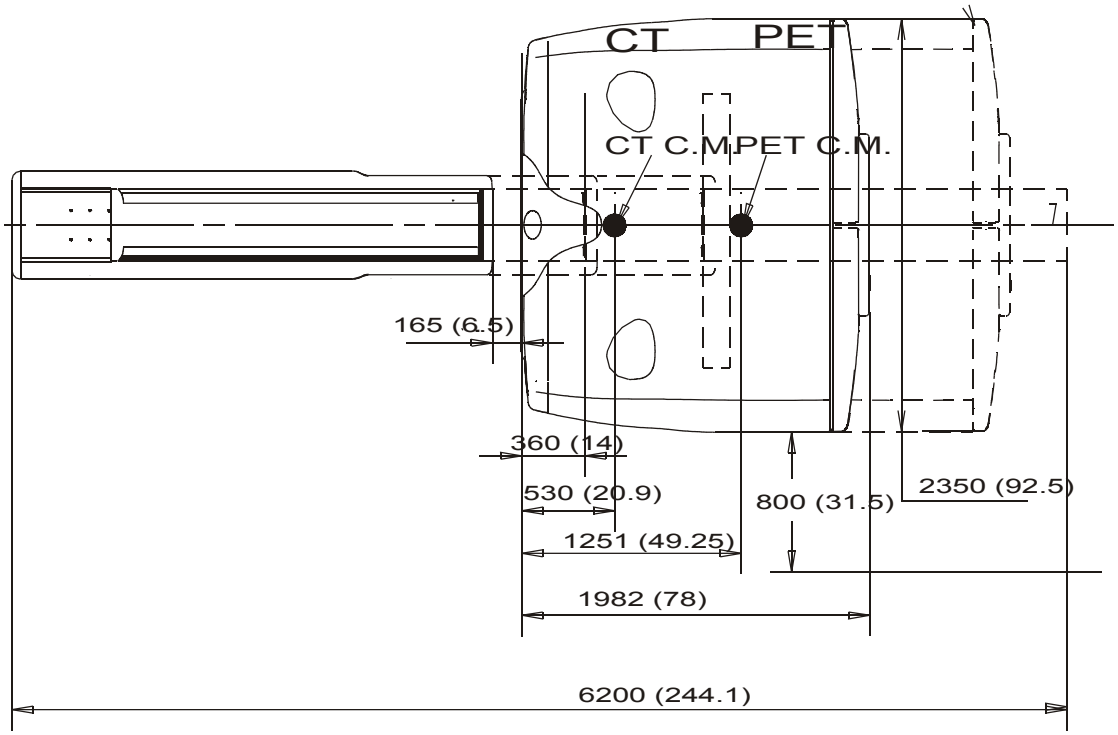
* See Figure 2-1.

Table 2-3: DLS Table Heights

Table Position	Height	
	in.	mm
Maximum Up	41.71	1,060
Maximum Down	22.1	560

Gantry and patient table basic footprint dimensions are shown in Figure 2-1.

Figure 2-1: DLS Gantry and Patient Table



All dimensions in mm (inches) and refer to the inner footprint.

2-2.3 DLS Gantry and Table Power

Both gantry and table are powered from the electronics cabinet. The power requirements are provided in Chapter 6 of this document.

2-2.4 DLS Gantry and Table Weights

Table 2-4: DLS Gantry and Table Weights

Item	Weight	
	lbs	kg
Gantry	10,000	4,464
Table without Patient	1,320	600
Table with 450 lb. (196 kg) Patient	1,770	804

Section 2-3: Electronics and PDU Cabinets

The CT and the PET system each has their own electronics cabinet.

2-3.1 CT PDU Dimensions and Weight

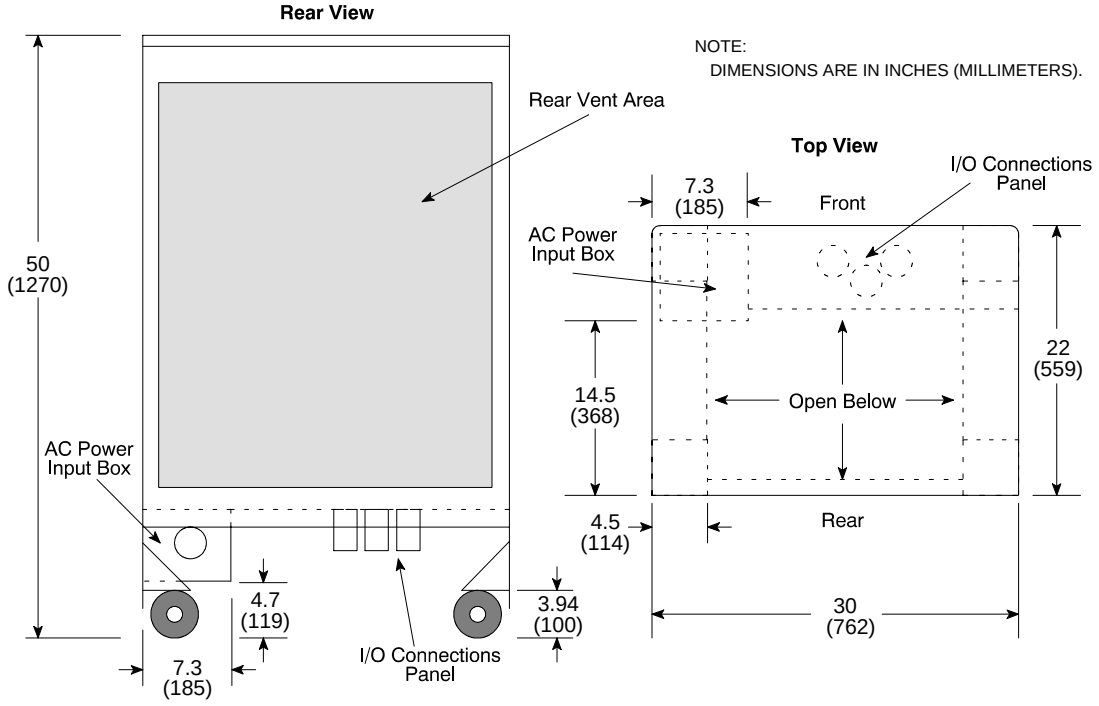
2-3-1.1 Compact PDU (CPDU)

Table 2-5: CPDU Specifications

Length		Width		Height		Weight	
in.	mm	in.	mm	in.	mm	lbs	kg
30	762	22	559	50	1,270	800	363

The Compact PDU dimensions are shown in Figure 2-2. Note that space must be provided for service access to the front and rear of the cabinet.

Figure 2-2: Compact PDU



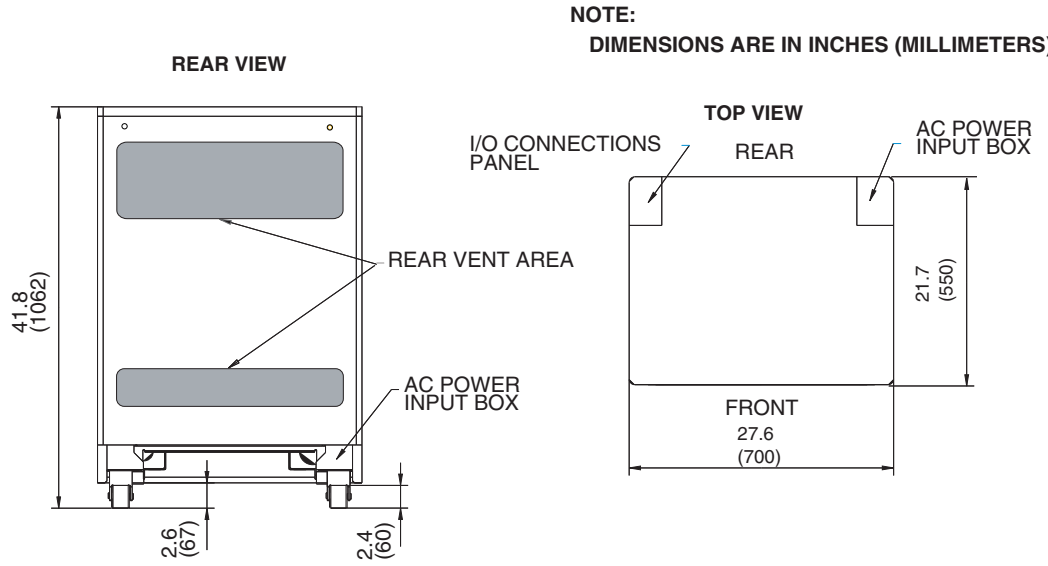
2-3-1.2 NGPDU

Table 2-6: NGPDU Specifications

Length		Width		Height		Weight	
in.	mm	in.	mm	in.	mm	lbs	kg
27.6	700	21.7	550	41.8	1,062	770	350

The NGPDU dimensions are shown in Figure 2-3. Note that space must be provided for service access to the front and rear of the cabinet.

Figure 2-3: NGPDU



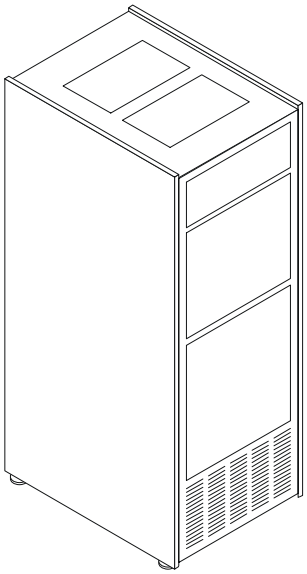
2-3.2 PET Electronics Cabinet Dimensions and Weight

Table 2-7: PET Electronics Cabinet Specifications

Length		Width		Height		Weight	
in.	mm	in.	mm	in.	mm	lbs	kg
38.2	970	23.25	590	74	1,880	420	190

The PET electronics cabinet dimensions are shown in Figure 2-4. Remember to provide space for service access to the front and rear of the cabinet.

Figure 2-4: PET Electronics Cabinet



2-3.3 PET Electronics Cabinet Power

Chapter 6 provides information about the power requirements for this system. A local source shall provide power for the CT and PET electronics cabinets.

Section 2-4: Acquisition Station

The Acquisition Station is a modular system made up of several components. The standard components are:

- Operator Console
- Two monitors – Scan Monitor and Image Monitor
- Two computers – One for CT and one for PET
- Computer Storage Cabinet
- Keyboard and Mouse
- Bright Box (optional) – Used to review images.

The Operator Console contains the monitors, keyboard, mouse and the optional Bright Box. A cabinet, located next to the console, holds both computers.

2-4.1 Acquisition Station Dimensions and Weight

Table 2-8: Acquisition Station Specifications

Component	Length		Width		Height		Weight	
	in.	mm	in.	mm	in.	mm	lbs	kg
CT Computer	16.5	419	16.1	409	3.1	79	16	7.3
Scan Monitor	19.5	495	19	483	18.6	471	70	32
Image Monitor	19.5	495	19	483	18.6	471	70	32
PET Computer	19.6	500	7.5	190	17.7	450	44	20
Console	48	1,219	39	991	33.5	851	662	300

2-4-1.1 eNTEGRA Computer

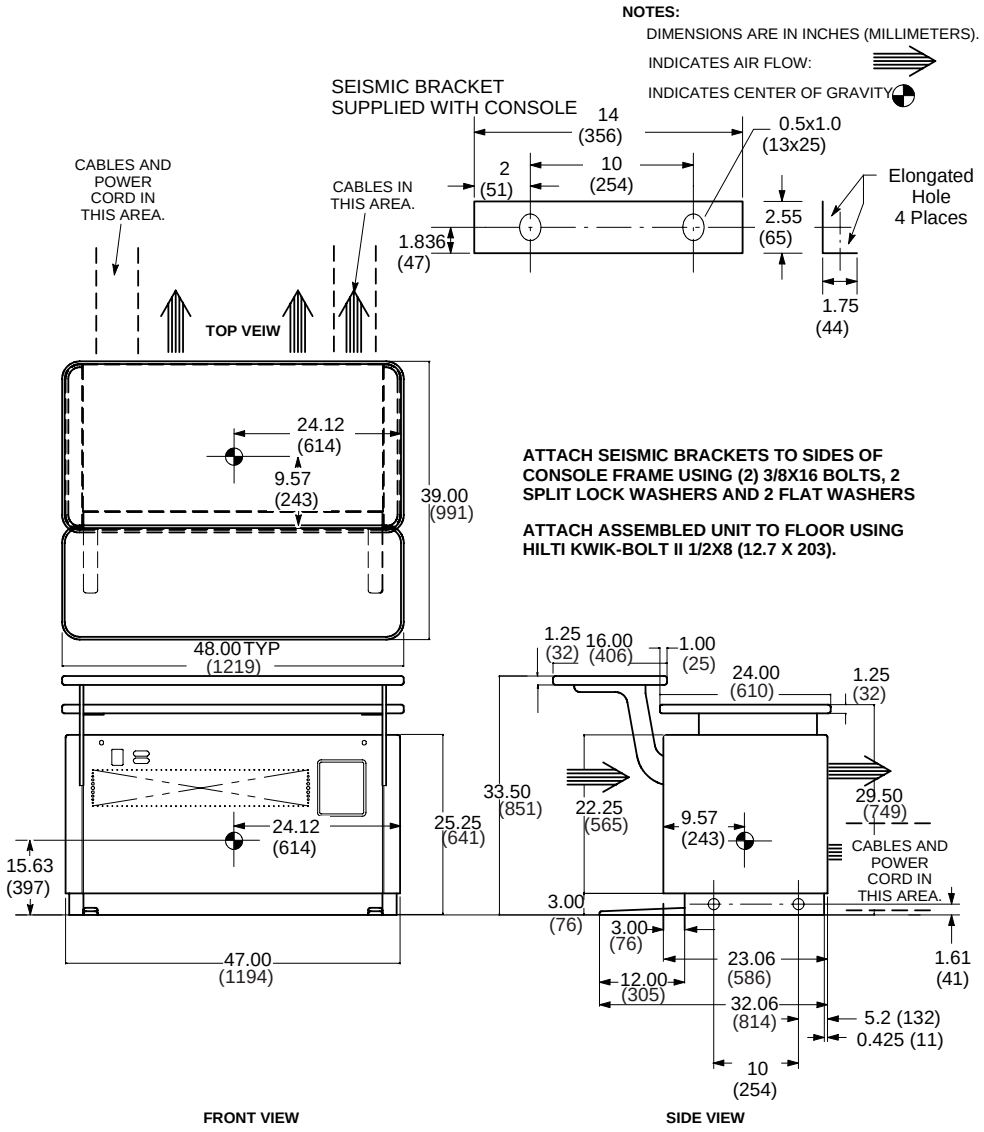
An eNTEGRA processing and review station is placed next to (or near) the Console.

Table 2-9: eNTEGRA Specifications

Component	Length		Width		Height		Weight	
	in.	mm	in.	mm	in.	mm	lbs	kg
eNTEGRA Computer	19.6	500	7.5	190	17.7	450	44	20

The dimensions of the Operator Console are shown in Figure 2-5.

Figure 2-5: Acquisition Station



2-4.2 Acquisition Station Power

All the components of the Acquisition Station are powered from the CT PDU, with the exception of the PET computer, which receives its power from the PET Electronics Cabinet.

Chapter 3 Suite Planning

Section 3-1: Overview

This chapter provides the Suite Planner and the Project Manager of Installation with the basic information and guidelines needed to lay out the Discovery LS imaging equipment.

NOTICE **OBSERVE MINIMUM CLEARANCES UNDER U.S. FEDERAL REGULATIONS AND NATIONAL STANDARDS: 29 CFR 1910 (OSHA), NFPA 70E (STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE) AND NFPA 101 (LIFE SAFETY CODE).**

Figure 3-1 is a diagram of clearance requirements for U.S. regulatory compliance. Be aware that all systems installed in the United States must comply with all Federal and local regulations. For installations outside the United States, country-specific or other local regulatory clearance requirements must be met.

Section 3-2: Space Considerations

This section discusses the:

- Number of rooms required to house all the components of the Discovery LS System.
- Room layouts and sizes.
- Access clearances required to service the equipment.
- Clearances required to transport the equipment through the building.

3-2.1 Recommended and Minimum Room Dimensions

Typically, the Discovery LS Imaging System occupies three rooms. The optimum configuration provides service access, allows space for clinical personnel to perform activities, enables patients to enter and exit the Scan Room comfortably and conforms with safety requirements.

Note: These three rooms do not include space for any tracer production chemistry equipment, patient prep/hold area or hot lab support area.

Figure 3-1 shows a typical suite layout. The size of this space provides the optimum situation for most installations. The suite is partitioned into the following rooms:

- Scan Room: Houses the DLS gantry and patient table.
- Operator Room: Houses the operator console and injector controls, and has a clear view of the Scan Room.
- Electronics Room: Houses the CT electronics cabinet and the PET electronics cabinet. (Sites requiring seismic mounting or with the optional UPS require additional space in this room.)

Refer to Figure 3-1. The recommended critical clearances between the system footprint and the walls of the room are as follows:

- Gantry to Side Walls of Room:
  Recommended: 1,380 mm (54.3 in.); **Minimum:** 914 mm (36 in.)*

- Table to Front Wall of Room:
  Recommended: 1,500 mm (59 in.); **Minimum:** 914 mm (36 in.)*
- Table Rear Travel Limits to Rear Wall of Room:
  Recommended: 711 mm (28 in.); **Minimum:** 711 mm (28 in.)
- Area Around A1 Breaker Box: 1,067 mm (42 in.)
- Rear of Operator Console: 203 mm (8 in.)

3-2-1.1 Service Access Door on the Right Side of the Room

A service access door on the right side of the room requires the minimum critical clearances between the system footprint and the walls of the room as follows:

- **Gantry to Side Walls of Room**: 914 mm (36 in.)*
- **Table to Front Wall of Room:** 550 mm (21.7 in.)*
- **Table Rear Travel Limits to Rear Wall of Room:** 711 mm (28 in.)
- **Area around A1 breaker box:** 1,067 mm (42 in.)
- **Rear of Operator Console:** 203 mm (8 in.)

3-2-1.2 Service Access Door on the Left Side of the Room

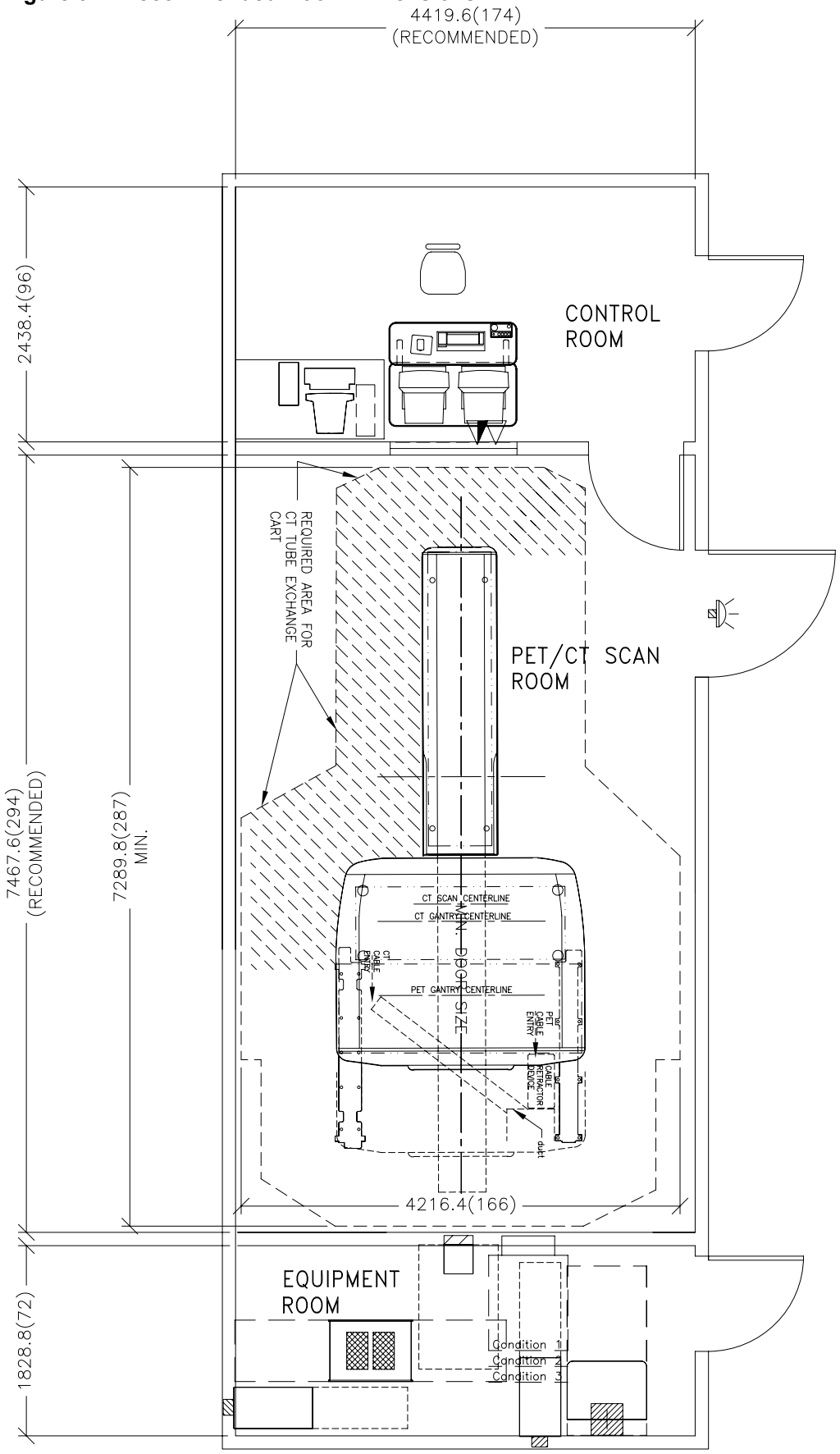
A service access door located on the left side of the room requires the minimum critical clearances between the system foot print and the walls of the room as follows:

- **Gantry to Side Walls of Room**: 914 mm (36 in.)*
- **Table to Front Wall of Room:** 914 mm (36 in.)*
- **Table Rear Travel Limits to Rear Wall of Room:** 250 mm (9.8 in.)
- **Area Around A1 Breaker Box:** 1,067 mm (42 in.)
- **Rear of Operator Console:** 203 mm (8 in.)

Note: *Sufficient space must be maintained around the equipment to ensure full operation, service and safety. For this reason, GE Healthcare requires the clearance between the gantry, table and covers and the side walls of the room to a minimum of 914 mm (36 in.) Egress around the foot end of the table when it is in the longest position is 711 mm (28 in.)

All dimensions are specified in millimeters (inches) and represent the inner footprint of the room.

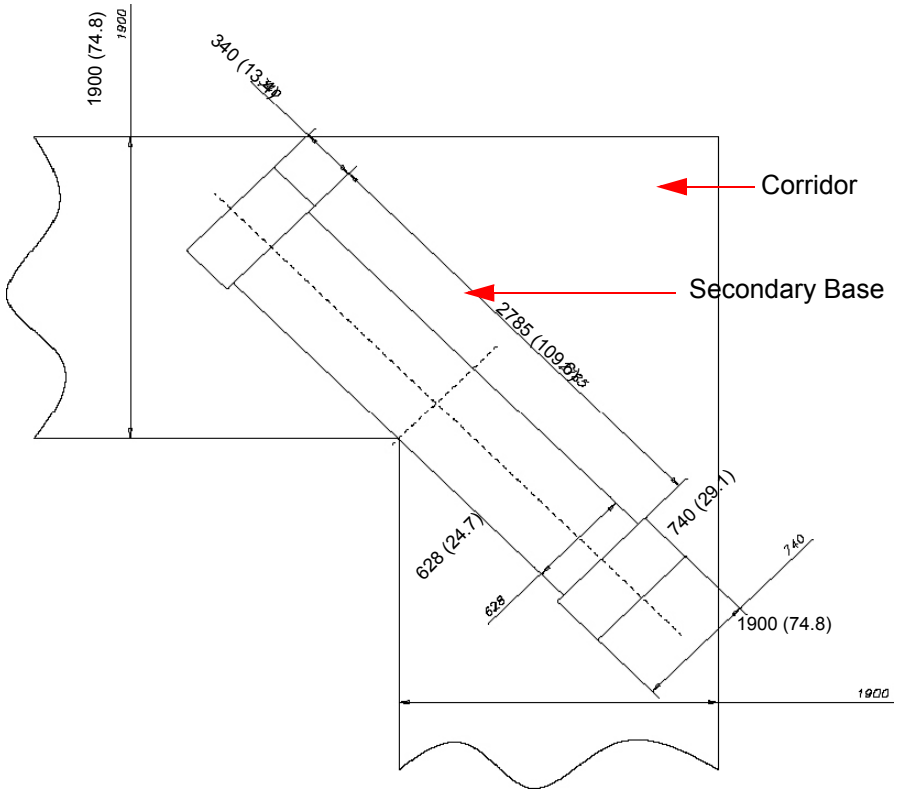
Figure 3-1: Recommended Room Dimensions



3-2.2 Corridor and Door Dimensions

The width of the exam room door should be sufficient to allow delivery of the gantry and the secondary base. The critical measurement is the length of the secondary base. The clearance needed depends on the dimensions of the corridor adjacent to the exam room and must be determined in each site by the Site Field Engineer. Figure 3-2 shows an example of the minimum corridor clearance required.

Figure 3-2: Corridor Clearance for Secondary Base



3-2.3 Service Access

Service access clearance is the space needed to properly service the equipment. For certain service operations, the CT and the PET imaging units in the DLS gantry must be moved apart to enable access. Section 3-2.2 describes the recommended equipment service clearances.

3-2.4 Doors Entrances and Elevator Clearances

Use the shipping dimensions listed in Chapter 7 when planning the transport route through the building. Doors and entrances must have sufficient clearance to allow passage of the crates and equipment listed in Chapter 7, along with the dollies and trollies used to transport them. The weights of the packages must also be taken into account if planning to use elevators.

Section 3-3: Floor Preparation Considerations

3-3.1 Floor Strength

NOTICE **Use of flush floor ducts or conduit in the floor may significantly affect floor strength.**

The total floor loading must also accommodate any shielded walls and ceilings. The customer should consult with a qualified Structural Engineer to receive approval for floor structure and strength required by local structural regulations. If these tests show that the floor strength does not meet the requirements, it is the customer's responsibility to bring the floor strength up to these requirements.

3-3.2 Floor Structure

The floor structure must withstand the occupied weight of the DLS table and gantry, and the individual contact area loading of these components. The DLS table-gantry requires a floor support in the 100 lbs/sq. ft. (490 kg/m^2) class or above. Brace any installation on a floor with a rating less than 100 lbs/sq. ft. (490 kg/m^2) to meet this requirement. Localized bracing to support the concentrated loads at the floor contact sections should also be provided.

3-3.3 Floor Anchors and Concrete Floors

The floor anchors provided in the installation kit are designed to be used only on concrete floors that meet the 5 in. concrete floor requirements. All other anchoring methods and/or use on floor types, other than the 5 in. concrete minimum, must be verified by the customer's engineering contractor at the customer's expense, indicating that the anchors chosen meet the stated GE minimum load requirements. The customer's contractor is responsible for the installation of all anchors, other than those shipped with the system, or any anchors to be installed in unapproved flooring.

Concrete floors must have a minimum strength of f'c = 2000 psi (1.4 x 10^7 MPa) at 28 days for mounting floor anchors. It is the responsibility of each customer to have appropriate tests performed to determine and measure concrete strength. The GE Healthcare Service representative can assist with this.

3-3.4 Floor Levelness

The Discovery LS floor levelness requirement is important for accurate patient positioning. Floor levelness in the Scan Room must not be greater than 0.3145 in. (8 mm) between depression and high spots over any 120 in. (3,048 mm) distance within the area of the gantry and the area around the table. (Refer to Figure 3-1 on page 35 for more detailed information.) Floors should be level to a tolerance of 3 mm per 1,000 mm.

3-3.5 Floor Vibration

The Discovery LS equipment may be sensitive to vibration in the frequency range of 0.5 to 20 Hz, depending on the amplitude of the vibration. It is the customer's responsibility to contract a vibration consultant or qualified engineer to implement design modifications

to meet the specific limits. However, it is ultimately the responsibility of the customer/ architect/engineer to design the site solution.

3-3-5.1 Steady State Vibration

The maximum steady state vibration transmitted through the floor should not exceed 10^{-3} m/s^2rms maximum single frequency above ambient baseline from 0.5 to 80 Hz (measured in any 1 hour during a normal operating period).

3-3-5.2 Transient Vibration

The behavioral characteristics must be such that any measurable transient disturbance must also be minimized to less than 0.01m/s^2 peak to peak.

3-3-5.3 Equipment Location

To minimize the interference, the DLS system should rest on a solid floor, located as far as possible from the following vibration sources:

- Parking Lots
- Roadways
- Subways
- Trains
- Hallways
- Elevators
- Heliports
- Hospital power plants containing pumps, motors, air handling equipment and air conditioning units

3-3.6 Gantry and Table Mounting Requirements

NOTICE **The purchaser has the responsibility to provide an approved support structure and mounting method. General Electric is not responsible for any failure of the support structure or method of anchoring.** Consult GE Healthcare Installation Support Services for additional details.

- Refer to Section 3-8 for additional details of floor loading, component weights, and Gantry and Table installation and anchoring.
- Anchor the gantry and table to floor by a means that maintains their relative alignment and meets applicable building and other local codes, including seismic structural mounting requirements.

3-3.7 Equipment Anchoring Points

The gantry of the CT unit and the rails that support the PET unit must be anchored to the floor by a means that will maintain their relative alignment and will conform with applicable building and other local regulations, including seismic structural mounting requirements.

It is the customer's responsibility to provide an approved support structure and mounting method. GE Healthcare is not responsible for any failure of the support structure or method of anchoring.

NOTICE **Consider any factor that could cause misalignment between the gantry and table, due to floor sag. The cradle can potentially carry a 450 lb (205 kg) patient. The center of gravity changes as the cradle cantilevers.**

The customer's structural engineer must verify that the site and method of anchoring are adequate to support loads and maintain table-to-gantry alignment.

- Take into consideration all other moving weights such as gurneys or personal equipment.
- No part of floor surface within table and gantry, nor the two interface areas between the table and the gantry, should be higher than the support area for table and gantry.
- Location of supporting beams and columns may dictate position of table-to-gantry assembly. Use of flush floor duct or conduit in the floor may significantly affect floor strength. The method and placement of anchoring through bolts must **not** reduce the structural strength of the floor.

3-3.8 Floor Covering

Support areas of the patient table and gantry must rest on solid concrete or other basic flooring. Resilient tile or carpeting will yield over a period of time and disturb alignment of the table to the gantry.

Section 3-4: Cable Routing Considerations

Power wiring between the facility Main Distribution Panel and the PDUs should be kept as short as possible to minimize the effects of voltage regulation.

Carefully consider advantages and disadvantages of conduits, floor troughs and surface raceways for running cables. Make cable passageways large enough to install any cable with all other cables already installed.

NOTICE **When routing power cables, all three phase wires and ground must run in the same conduit or trunk. Separate power cables from system control cables, if they occupy the same duct or conduit.**

3-4.1 CT-PET Cable Routing

For best results: Route the cables from the electronics cabinets to the DLS gantry, and cables between the PET and CT units within the DLS gantry, through troughs or trunks set into the floor.

Note: This section contains general cable routing guidelines. Actual routing will vary from site to site.

- Figure 3-3 shows an example layout of cable raceways between the subsystem units (gantries, PDUs and operator console).
- Figure 3-4 shows a general concept of the floor troughs for the PET, CT, and CT-PET internal cables, as well as the PET cable retractor.
- Figure 3-5 shows a more detailed view of the floor troughs for the PET, CT, and CT-PET internal cables.

3-4-1.1 Subsystems Cable Routing

Figure 3-3: Recommended Cable Raceway Layout

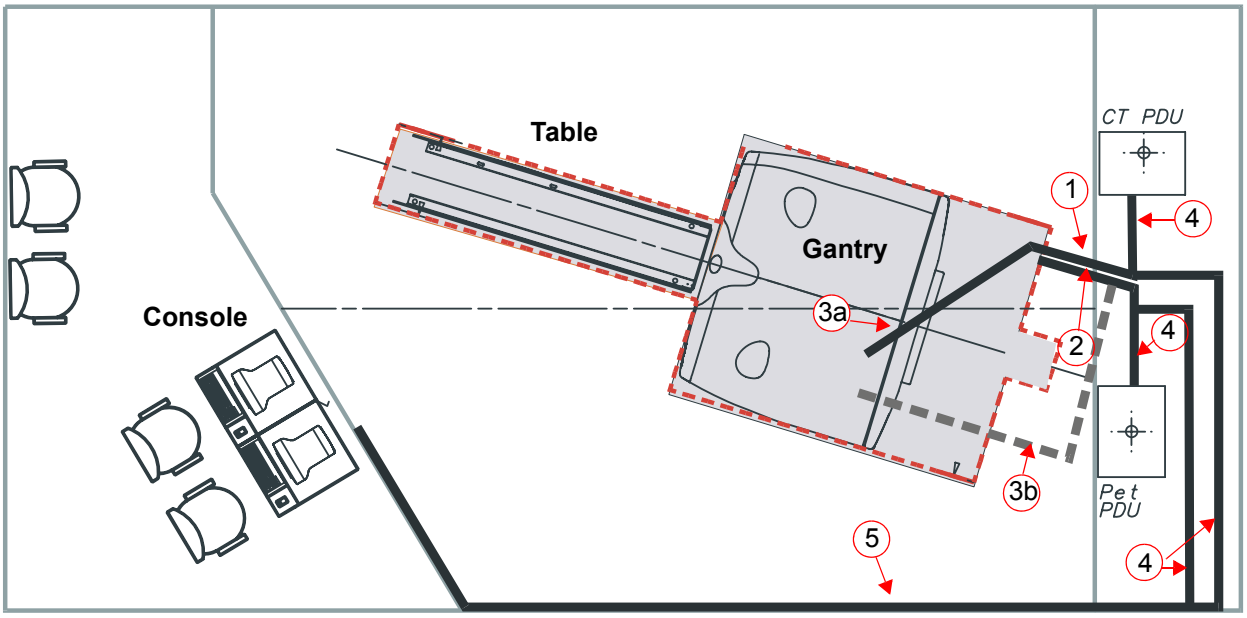


Table 3-1: Recommended Cable Raceways

Raceway No.	Description
1	Refer to Figure 3-4. CT PDU-Gantry interconnect cabling inside the floor trough
2	Refer to Figure 3-4. PET PDU-Gantry workstation interconnect cabling inside the floor trough through the PET retractor
3	Refer to Figure 3-4. CT gantry and internal CT-PET cabling may be routed in: • Troughs cut into the floor (Option 3a in Figure 3-3) • Conduits or raceways mounted over the floor (Option 3b in Figure 3-3)
4	Spare cable arrangement under the raised floor
5	CT-PET PDU gantry-workstation interconnect cabling may be routed through: • Troughs cut into the floor, • Conduits/raceways mounted over the floor, or • Raceway/conduits mounted above the ceiling.

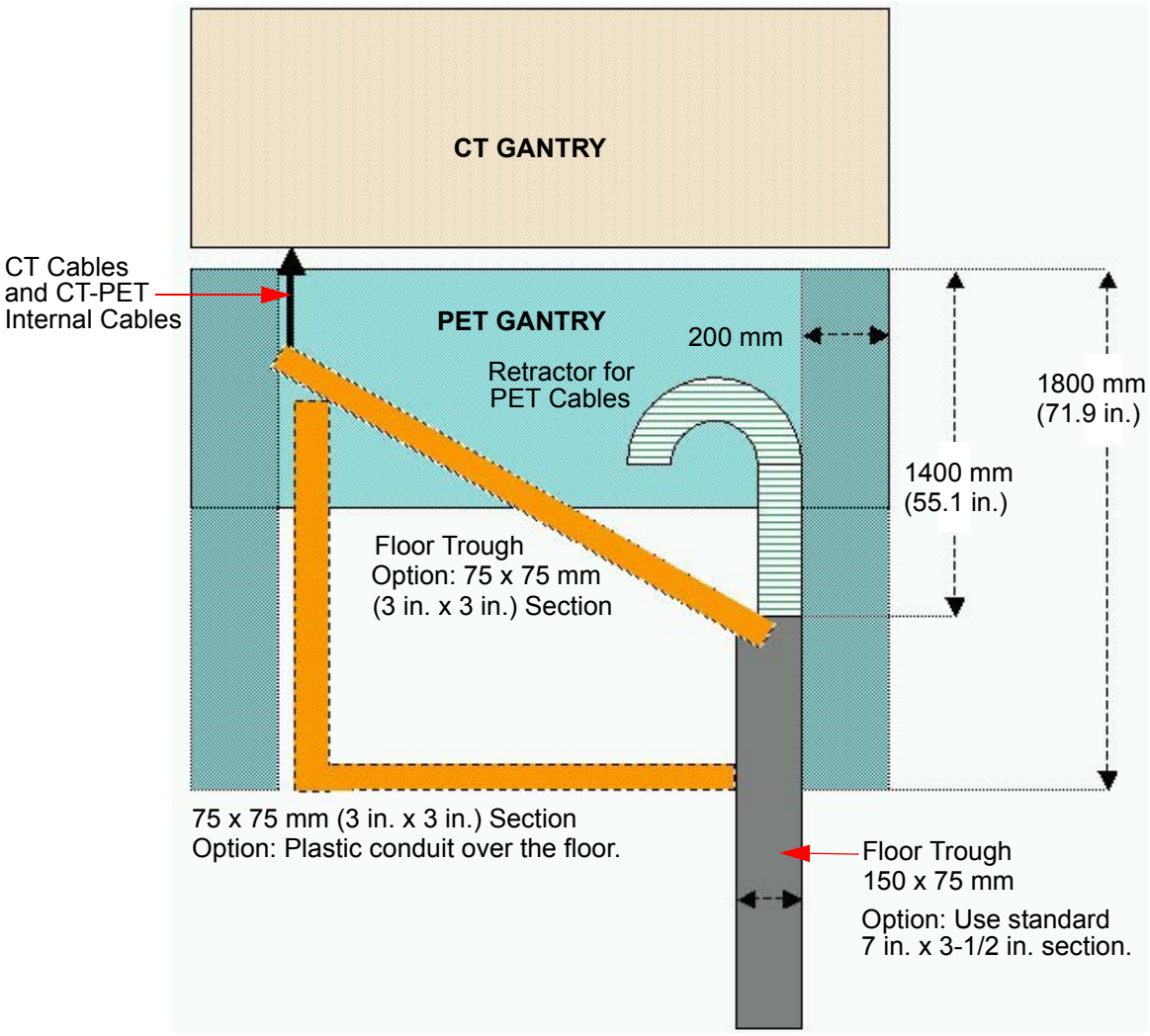
Note: Figure 3-3, Figure 3-4 and Figure 3-5 show general recommended floor trough positions. However, give special consideration to the details of the routing between cover supports and any site specific obstacles.

3-4-1.2 Cable Routing Under Gantries

Figure 3-4 shows recommended routing for DLS Gantry cables:

- A 150 x 75 mm (7 in. x 3-1/2 in.) trough in the floor from the wall (leading to the electronic cabinets) is contractor supplied.
- Figure 3-4 shows two suggested routing options for CT cables and internal DLS Gantry cables (contractor supplied):
  - A diagonal trough 75 x 75 mm (3 in. x 3 in.) under the PET gantry unit.
  - A plastic conduit 75 x 75 mm (3 in. x 3 in.) running over the floor behind the PET gantry.

Figure 3-4: CT-PET Cable Routing Concept



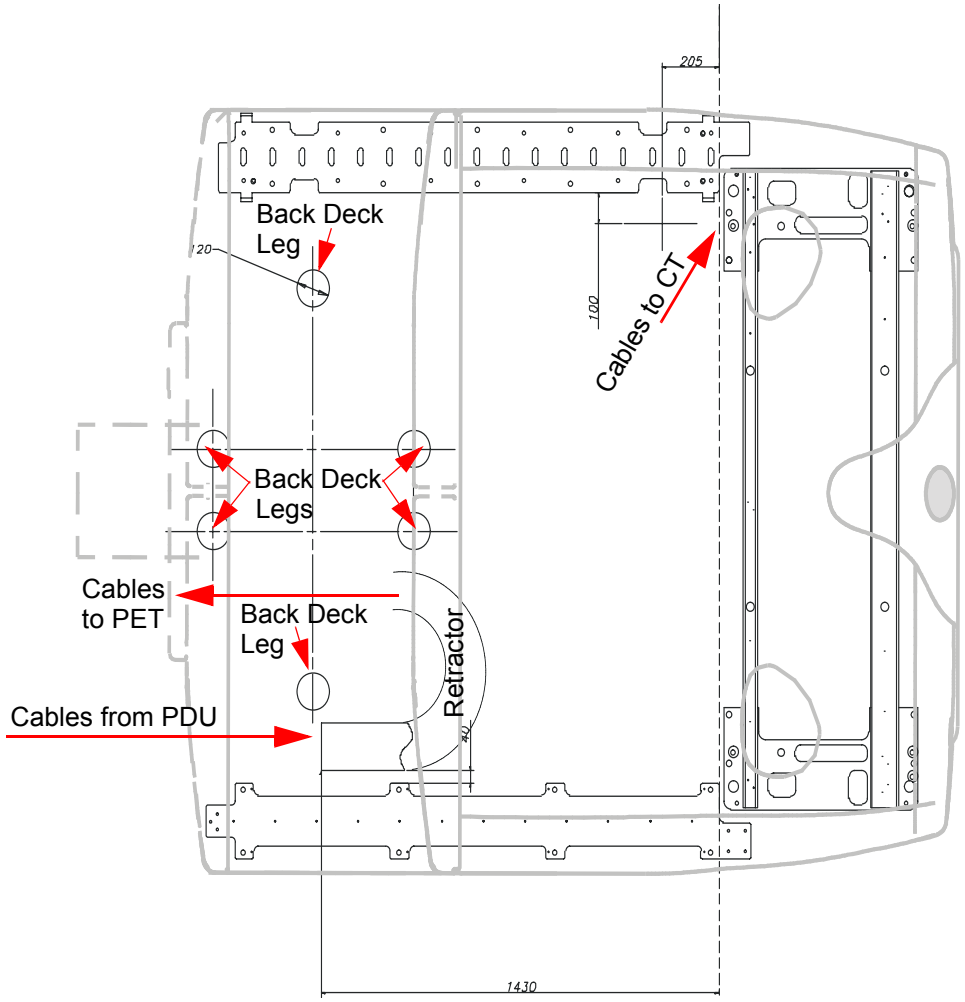
Note: Cables may be routed through:

- Troughs cut into the floor
- Conduits/raceways mounted over the floor (as determined by the site field engineer.)

3-4-1.3 Avoiding Obstacles

Route the troughs and conduits under the gantry to avoid any obstacles. Make sure the trough clears the rear deck support legs as people stand on the rear deck. Figure 3-5 shows the size and location of the back deck legs, relative to the entrance and exit points of the CT and PET cables.

Figure 3-5: CT-PET Cable Routing Obstacles



Note: The Field Engineer at each site should decide the routing of the cables from the PDU to the CT in troughs, conduits or raceways.

Note: Floor troughs and floor, wall or ceiling conduits or raceways should be 75 mm wide x 75 mm deep (includes an over allowance of 30%).

Section 3-5: Radiation Protection Considerations

This section discusses the protective measures that must be considered for:

- X-ray radiation from the CT equipment. (See X-Ray Radiation Protection on page 43.)
- Gamma radiation from the PET radioactive pin sources in the gantry. (See Dose Rate from Radioactive Pin Sources on page 48.)

A qualified radiological health physicist should review the Scan Room shielding requirements, taking into consideration equipment placement, weekly projected work-loads, and materials used for construction of walls, floors, ceiling, doors, and windows. Remember to include radiation from the patient, in the scan room and waiting areas, and radiation from tracers. (See also Control of Airborne Radiation on page 66.)

3-5.1 X-Ray Radiation Protection

The main X-Ray beam is collimated within the transaxial slice of the patient. During CT scans, scatter radiation from the patient and leakage from the X-Ray tube housing will be present in the Scan Room. The scatter varies with the shape and size of the patient, and exam type. The example plots shown in Figure 3-6 use a CT Body Torso Phantom (Alderson Phantom) - a phantom filled with water - to simulate scatter from the patient. All measurements have an accuracy of ± 20% because of measurement equipment, technique, and system-to-system variation.

Note: To generate scatter from the main beam, position the Alderson phantom on the table and center it in the imaging plane. The phantom has a variable 22-29cm diameter and is a 24cm long ellipsoid of polymethylmethacrylate, filled with water. The phantom also contains 3 plastic rods, terminated with plastic spheres.

Use the correction factors in Table 3-2 to adjust exposure levels to the usual scan technique at your site.

Table 3-2: Correction Factors

Changed Parameter	Multiplication Factor
mAs	New mAs/100
80 kV	0.21
120 kV	0.71
140 kV	1.0
4 x 3.75 mm images	0.82
4 x 2.5 mm images	0.59
4 x 1.25 mm images	0.40

Axial # Scan Seconds = (# Images * Gantry 360 Rotation Time) / 4 [for 5 mm images or less].

Table 3-3: Additional Correction Factors

Changed Parameter	Multiplication Factor
mAs	New mAs/100
80 kV	0.21
120 kV	0.71
140 kV	1.0
15 mm Table Travel/Rotation (10 / 7.5 / 5 mm image thickness @ premium IQ mode)	1
11.25 mm Table Travel/Rotation (7.5 / 5 / 3.75 mm image thickness @ premium IQ mode)	0.82
7.5 mm Table Travel/Rotation (5 / 3.75 / 2.5 mm image thickness @ premium IQ mode)	0.59
3.75 mm Table Travel/Rotation (2.5 / 1.25 mm image thickness @ premium IQ mode)	0.40
30 mm Table Travel/Rotation (10 / 7.5 / 5 mm image thickness @ standard IQ mode)	1
22.5 mm Table Travel/Rotation (7.5 / 5 mm image thickness @ standard IQ mode)	0.82
15 mm Table Travel/Rotation (5 / 3.75 / 2.5 mm image thickness @ standard IQ mode)	0.59
7.5 mm Table Travel/Rotation (2.5 / 1.25 mm image thickness @ standard IQ mode)	0.40

Helical # Scan Seconds = [(# Images * Image Thickness / Table Advance per Rotation) + 1] * Gantry 360 Rotation Time.

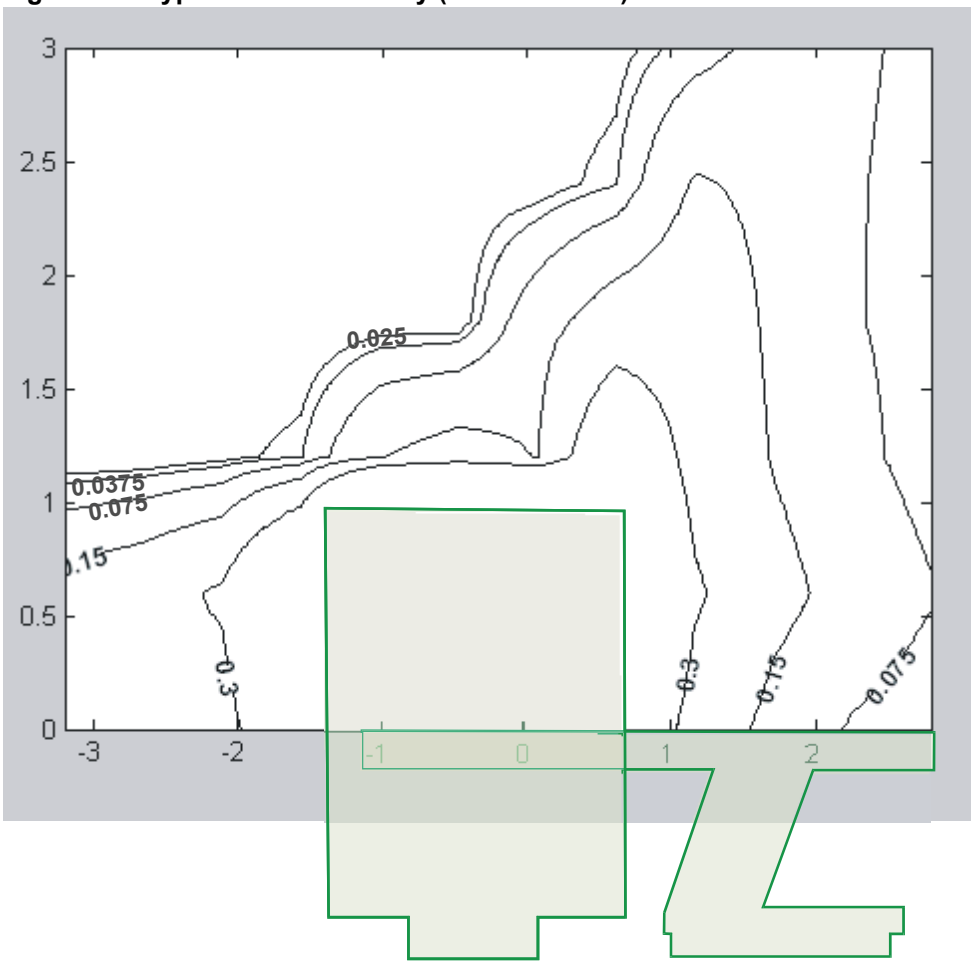
Note: Premium Image Quality (IQ) mode requires 50 - 70% the mAs of standard IQ mode for comparable LCD and noise (dependent on image thickness and table advance per rotation).

Values, in mR per scan, apply to both 60 Hz and 50 Hz operation.

VERTICAL PLANE

Stray Radiation from Body Torso Phantom (Alderson Phantom)
ISO Contour Levels: 0.075, 0.15 and 0.3 mR/scan 100 mAs/scan, 140 kV, 4 x 5.00 mm scan acquisition.

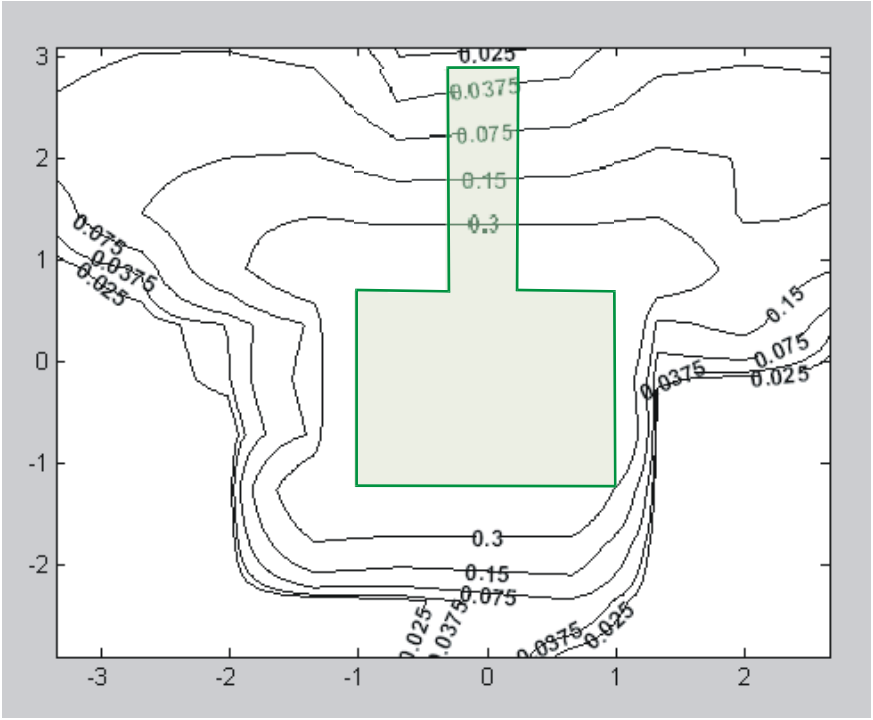
Figure 3-6: Typical Scatter Survey (Vertical Plane)



HORIZONTAL PLANE HEIGHT = -0.5 M

Stray Radiation from Body Torso Phantom (Alderson Phantom)
ISO Contour Levels: 0.075, 0.15 and 0.3 mR/scan 100 mAs/scan, 140 kV, 4 x 5.00 mm scan acquisition.

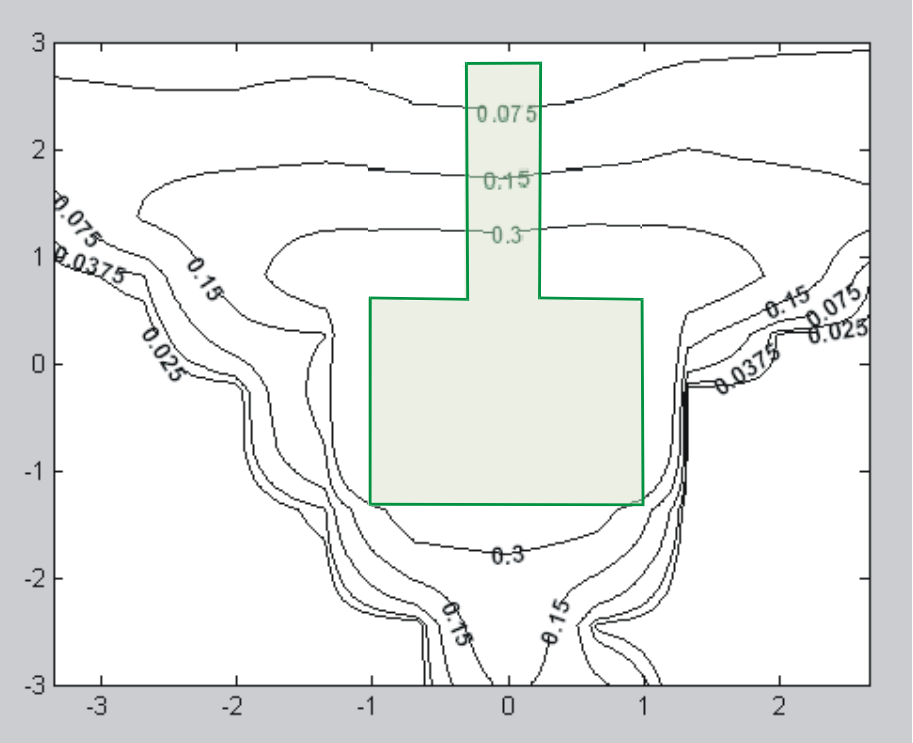
Figure 3-7: Typical Scatter Survey (Horizontal Plane Height = -0.5 m)



HORIZONTAL PLANE AT COR - HEIGHT = 0 M

Stray Radiation from Body Torso Phantom (Alderson Phantom)
ISO Contour Levels: 0.075, 0.15 and 0.3 mR/scan 100 mAs/scan, 140 kV, 4 x 5.00 mm scan acquisition.

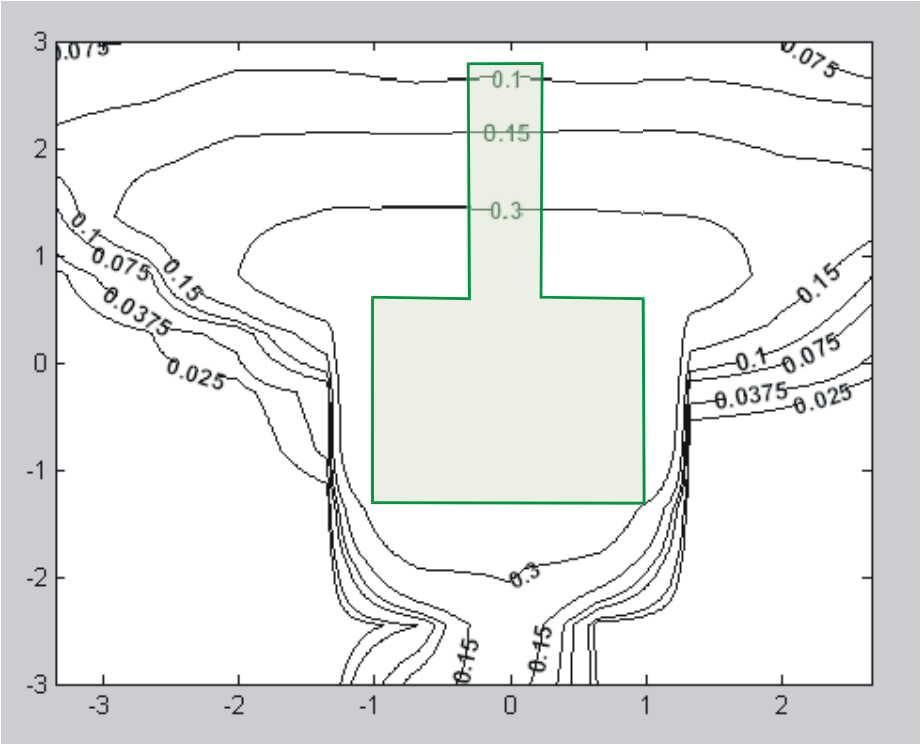
Figure 3-8: Typical Scatter Survey Horizontal Plane at COR (Height = 0 m)



HORIZONTAL PLANE HEIGHT = +0.5 M

Stray Radiation from Body Torso Phantom (Alderson Phantom)
ISO Contour Levels: 0.075, 0.15 and 0.3 mR/scan 100 mAs/scan, 140 kV, 4 x 5.00 mm scan acquisition.

Figure 3-9: Typical Scatter Survey (Horizontal Plane Height = +0.5 m)



3-5.2 Dose Rate from Radioactive Pin Sources

The PET Advance unit uses radioactive pin sources. The sources are stored in a shielded container inside the gantry, and remain within the gantry during use. A robot arm automatically removes the sources from the container before each use, and returns them to the container after each use.

Dose rates described in this document are estimates based on measurements taken under specific measurement conditions, described in detail for each measurement. Since the measurement conditions vary at every scanner installation (due to differing room geometries, the presence of other equipment or shielding material, etc.). Use these measurements as guidelines only.

3-5-2.1 Radioactive Source Pin

PET images are generated by measuring radiation arising from electron-positron annihilation events that occur within the patient. No external radiation sources are required to generate this data. The PET system uses radioactive source pins:

1.) To calibrate the scanner detectors and electronics.

2.) To assess the relative performance of the scanner's detector channels so that differences in individual detectors' efficiency can be accommodated during the reconstruction process.

To achieve these functions, the PET Advance imaging system uses radioactive sources, referred to as "source pins." The pins contains ^{68}Ge, an isotope with a half-life of 287 days. The two source pins used for transmission scans and calibration are referred to as "high

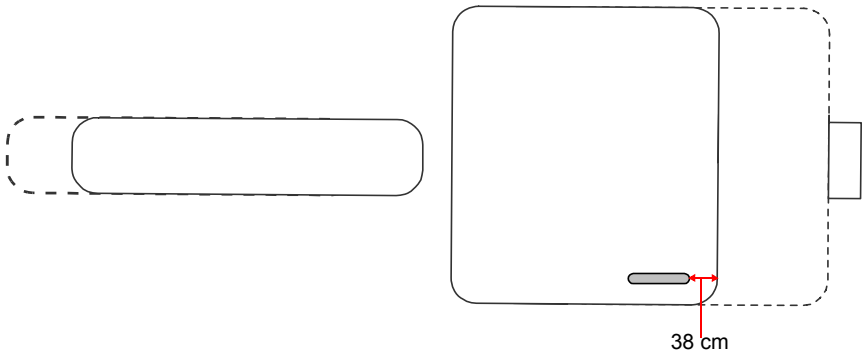
activity pins". The normalization source pin is referred to as the "low activity pin". Table 3-4 lists the source pin activity levels.

Table 3-4: Source Pin Activity Levels

Source Pin	Maximum Activity Level	Activity Level After 287 Days Half-Life
High Activity Source Pin	480 MBq	Approx. 200MBq
Low Activity Source Pin	72 MBq	Approx. 30MBq

When not in use, the source pins are housed in a lead storage container located inside the PET gantry unit. Refer to Figure 3-10. When standing behind the DLS gantry, the storage container resides in the lower left quadrant of the gantry, near the rear cover.

Figure 3-10: Location of Pin Source



During use, the pin moves near the center core of the gantry, just beyond the wall of the patient port. Depending on the task, the pin remains stationary, or the T-Ring rotates around the circumference of the patient port at a speed of 20 revolutions per minute (one revolution per three seconds). A software driven mechanical system (robot arm) transfers the pin from the storage container to the T-Ring, and returns it to the storage container after each use. The gantry control panels and the operator keypad (SCIM) contain Radiation indicators that activate as long as any pin source is outside of the storage container.

3-5-2.2 Dose Rates With Pin Sources Stored

Refer to Figure 3-10. When the pins are stored in the lead container, and no other sources are present in the scanner room, the highest doses measured in the scanner room are at the gantry cover closest to the storage container. The distance from the back of the source container to the back of the gantry, approximately 38 cm.

To estimate the dose rates, measurements were taken on an uncovered gantry at positions corresponding to the front and back surfaces of the gantry. The results of those measurements, normalized per milliCurie of source activity are:

At the back cover: dose rate of 0.013 mR/hr/mCi, maximum dose rate of 0.37 mR/hr.

3-5-2.3 Dose Rates With Pin Source In Use

The dose rates were measured with the following conditions in place:

1.) Pin sources rotating around the patient port.
2.) Patient table lowered to its lower limit (55 cm above the floor).
3.) All measurements were performed at a height corresponding to the center of the

patient port.

Table 3-5 lists the results of these experiments, measured along the central axis of the scanner (distances are measured from the frontmost imaging slice; positive distance is in the direction towards the scanner table):

Table 3-5: Dose Rates with Pin Source in Use

Dose Rate per mCi mR/hr/mCi	-2 m	-1 m	Front Slice	+1 m	+2 m	+3 m
	0.13	0.77	3.2	0.40	.11	0.04

3-5-2.4 Gamma Ray Protection

The DLS PET unit uses a number of radioactive substances (tracers), of various levels of stability. The exam type determines the type of tracer used. Before the suite is operational, unstable material may be on the premises. **It is very important to recognize that clear and significant hazards from ionizing radiation may exist on site, as it undergoes installation.** If the facility is open, other equipment may be in place and operational at this time, such as X-Ray systems and CT scanners (other than the DLS CT unit). Calibration sources for the PET Advance imaging system may be on site near the end of the site preparation and installation process. Some facilities have on-site cyclotrons, which may be operational. Follow all local, state and/or facility guidelines to ensure the safety of workers, patients, and visitors during all phases of the DLS site construction, installation and operation.

NOTICE **The licensing process must be complete by the time the site is ready to use radioactive materials. The site must be properly licensed to receive this radioactive material.**

3-5-2.5 Protection of Equipment

The Discovery LS PET Advance imaging system is very sensitive to extremely low levels of ionizing radiation. **Important:** keep all background radiation to a minimum. Store all radioactive sources in approved shielded containers. GE Heatlhcare recommends that any radioactive source, not specifically designed to be housed in the DLS gantry lead shield, be stored in a separate room (hot lab) adjacent to and accessible from the scan room. This hot lab should be near the cyclotron (if used). Prepare doses in the same hot lab area.

Consider the placement of the DLS gantry relative to existing X-Ray, Magnetic Resonance, or Nuclear diagnostic equipment. Magnetic interference above 1.0 gauss, at the surface of PET components, can adversely affect the image quality. Implement good shielding techniques to avoid this type of interference.

Some procedures involve the use of radioactive water, which results in the patient exhaling radioactive carbon dioxide. This carbon dioxide must be contained in order to avoid adversely affecting the image quality. Some PET procedures require the use of radioactive gases. This too can result in compromising image quality, if not properly controlled.

3-5-2.6 Protection of Personnel

The escape of radioactive gases, if not properly confined, can cause unnecessary exposure to clinical staff. Store all sources in appropriate enclosures to provide adequate protection to all in the suite.

3-5-2.7 Barriers Partitions and Shielding

Install appropriate barriers such as walls, lead-shielded glass and lead shields to protect staff from unnecessary exposure to radiation. Since the Discovery LS suite involves the use and storage of radionuclides, consult a qualified radiological health physicist during the design of walls and safety barriers to assure proper attenuation.

Remember, patients become significant sources of radioactivity. Design the suite to maximize the distance between the patient and operator during the uptake and acquisition phases of DLS PET-CT and DLS PET scan procedures.

3-5-2.8 Radiation Sources

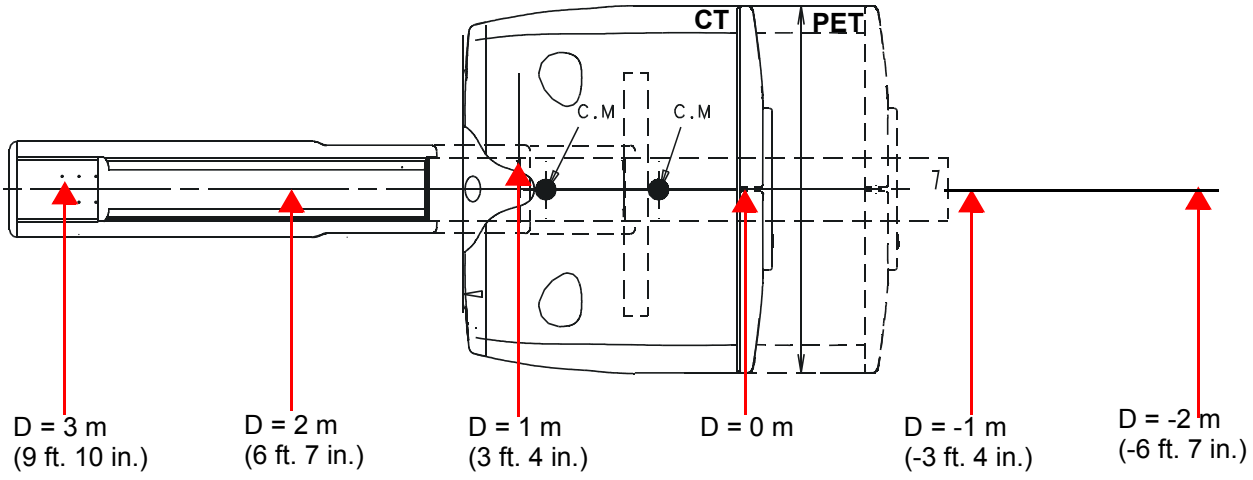
The DLS system uses a number of common radionuclides. These radionuclides will either be produced on-site, or brought to the site from an outside source. In either case, these tracers have a relatively short half-life (2 min. to 110 min. maximum), so they rapidly decay to benign levels. Typical positron emitting isotopes include: Carbon-11, Nitrogen-13, Oxygen-15, and Fluorine-18.

Table 3-6 shows the dose rate at various distances. Refer to Figure 3-11 and Table 3-6. The measurements were taken at the designated locations around the equipment, **without** the presence of the CT gantry.

Table 3-6: Dose Rate Over Distance

Distance in meters (ft.)	D=-2 (-6 ft. 7 in.)	D=-1 (-3 ft. 4 in.)	D=0	D=1 (3 ft. 4 in.)	D=2 (6 ft. 7 in.)	D=3 (9 ft. 10 in.)
Dose Rate	4 mR/hr	23 mR/hr	96 mR/hr	12 mR/hr	3.2 mR/hr	1.1 mR/hr
Activity of Source	15 mCi	15 mCi	15 mCi	15 mCi	15 mCi	15 mCi

Figure 3-11: Distance Measurement Location



Section 3-6: Space Requirements and Design Considerations

When planning the suite size and shape, consider door swing, traffic patterns and accessibility, as well as lighting and cooling. Provide adequate space in the scan room for the equipment, personnel and patient, as well as support devices, such as IV hangers, monitors, wheelchairs and gurneys.

The recommended room sizes described in Section 3-2.1, does not include areas for ancillary equipment such as a patient preparation and reception area, isotope receiving area, blood work laboratories, or a cyclotron.

The minimum room size described in Section 3-2.2, may not be appropriate for every suite of limited space. At the same time, too large a space can add unnecessary costs. Each installation is unique. Ultimately, the needs of the facility, the existing structures and budget dictate the shape and size of the DLS suite.

Upon request, GE Healthcare Site Planners can work with the purchaser to establish the best possible equipment layout in a customized department configuration.

3-6.1 Traffic Patterns

Some patients may be ambulatory, while others require wheelchairs and other such devices. Others may be able to walk on their own. Patients will be having procedures done requiring different amounts of time. It is not realistic to expect patients to be processed in consecutive order in all cases. Traffic in the suite can at times, cause confusion. That confusion will be augmented if the space is poorly planned.

In general, the most efficient traffic pattern is a linear one, where space can be used for holding areas that allow other patients to pass through. A number of such patterns may exist in many suites. the most efficient suites are generally those which have the Scan Room located at the mid-point of linear traffic patterns. When possible, the Imager should be the center of activity.

If a hot lab is part of the plan, it should be placed near any Radiopharmaceutical Laboratory. If a cyclotron is part of the suite, the hot lab should be placed near by. Patients can be dosed in that part of the suite, if need be, and then brought into the Scan Room. Ordinarily, a “cool down” area would be needed as a last stop for the patient.

Some configurations may have two or even three systems. this does not change the basic approach to space planning of a suite. If possible, the Operator Room, along with the Scanners and Imagers should be at the center of activity. In this situation, it may be wise to have two or three different linear traffic patterns.

3-6.2 Furniture

Consideration must be given to the space requirements of furnishings in the suite. In order to accommodate the needs of the people in the suite, and any desk-top type equipment, tables, chairs, desks and other furniture will be required. Weight loading of the equipment must be considered when specifying tables. When selecting the suite furniture, ergonomically correct components should be chosen. Section 3-7 covers the ergonomics of furnishing the suite.

3-6.3 Typical Suite Characteristics

Most Discovery LS suites have a number of common characteristics. This is true for clinical, research, or combination suites which have both types of activity. These suites have some common properties:

1.) The Scan Room tends to be the center of activity, thus locating it at, or near, the center of the suite.

2.) The Electronics Room and the Scan Room are generally accessible from the Operator Room.

3.) Unrelated activity should have traffic patterns which do not overlap.

4.) All activity involving the use of radionuclides tends to come together forming a traffic pattern. That pattern is generally adjacent to the imager.

5.) The Operator has the patient table in sight from the Operator's Work Station. This requirement can be implemented by having a lead-shielded glass window between the Operator Room and the Scan Room or by using a Closed Circuit Television system. A qualified radiological health physicist should be consulted when planning this aspect of suite layout.

Section 3-7: Ergonomic Considerations

Ergonomic considerations are an important part of the suite. A well planned suite will reflect a sensitivity to the health and welfare of the personnel who will be using the facility.

The Discovery LS suite should be designed to accommodate the routine movements of the day-to-day activity of the personnel. Failure to provide an ergonomically correct suite will compromise suite efficiency.

Review the notes below. These are to serve only as a reminder, professional assistance in the area should be sought.

- The operator should be able to change focus from the acquisition station to an unobstructed view of the patient with minimum head movement.
- Personnel must be allowed to stand and walk erect, without having to avoid objects which could require ducking and dodging. Workers should be able to strike a regular rhythm of pace when travelling from one place to another.
- Chairs should be adjustable in height and tilt. Workers must be able to sit straight with feet flat on the floor. It is important for workers to change position from time to time.
- Tables should be at an appropriate work surface height.
- Bending at the middle of the body is hazardous, particularly when holding heavy objects. The suite should be designed to minimize the need for this type of bending. Space should be sufficient to allow a person to kneel down on one knee in any place in the suite.
- Generally, it is best to push large objects rather than to pull. Provide space to push wheelchairs and beds. This usually requires space at the head and the foot of beds.
- Personnel should not be required to reach for objects causing gravity to be off-center. Adequate floor space must be provided for workers to stand close to objects that need to be moved.
- Only light and soft items, like linens and pillows, should be stored in overhead locations. Excessive reaching should not be required to retrieve these items.
- Equipment and materials stored in lower lockers should be visible from a standing position. Long reaches to the back of deep cabinets should not be required.
- Provide adequate space to lift with the use of legs rather than the back.

Section 3-8: Structural Considerations

3-8.1 Floor Loading

The Discovery LS system has an approximate total floor load (including lead shielding) of 27,500 lbs (12,276 kg) composed of:

- **Gantry:** 8,950 lbs (4,060 kg)
- **Table (including a 450-pound patient):** 1,770 lbs (804 kg)
- **CT Console:** 662 lbs (300 kg)
- **CT Compact Power Distribution Unit (CPDU):** 800 lbs (363 kg), or
  CT New Generation Power Distribution Unit (NGPDU): 770 lbs (350 kg)
- **PET Electronics Cabinet:** 420 lbs (190 kg)
- **Shielded Walls /Door (5 mm lead):** 8,500 lbs (3,794 kg) - site specific*
- **Shielded Ceiling (3 mm lead if required):** 2,500 lbs (1,232 kg) - site specific*
- **Shielded Floor (3 mm lead if required):** 2,500 lbs (1,232 kg)

Note: *The specifications of the shielded walls and ceiling are site specific. Each site field engineer must calculate this aspect of the floor load in accordance with the site requirements for shielding.

In addition to the DLS loading, there may be other equipment to consider, such as furniture, imaging support equipment, and a cyclotron. Due to the mass involved, GE Healthcare recommends hiring the services of a Structural Engineer to evaluate the site-loading capabilities.

All the above factors should be taken into consideration when calculating and verifying the floor strength rating mentioned in Section 3-3.1.

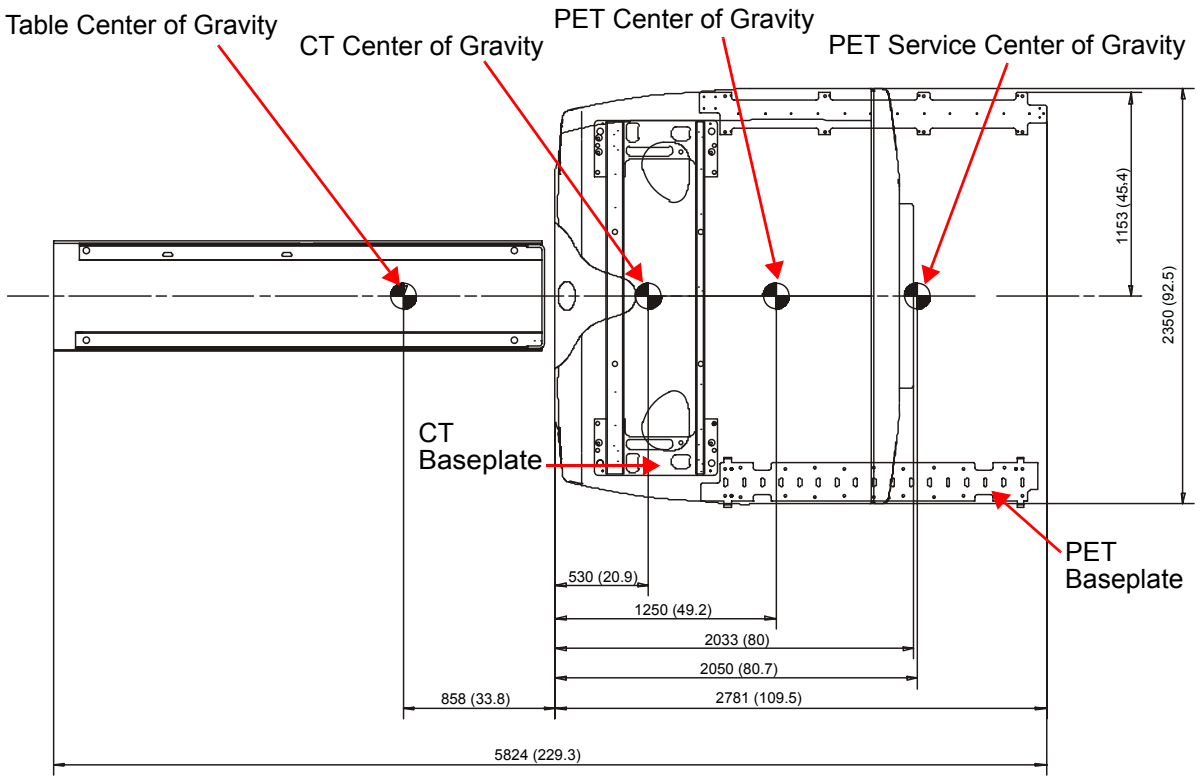
3-8.2 Floor Loading Footprint

Figure 3-12 shows the DLS gantry footprint and dimensions. Refer to Section 3-8.1, and apply the loads of the equipment and shielding when calculating floor loading from the footprint.

The PET gantry has two centers of gravity:

- When the gantry is in its operating position.
- When the gantry is in its service position.

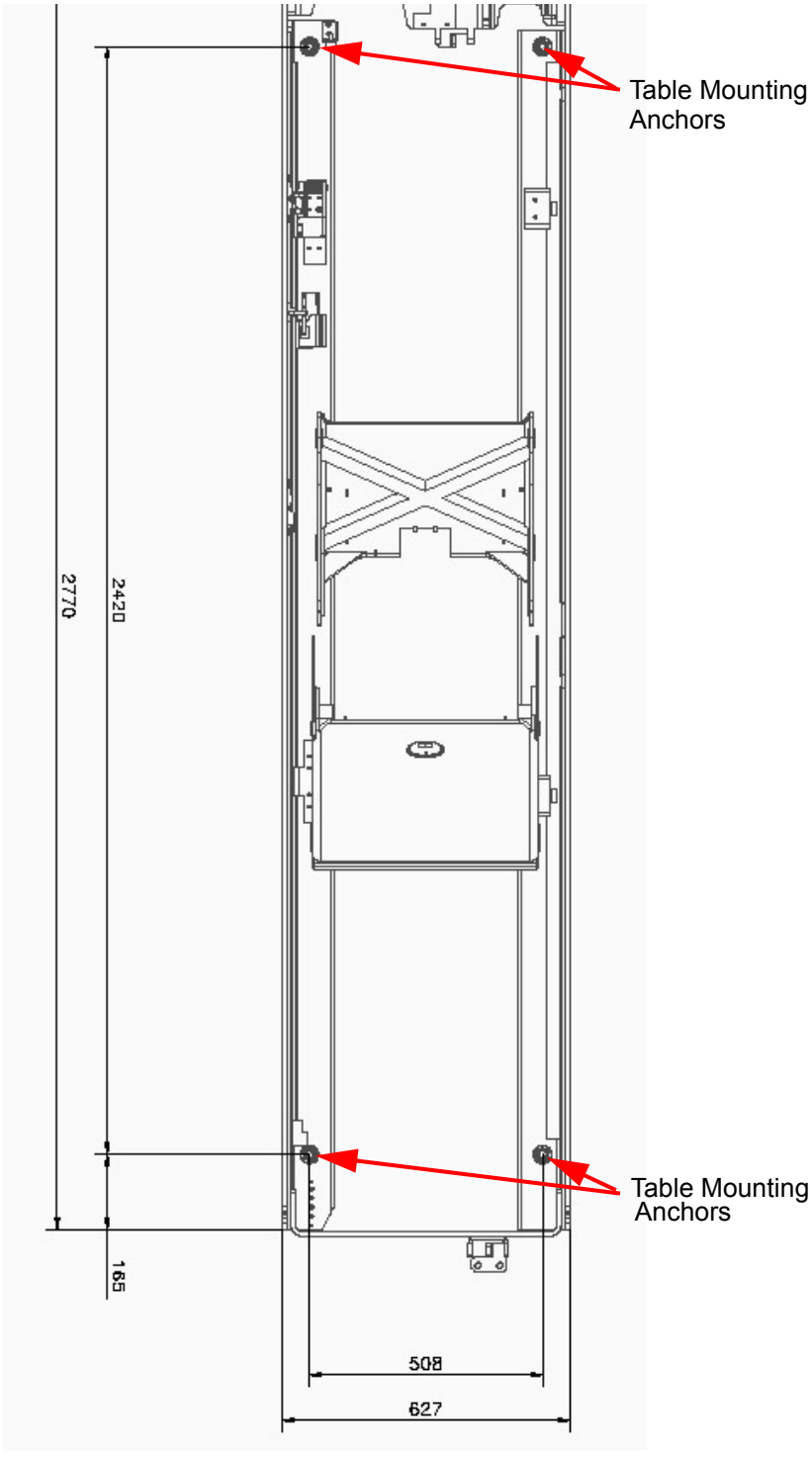
Figure 3-12: Floor Loading Footprint



3-8.3 Table Secondary Base Floor Anchoring Points

Figure 3-13 shows the position of the four secondary base floor anchoring bolts. In case of existing floor structural limitations at the site that may interfere or obstruct the table's floor anchors, use this diagram to plan the position of the secondary base.

Figure 3-13: Secondary Base Anchoring Positions



Discovery LS Floor Loading and Mounting Requirements

The Discovery LS system has a total floor load of approximately 13,000 lbs (5,900 kg). About 11,000 lbs (5,000 kg), including patient weight up to 450 lbs (204 kg), is concentrated in the table-gantry assembly.

Table 3-7 shows Discovery LS components with size and weight, floor loading and normal mounting requirements. For details of floor rails positioning, refer to Figure 3-12.

Table 3-7: System Component Floor Loads

Item	Net Weight lbs (kg)	Overall Width x Depth in. (mm)	Weight/ Area lbs/sq. ft. (kg/m^2)	Load Pattern in. (mm)	Normal Method of Mounting in. (mm)
CT Gantry (LS 2.X)	3750 (1701)	88 x 43 (2235 x 1092)	153 (736)	Rectangular baseplate 24 x 81 (610 x 2057) with four round pads, each 2.5 (63.5) in contact with floor and supporting 1,850 lbs (840 kg) center to center.	Hilti Kwik-Bolt II 1/2 in. (12.7 mm) diameter by 8 in. (203 mm) long per P/N 2106573 at four leveling pads in concrete floor.
PET Gantry	6400 (2900)	91 x 35 (2320 x 890)	266 (1296) *See note.	Two baseplates support the gantry; right plate (linear rail) with overall dimensions of 69 x 9 x 3/4 (1740 x 220 x 20); left plate (rollers) with overall dimensions of 77 x 6 x 3/4 (1740 x 160 x 18).	Hilti Kwik-Bolt II 1/2 in. (12.7 mm) diameter. Eight bolts on each plate.
Patient Table	1770 (804) includes 400 (180) patient	29 x 110 (740 x 2800)	182 (897)		Hilti Kwik-Bolt II 1/2 in. (12.7 mm) diameter by 8 in. (203 mm) long per P/N 2106573 at three leveling pads into concrete floor.
CT CPDU	800 (363)	30 x 22 (762 x 559)	180 (82)	Four casters support area of 30 x 22 (762 x 559).	Casters are for positioning and service; set on floor. May be anchored to floor using angle brackets in seismic zones.
CT NGPDU	770 (350)	27.6 x 21.7 (700 x 550)	185 (909)	Four Casters support area of 27.6 x 21.7 (700 x 550).	
PET Electronics Cabinet	420 (190)	23.25 X 38.2 (590 X 970)	68 (30)	Four casters or leveling feet support area of 23 x 38 (584 x 960)	Casters are for positioning; set on floor. Four leveling pads. May be anchored to floor using angle brackets in seismic zones.
System Operator's Console/ Computer with Two Monitors	662 (300)	48 x 39 (1219 x 991)	50 (23)	Four casters or leveling feet support area of 46 X 19 (1168 x 483)	Casters are for positioning; set on floor. Four leveling pads may be anchored to floor using angle brackets in seismic zones.

Note: * PET gantry floor loading specifications:

1.) Maximum load on linear plate (over 810 x 220 mm) and roller plate load (over 810 x 160 mm) = 7,662 kg/m^2 1,569 lbs/sq. ft.

2.) Distributed load-on-load bearing section of each plate = 3,570 kg/m^2 731 lbs/sq. ft.

3.) Distributed load on load bearing section of floor = 1,296 kg/m^2 266 lbs/sq. ft.

Figure 3-14: Center of Gravity – CT Gantry

Note: Not to Scale

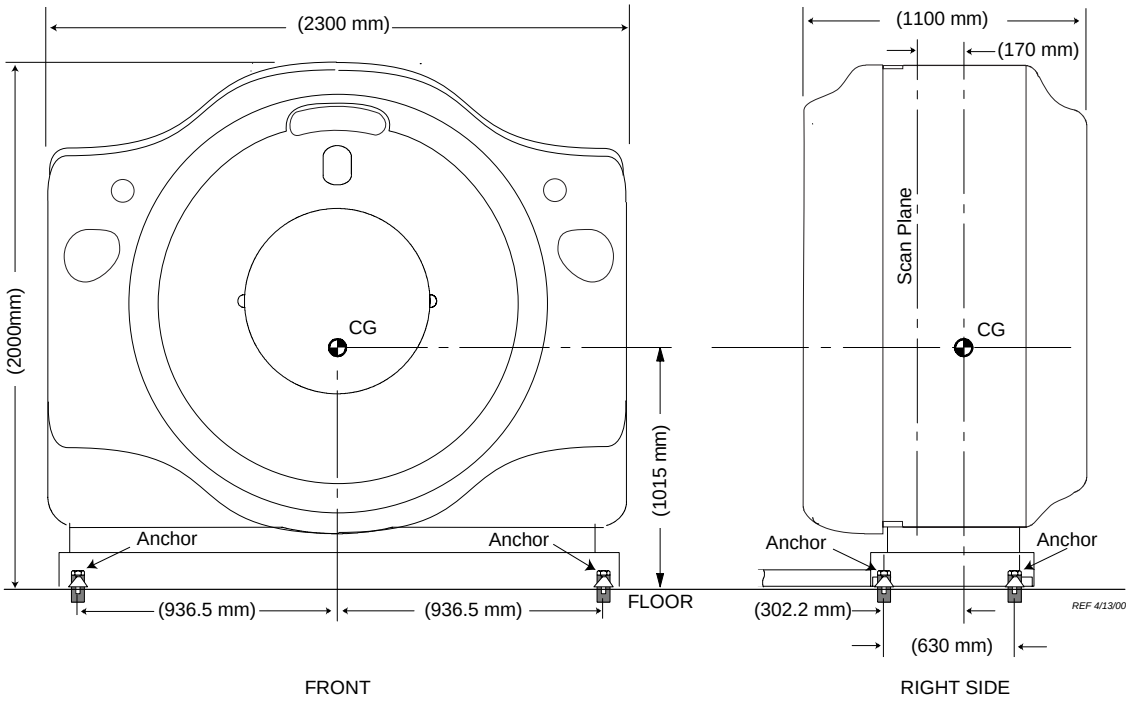
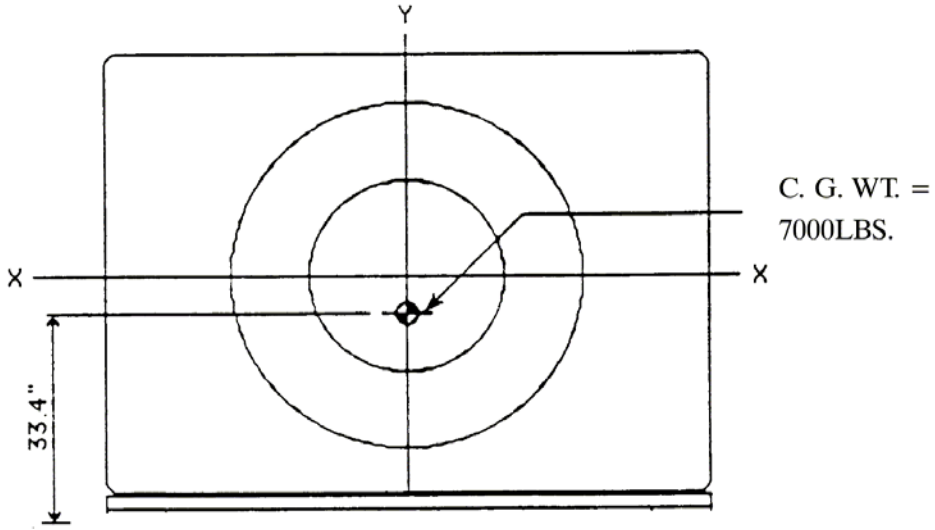


Figure 3-15: Center of Gravity – PET Gantry



3-8.4 Seismic Considerations

Depending on the geographic location, seismic activity may be a concern. Both the table and gantry are designed to be bolted to the floor under normal circumstances. The design used complies with the California Code of Regulations, Title 24.

In seismic active locations, the electronics cabinets and other equipment in the suite must be also be anchored in compliance with local seismic regulations.

Refer to Figure 3-16, Figure 3-17, and Figure 3-18 for more detailed information.

Figure 3-16: Seismic Anchorage - Front Elevation

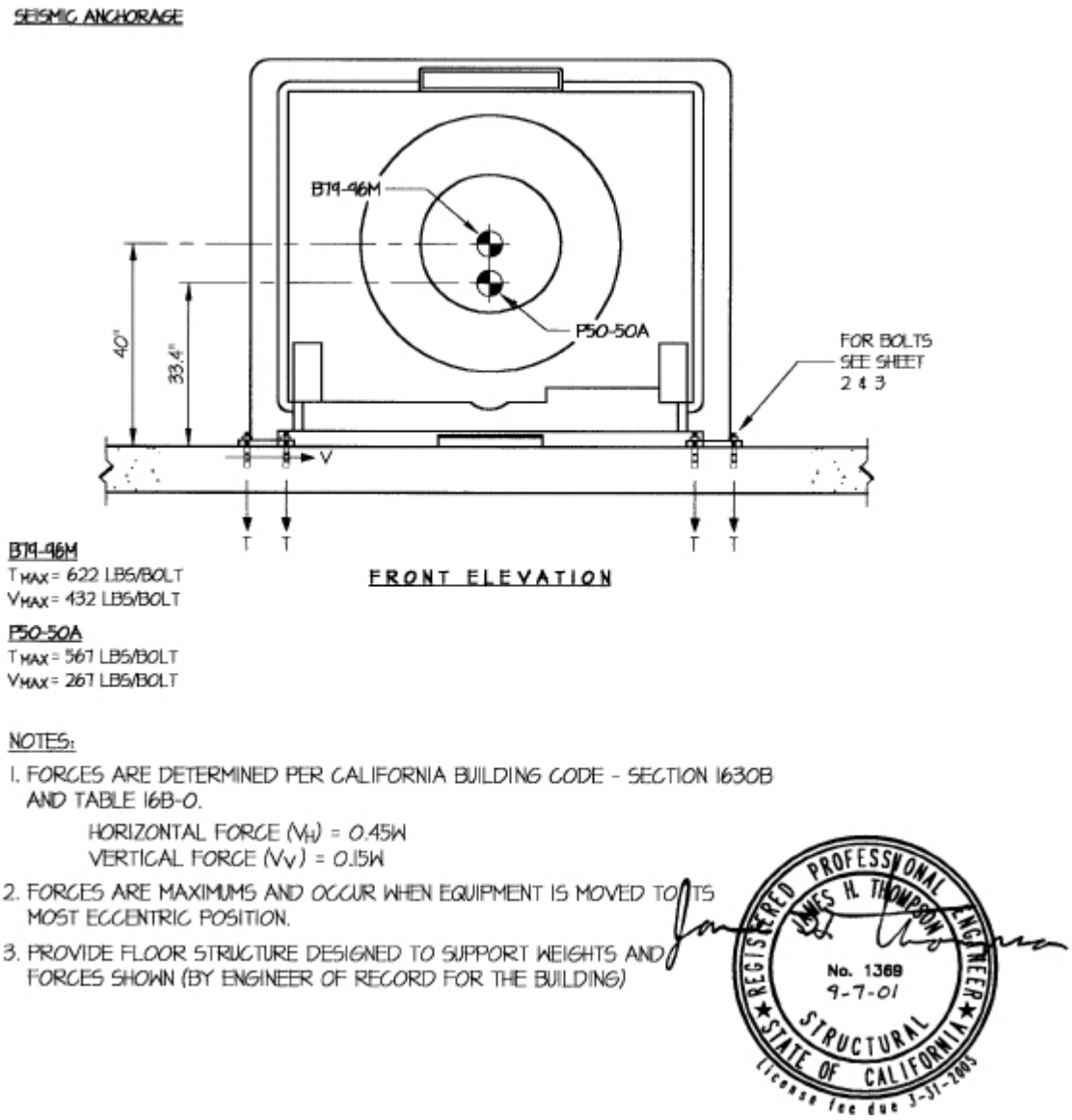
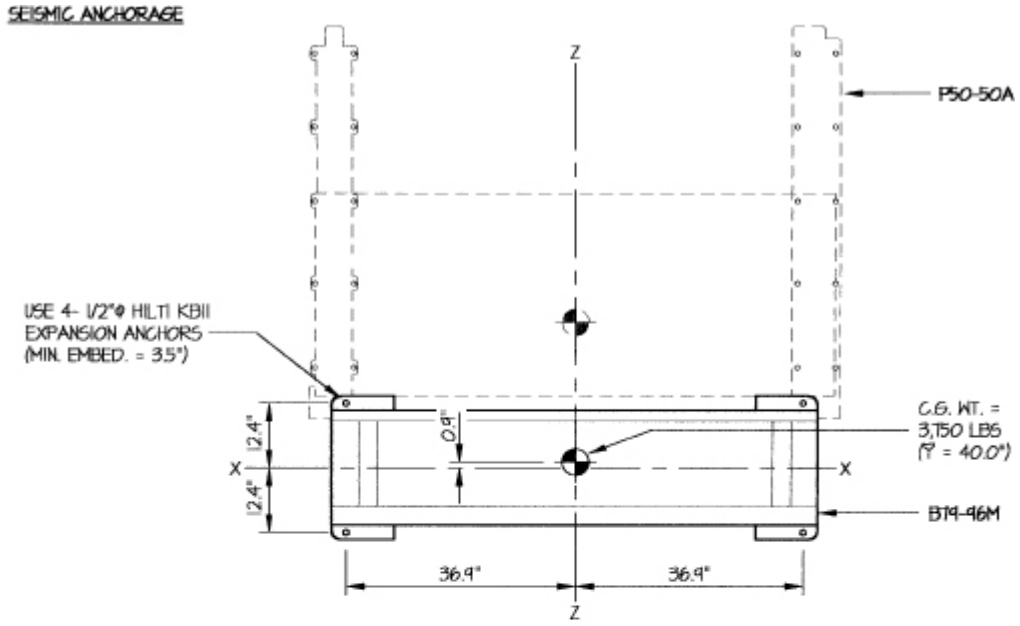


Figure 3-17: Seismic Anchorage - Plan at Base #1



PLAN AT BASE

LOADS: B19-96M
WEIGHT = 3150 LBS
HORIZONTAL FORCE (V_H) = 1688 LBS
VERTICAL FORCE (V_V) = 563 LBS

BOLT GROUP PROPERTIES:
I_{X-X} = 615 in.^{4}
I_{Z-Z} = 5446 in.^{4}
I_{Y-Y} = 6061 in.^{4}

MOMENTS:
M_{XX} = 1688#(40.0") + (3150# - 563#)0.9" = 70,388"#
M_{ZZ} = 1688#(40.0") = 67,520"#
M_{YY} = 1688#(0.9") = 1,519"#

BOLT FORCES:

TENSION (T)

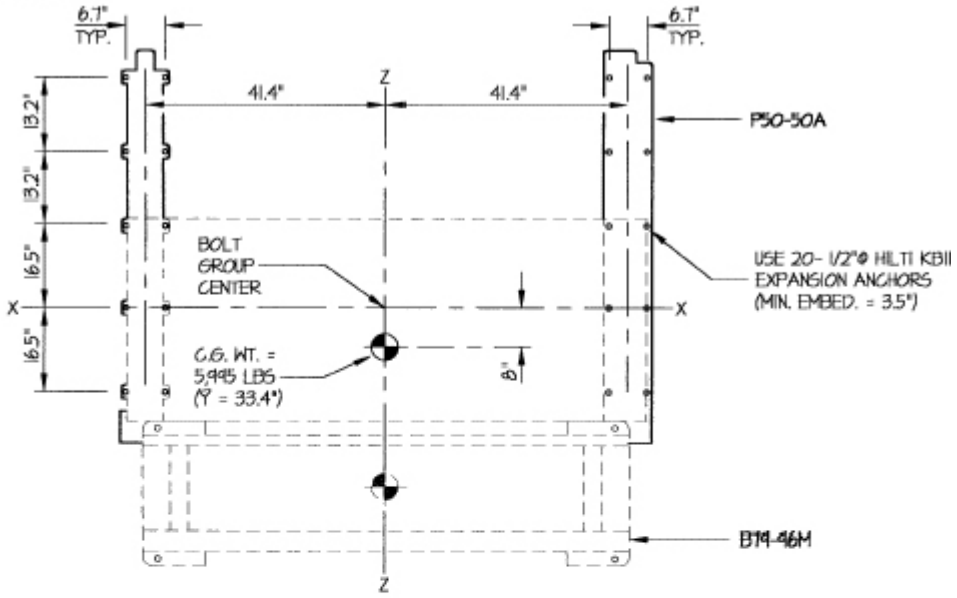
$$T = \frac{70388"\#(12.4")}{615} - \frac{3150\# - 563\#}{4} = 622 \text{ LBS/BOLT (MAX)}$$

SHEAR (V)

$$V = \frac{1688\#}{4} + \frac{1519"\#\sqrt{12.4^2 + 36.9^2}}{6061} = 432 \text{ LBS/BOLT (MAX)}$$

Figure 3-18: Seismic Anchorage - Plan at Base #2

SEISMIC ANCHORAGE



PLAN AT BASE

LOADS: P50-50A
WEIGHT = 5995 LBS
HORIZONTAL FORCE (V_H) = 2698 LBS
VERTICAL FORCE (V_V) = 899 LBS

BOLT GROUP PROPERTIES:
I_{X-X} = 2178 in.^{4}
I_{Z-Z} = 20568 in.^{4}
I_{Y-Y} = 22146 in.^{4}

MOMENTS:
M_{XX} = 2698#(33.4") + (5995# - 899#)8" = 130,881"#
M_{ZZ} = 2698#(33.4") = 90,113"#
M_{YY} = 2698#(8") = 21,584"#

BOLT FORCES:

TENSION (T)

$$T = \frac{130881"\#(16.5")}{2178} - \frac{5995\# - 899\#}{12} = 567 \text{ LBS/BOLT (MAX)}$$

SHEAR (V)

$$V = \frac{2698\#}{12} + \frac{21584"\#\sqrt{16.5^2 + 41.4^2}}{22146} = 267 \text{ LBS/BOLT (MAX)}$$

Chapter 4 Environmental Requirements

Section 4-1: Overview

Special care needs are required to assure that environmental controls are appropriate to maintain the proper environment. This equipment is sensitive, not only to extremes in temperature and humidity, but also to drastic changes in these factors. The gantry has devices designed to be sensitive to radiation. For these reasons, special attention must be given to controlling the environment.

This chapter contains specific temperature and humidity requirements of the equipment. This includes Heating Ventilation and Air conditioning (HVAC) design criteria. Since the PET unit will involve the use of radioactive isotopes, special attention has been given to the matter of protection against radioactive gases.

Note: Radiation protection measures are described in Section 3-5.

Section 4-2: General Considerations

Two main considerations must be addressed in the design of the climate controls for the Discovery LS suite:

- The comfort of the patient and staff
- The protection of the equipment

Both of these factors are of equal importance. The HVAC system must be designed to meet the requirements of the equipment. If the suite is maintained within the operating limits of the equipment, the patient and personnel will be comfortable, thus satisfying both criteria.

Since some PET procedures require the use of radioactive gases, it may be necessary to install radiation detectors in the duct work that can stop blower motors transporting these gases to active ducts.

Section 4-3: Temperature

The heat energy generated by the equipment in the Discovery LS suite, and the BTU (British Thermal Unit) loading of the maximum number of people that may be present at any given time, will be the main factors driving the design of the HVAC system.

4-3.1 Operating Temperature Range

The operating temperature must be maintained within the required range for each of the rooms of the Discovery LS suite.

Scan Room – The equipment is designed to operate in the temperature range between 18.3ºC and 24ºC (65ºF and 75ºF). The operating temperature in the Scan Room must be maintained at a constant temperature within that range. Generally the cooler temperatures provide the best performance.

The maximum temperature change in the Scan Room must not exceed 3ºC (5ºF) per hour. The maximum room temperature gradient is 3ºC/hr. (5ºF/hr.). Normally doors to the Scan Room should be kept closed. Any equipment that is installed in the Scan Room must be operable within these parameters. For patient comfort a temperature of between 21ºC and 24ºC (70ºF and 75ºF) should be maintained.

⚠ **NOTICE** **Ratings and duty cycles of Discovery LS subsystems apply if site environment meets the standards of this section. Maintain environmental conditions listed below at all times including overnight, weekends and holidays. Shut down the CT system if air conditioning is not working. When the system is shut down for major repair, air conditioning may be shut down also.**

No components of the PET equipment should be located near heating or air conditioning ducts, windows or devices which might significantly affect the ambient air temperature.

4-3-1.1 Control Room

The Operator Console/computer is designed to operate in the 15ºC to 29ºC (60ºF to 84ºF) temperature range. The Control Room temperature can be adjusted to accommodate the comfort level of the occupants.

Since this room is generally accessible from the Scan Room, there must not be a significant temperature difference between the two rooms as this may adversely affect the temperature of the Scan Room. Normally, doors between the Scan Room and the Control Room should be kept closed.

Store media (cartridges) in long term storage in the same temperature range as the host computer. Store media in the host computer environment for one-half hour before use.

4-3-1.2 Electronics Room

The temperature range of the electronics cabinets components is between 18.8º C and 22.2º C (65º F and 72º F). the operating temperature in the Electronics Room must be maintained at a temperature within that range. Cooler temperatures provide the best environment for these components. The maximum temperature change in the Electronics Room must not exceed 3º C (5º F) per hour. The maximum room temperature gradient is 3º C/hr. (5º F/hr.) Any equipment installed in this room must be operable within these parameters.

The electronics cabinets fan speed and noise level output are indirectly proportional to ambient temperatures. Therefore if noise level is a consideration, the temperature should be kept as cool as reasonably possible.

4-3.2 Cooling Requirements

Use Table 4-1 to assist in planning the cooling requirements of the Discovery LS suite.

- To reduce the noise level, several smaller air-conditioning units should be used. These can ideally be connected to one thermostat.
- Locate a wall air-conditioning vent at floor level beside and behind the gantry to meet both gantry cooling needs and provide patient comfort.

Table 4-1: Cooling Requirements for the DLS Suite

Room and Components	KW	BTU/hr.
Scan Room:		
PET Gantry	2.8	9,554
CT Gantry	5.4	*18,425
Table	0.7	2,388
Total	8.9	30,367
Control Room:		
PET Computer	1.0	3,412
Operator's Console	2.0	6,824
Total	3.0	10,236
Electronics Room:		
PET Electronics	3.5	11,942
CT PDU	1.0	3,412
Total	4.5	15,354
Total CT-PET Requirement	16.4	55,957

* This value is an average based on four patients per hour (10% duty). The actual heat loading may be less in normal Discovery LS operation.

Additional heat removal requirements for lighting and people in the suite must be added to the figures in Table 4-1 as follows:

- Each person in a room requires 200 watt (100 W dry heat and 100 W to dry out perspiration).
- Each light fixture requires 100 W.

Section 4-4: Humidity

The relative humidity should be maintained at 30 to 60% noncondensing in the Scan Room, Control Room and the Electronics Room. The maximum humidity change in any of these rooms should not exceed 5% per hour. Any equipment that is installed in these rooms must operate within these parameters.

Section 4-5: Air Flow

When designing the HVAC controls for the Discovery LS suite, three main factors need consideration:

1.) Air quality
2.) Control of airborne radiation
3.) BTU output of each major system component

4-5.1 Air Quality

In order to maintain the quality of the air, frequent air changes will be required. The frequency of air change will be proportional to the number of people in the suite. A typical three room suite may have up to 10 patients and staff at any given time. The HVAC system should be designed to provide 5 air changes per hour in order to maintain adequate air quality and temperature for the Discovery LS equipment. In a typical 3 room portion of a suite of 126 m^3 (4,464 ft^3), the required air velocity would be 10.5 m^3 per minute (370.5 ft^3 per minute).

4-5.2 Control of Airborne Radiation

Some PET procedures involve the use of radioactive water. This will result in the patient exhaling radioactive carbon dioxide. Some PET procedures require the use of radioactive gases. These gases, if not properly confined can cause unnecessary exposure to clinical staff. Escaped gases, and exhaled radioactive carbon dioxides, should not be allowed to enter active air-conditioning systems. It may be necessary to install radiation detectors in duct work that can be used to stop any blower motors which could transport radiation to active ducts.

One of the best ways to control airborne radioactive contaminants is to provide a slightly more negative pressure in those areas where radioactivity originates. In applications involving the use of a cyclotron, that portion of the suite should have the most negative pressure in the entire suite.

Air flow through heat generating components should be considered when planning the placement of registers and returns. Never place return air systems near the output of heat generating equipment. This would result in a poorly balanced circulation system.

Figure 4-1, Figure 4-2, and Figure 4-3 show the entry and exit points for cooling air through some of the high BTU system components.

Figure 4-1: Air Flow through the Operator's Console

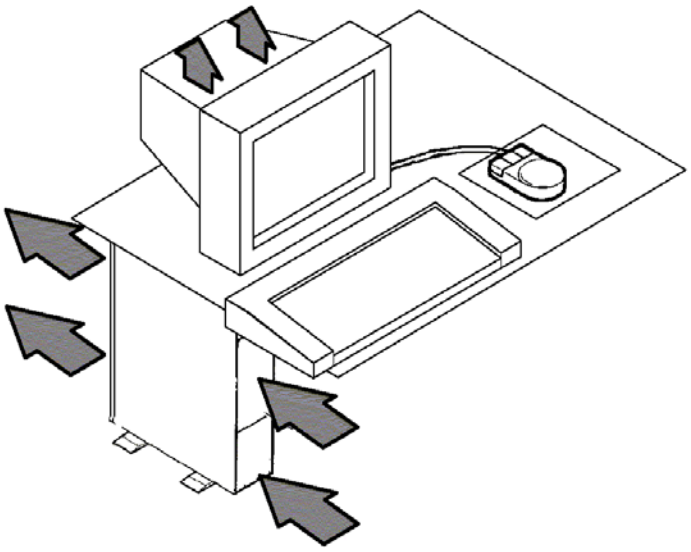


Figure 4-2: Air Flow through the Electronics Cabinet

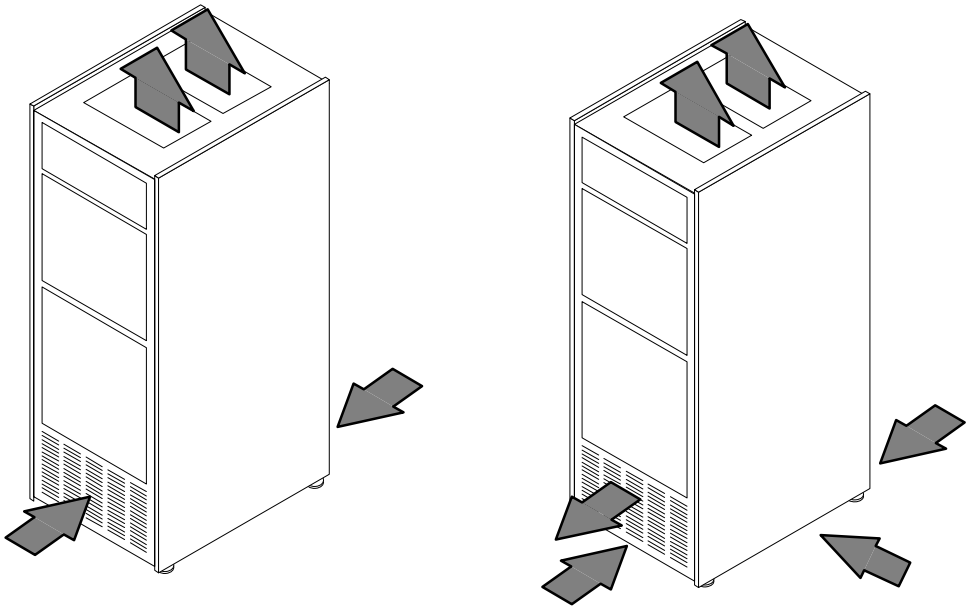
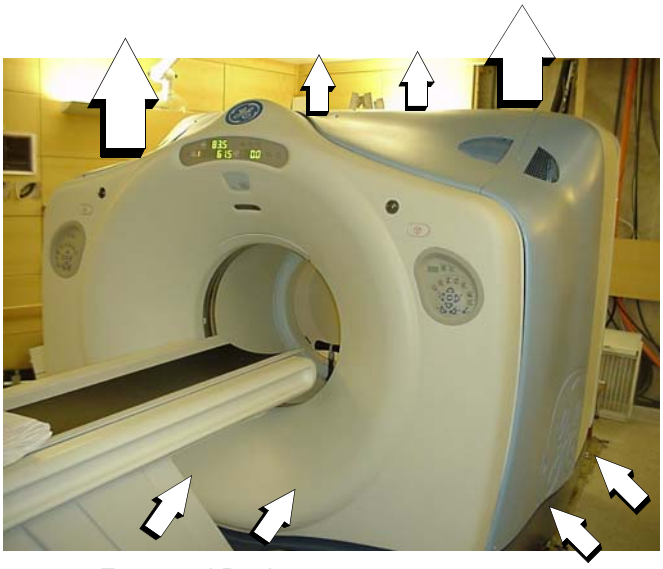


Figure 4-3: Air Flow Through the Gantry



Both Sides

Front and Back

Section 4-6: Electro-Magnetic Interference

4-6.1 Gantry

Locate the gantry in ambient static magnetic fields of less than 10^{-4} tesla to guarantee specified imaging performance. Ambient AC magnetic fields must be below 10^{-6} tesla peak.

4-6.2 Color Monitor

Locate color monitors in ambient static magnetic fields of less than 5×10^{-5} tesla to guarantee color purity and display geometry.

4-6.3 Console / Computer Equipment

Locate computer equipment in ambient static magnetic fields of less than 10^{-3} tesla to guarantee data integrity.

4-6.4 Magnetic Media

Locate magnetic media in ambient static magnetic fields of less than 10^{-3} tesla.

4-6.5 EMI Reduction

If fields of excessive EMI are known or suspected to be present, consult GE Healthcare for recommendations. Consider the following if attempting to reduce EMI:

- External field strength decreases rapidly with distance from source of magnetic field.
- External leakage magnetic field of a three-phase transformer is much less than that of a bank of three single phase transformers of equivalent power rating.
- Large electric motors are a source of substantial EMI.
- Steel reinforcing in building structure can be a conductor of EMI.
- High-powered radio signals are a source of EMI.
- Maintain good screening of cables and cabinets.

Chapter 5 Network Requirements

Section 5-1: Network Installation Preparation

If the installation includes an interface to an existing network, it is necessary to integrate the two systems. This will require configuration of the GE imaging system network so that it can be compatible with the existing system. It is necessary to have some information about the existing network to integrate the systems. This section provides information relative to collecting the necessary data.

The two main considerations are:

- Physical configuration
- Node address data

This document contains a special grid upon which the basic physical configuration of the existing network can be mapped. In addition to the grid, a special form is provided for collecting the data needed for software configuration. The form and grid are to be completed by the GE Healthcare Installation Team in cooperation with the Project Manager of Installation. The Project Manager of Installation must provide information to GE as an early step in the site preparation process. The steps outlined in the next sections are essential to gathering the needed data for a successful network installation.

If the installation does not include an interface to an existing network, it is still necessary to supply legitimate addresses for the system. If there are no addresses available for use in the system, one can be obtained by contacting the NIC and asking for a Class C network address.

5-1.1 Data Form

The Project Manager is responsible for assisting GE Healthcare in performing the following tasks:

1.) Record all pertinent data needed for system integration.
2.) Put the data form with the other site documentation.

5-1.2 Network Grid

The Project Manager is responsible for assisting GE Healthcare in obtaining a drawing of the site network, including:

1.) Analysis of the existing network and count the number of nodes.
2.) Noting the location of all nodes.
3.) Drawing the existing network on the photocopy of the network integration grid, making sure to indicate the location of each node.
4.) Drawing the Discovery LS imaging equipment on the grid in dashed lines.
5.) Placing the grid with the other site documentation.

NOTICE **The distance between any T and a connection, must be at least 10 ft. (3 m) long. Do not cut the coax any shorter than this. In the event that drops are in close proximity to the main network cable, GE Healthcare installation personnel will simply coil up the extra cable and fasten it with a cable tie.**

5-1-2.1 Support Documentation

Different vendors may be involved in providing network hardware at the site. It is generally helpful to obtain documentation from these sources. GE Healthcare publishes a document, *Network Service Documentatio*n, *Direction 46-021650*, that will help in planning this portion of the suite.

5-1.3 Collecting Network Integration Data

If the installation is to include an interface to an existing network, it is necessary to integrate the two systems. This will require configuration of the GE scanner system network. It is necessary to have some details about the existing network in order to integrate the systems. The network information can be retrieved from the Site Prep networking data sheets.

The four main considerations are:

1.) Network address where the suite will be connected.
2.) Node addresses and name data for pertinent machines in the suite.
3.) Broadcast address for the network (or subnetwork).
4.) Netmask for the network.

Once the network data sheets are completed:

1.) Photocopy the complete data form.
2.) Put the data form with the other site documentation.

5-1.4 Host Name Assignments

Observe the following rules when assigning host names:

1.) The host name should not contain any upper case letters.
2.) The host name should not be longer than eight characters.

5-1.5 Internet Address Assignments

An Internet address and a sub-net address are required for the Discovery LS suite. Use Table 5-1 to record the Internet addresses of the various site hosts.

Note: For best results, do **not** install any hospital network interfaces until the scanner is fully functional. Gather the hospital network configuration information at this time, but delay the actual installation until the scanner is functional.

Table 5-1: Internet Addresses of Suite Hosts

Interface Description	Default Internet Address	Interface Name	Internet Address	Net Mask	Broadcast Address

5-1.6 Account Password Assignments

Networking should be considered when assigning passwords. Since each machine that is required to network with another will need the passwords for the operator and service accounts on the other machine, Table 5-2 should be copied and used for each of the hosts installed at this suite. Passwords are required for the following accounts for each host installed during the software installation process:

Table 5-2: Account Passwords

Account	Owner	User	Password

For all items whose owner is listed as Site Administration will be owned by Site Service if there is no Site Administration. The Owner is assumed to also be a user. The Owner is responsible for creating and managing the password. The User has Authorization to use the password created by the Owner.

5-1.7 Other Pertinent Hosts

Enter other host addresses necessary for communication in Table 5-3, i.e., eNTEGRA workstations, film hosts and PC4096 hosts as well as other OWS and AWS. These may include development servers, printers, printer servers, workstations, and/or routers. Host names, IP addresses, login IDs and passwords are required for all networked components:

Table 5-3: Network Machine IDs

Host Name	IP Address	Login ID	Password

5-1.8 Site Assignment Matrix

The following information is required to configure the Discovery LS system.

Table 5-4: DLS Parameters - Page 1

Workstation Parameters					
Institution ID		Network Type (Thin, Thick, Twisted Pair, Fiber)			
Administrator Password		Default Gateway (Optional)			
IP Address		DNS Server (Optional)			
Subnet Mask		WINS Server (Optional)			
OSI Based Systems					
System Name	**System Type**	**Ethernet Address**			
DICOM Stations and Printers					
System Name	**System Type**	**IP Address**	**Application Entity**	**Service (Q, F, S)**	**Port #**

Table 5-5: DLS Parameters - Page 2

Remote Database				
Remote eNTEGRA System Name		**IP Address**		
TCP/IP Network Printer				
Printer Name	**Printer Type**	**IP Address**		
Remote Connectivity				
Host Name	**IP Address**	**Phone Number**	**User Name**	**Password**
Modem Phone #				
CARES/MUST ID				

Chapter 6 Electrical Requirements

Section 6-1: System General Power Requirements

The Discovery LS system operates on three-phase, four wires: L1, L2, L3, N, GND (Neutral optional), which provides power to both CT LightSpeed and PET Advance systems through the Main Distribution Panel. (See Section 6-2). The Discovery LS power requirements are summarized in Table 6-1.

Table 6-1: DLS Power Requirements

Discovery LS System Power Requirements	
Nominal Voltage	400/480 VAC (± 8%) Three-Phase, 4 Wires L1, L2, L3, N, GND (Neutral is optional.)
Frequency	50/60 Hz (± 5%)
Maximum Power	95 kVA Maximum
Average Power	25 kVA

The Main Distribution Panel circuitry supports the three-phase inputs for the CT and the single-phase input for the PET, explained in Section 6-2.

Section 6-2: Main Distribution Panel

6-2.1 Facility Source

Power to the system should be supplied by a dedicated feeder from the nearest Main Distribution Panel (MDP). A protective disconnect device must be provided in the power line supplying the PDU in accordance with National Electric Code and applicable local codes.

NOTICE **Lockout/Tagout provision required.**

The disconnect device must be located within 40 feet of the CT PDU and PET PDU, visible to PDU service personnel, and **must** have provision for lockout/tagout. It is identified as “A1” in the interconnection schematic diagram shown in Figure 6-11.

6-2.2 Main System Disconnect

Customer supplied emergency off buttons are to be mounted in the CT-PET Scan room near each exit, 60 in. (1424 mm) from the floor and connected to the protective disconnect device (A1) in order to disable the power to all CT-PET system equipment in emergency situations. This button is to be clearly labeled "Emergency Off" and visible to personnel in the CT-PET Scan Room.

It is important that the button be labeled "Off" and not "Stop" since there exists an "Emergency Stop" button in the Discovery LS system that disables output power to the CT-PET system equipment in the patient area of the CT-PET system. An additional emergency button should be mounted in the computer/equipment room near the exit door.

GE-supplied Main Disconnect Panel must be lockable to meet the OSHA requirements for power Lockout/Tagout. An optional Main Disconnect Panel is available from GE providing for the disconnect of the facility power to the CT PDU and the PET PDU, including the emergency buttons and contacts for an interlock to the air conditioning units in the computer/equipment room.

The Main Disconnect Panel must be UL or other nationally recognized testing organization listed and labeled in accordance with 1999 National Electric Code (NEC) Article 110-2.

Section 6-3: Power Requirements

The Discovery LS system is supplied with two Power Distribution Units (PDUs). One is for the CT system and one for the PET system components.

Power wiring between the facility Main Distribution Panel and the PDU should be kept as short as possible to minimize the effects of voltage regulation.

Carefully consider advantages and disadvantages of conduits, floor ducts and surface raceways for running cables. Make cable passageways large enough to install any cable with all other cables already installed.

⚠ **NOTICE** **When routing power cables, all three-phase wires and ground must be run in the same conduit or raceway duct work. Power cables should be routed separately from system control cables (for example, use a separate trough in duct).**

6-3.1 Configuration

The DLS system is designed to operate on three-phase, four-wire Delta or Wye power. A ground referenced Wye source produces the lowest leakage currents and is preferred. However, the neutral wire does not need to be run to the system, i.e., four-wire connection. (A dummy terminal is provided for parking the neutral wire in the event a five-wire service is already installed at the site.)

6-3.2 Rating

The absolute range of line voltage at the input to the PDU must remain within one of the ranges shown below at all times.

Table 6-2: System Power Rating

Voltage	400 to 480 VAC*
Capacity	95 kVA @ 85% PF
Frequency	50 or 60 Hz +/-0.5 Hz

6-3.3 Regulation

The size of the facility transformer and feeder wires determine load regulation presented to the system. Total load regulation as measured at the PDU input terminals **must** not exceed 6%.

6-3.4 Phase Imbalance

The difference between the highest line-to-line voltage and lowest line-to-line voltage must not exceed 2% of the lowest line-to-line voltage.

6-3-4.1 Sags, Surges and Transients

Sags and surges of the power line must not exceed the absolute range limits shown in Table 6-3. Limit maximum transient voltage to 1,500 V peak.

Table 6-3: Allowable Voltage Variations

Nominal Voltage	Absolute Range	Current (Amps)		Minimum Standard Overcurrent Protection
		Momentary	Continuous	
400	368 to 432	137	36	110-A
440	405 to 475	125	33	110-A
480	442 to 518	114	30	110-A

6-3.5 Microcuts

The Discovery LS CT System is generally unaffected by microcuts.

6-3-5.1 Grounding

- The ground to the DLS system **must** originate at the system power source (i.e., transformer or first access point of power into a facility), and is continuous to the DLS system power disconnect in the room.
- A dedicated 1/0 (55 mm or larger) insulated copper ground wire **must** be run with the phase wires from the Main distribution panel to the PDU. These grounds should be spliced with high compression fittings and terminated at each distribution panel it passes through.

When the ground is broken for a connection to a panel, it must be connected into an approved noninsulated grounding block with the incoming and outgoing ground in this same grounding block connected to the steel panel, but never using the steel or other material of the panel as the block.

The resistance between the PDU ground and the facility earth ground must not exceed **0.5 ohms**. In addition, the total resistance between the PDU ground and earth must not exceed **2 ohms**. Resistance between any two grounded devices must not exceed **0.1 ohms** to ensure equal potential ground system within the DLS suite.

6-3.6 Recommended Power Distribution System

A single-unit installation where the distribution transformer and feeder are dedicated to the DLS system is recommended. In this case, the minimum recommended transformer size is 125 kVA, rated 3.2% regulation at unity power factor. The minimum recommended feeder size and overcurrent protection device ampacity based on line voltage is shown in Table 6-3.

- Maximum power demand = 100 kVa @ 0.85 PF at a selected technic of 140 kV, 380 mA.
- Average (continuous) power demand at maximum duty cycle = 25 kVa.
- Maximum allowable total source regulation = 6%.

6-3-6.1 Voltage

Primary source is required for all installations.

- Range of line voltages = Nominal 400 to 480 V, three-phase, 50 or 60Hz.
- Recommended Power Supply = Delta or Wye.
- Maximum daily voltage variation must fall within the ranges in Table 6-3.

6-3-6.2 Phase Balance

Phase-to-phase voltages must be within +2 percent of the lowest phase-to-phase voltage. Maximum allowable transient voltage excursions are 2.5 percent of rated line voltage at a maximum duration of one cycle and frequency of 10 times per hour.

Voltage transient or impulse on the incoming power must be held to a minimum. Transients caused by lightening surges, load switching, static electricity, etc. can cause scan aborts or in extreme instances, component failure in the computer subsystem.

6-3-6.3 Power Demand

- Continuous power demand ˜ 25 kVa.
- Maximum demand ˜ 95 kVa @ 0.85 power factor at a selected technic of 140 kV, 140 mA.
- Maximum allowable source regulation is 6%.

6-3-6.4 Distribution Transformer

For a single unit installation, the minimum transformer size is 120 kVA with 3.2% rated regulation at unity power factor. Resultant maximum allowable feeder regulation is 2.3%. GE Healthcare does not recommend using a regulation device.

NOTICE **The Discovery LS System must not be powered in a multiple installation where film chargers are used. Film chargers utilize a large number of high powered closely spaced exposures that may coincide with scans.**

MDP – Main Distribution Panel
PDU – Power Distribution Unit

1.) Table 6-4 is based on the use of copper wire, rated 75C and run in steel conduit. Ampacity is determined in accordance with the National Electrical Code (NFPA 70), Table 310-16 (1966).

2.) Minimum feeder size is determined by the ampacity of the circuit protection device listed above, except where a larger size is necessary to meet total source regulation limits.

3.) A 1/0 (55 sq. mm) ground wire is recommended in all cases.

Table 6-4: DLS Feeder Wires

Feeder Length, MDP to A1 feet (meters)	Nominal Line Voltage					
	380 V	400 V	420 V	440 V	460 V	480 V
	Minimum Feeder Wire Size, AWG or MCM (sq. mm)					
50 (15)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
100 (30)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
150 (46)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
200 (61)	1 (45)	1 (45)	2 (35)	2 (35)	2 (35)	3 (30)
250 (76)	2/0 (70)	1/0 (55)	1/0 (55)	1 (45)	1 (45)	2 (35)
300 (91)	2/0 (70)	2/0 (70)	1/0 (55)	1/0 (55)	1 (45)	1 (45)
350 (107)	3/0 (85)	3/0 (85)	2/0 (70)	2/0 (70)	1/0 (55)	1/0 (55)
400 (122)	4/0 (100)	3/0 (85)	3/0 (85)	2/0 (70)	2/0 (70)	2/0 (70)
Sub-Feeder Length 40 (12.192)						
(A1 to CT-PDU)	1 (45)	2 (35)	2 (35)	2 (35)	3 (30)	3 (30)
(A1 to PET-PDU)	8 (8)	8 (8)	8 (8)	8 (8)	8 (8)	8 (8)

6-3.7 Uninterruptable Power Supply (UPS)

Uninterruptable Power Supplies (UPS) are recommended for areas or sites with known power issues. Consult your local power provider for power quality data in your area. UPS is standard equipment on all mobile units. Filter and surge protectors are not needed with Discovery LS systems.

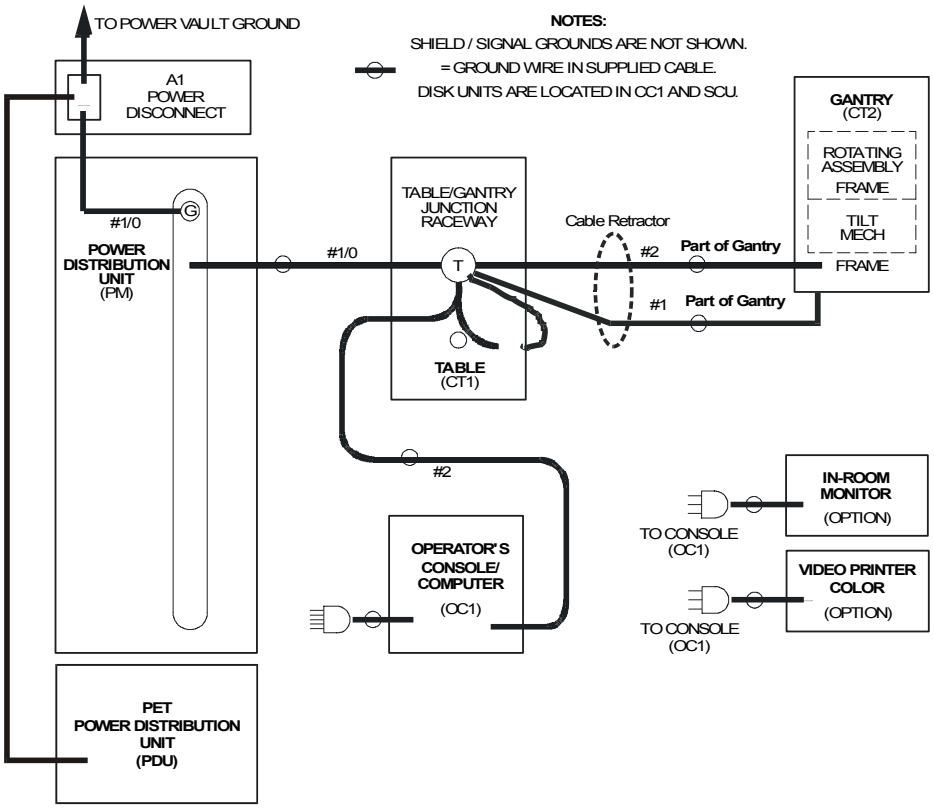
If it is determined that a UPS is needed at the site, order L5050UP, Discovery PET/CT UPS from GE Healthcare, and refer to the *A1 Disconnect Panel and UPS Installation Manual, Direction 2331437-100.*

6-3.8 Ground System

The DLS system was designed to use an equal potential grounding system. The required ground system is shown in Figure 6-1. There are three primary grounding points:

- A system power ground point located in the PDU.
- A reference ground point located between the gantry and table base.
- A patient ground point located at the front of the table base.

Figure 6-1: System Ground Map



6-3.9 DLS Interconnection Data

Figure 6-5 shows interconnection runs for a 50/60 Hz system.

Table 6-5 shows component designators for supplied equipment and options, and wall power outlets.

Table 6-5: Component Designator

Component Designator	Applies To:	Source:
A1	Primary Power Disconnect	**Contractor supplied**
CT1	Patient Table	System
CT2	Gantry	System
ITL	Telephone Lines	**Contractor supplied**
LP	Line Printer	Option
OC1	Operator's Console/Computer	System
PDU	Power Distribution Unit	System
SEO	System Emergency Off	**Contractor supplied**
SM	Slave Monitor	Option
WL	X-ray On Warning Light	**Contractor supplied**
DS	Door Interlock Switch	**Contractor supplied**
XCVR	Ethernet Transceiver	System

Table 6-6 and Table 6-7 list details for connection to Discovery LS equipment, using standard (short) length and non-standard (long) length cables, respectively. Details are listed for the following types of runs as appropriate:

- Flush-floor duct
- Surface floor duct
- Computer floor
- Through-floor duct
- Through-wall bushing
- Wall duct
- Junction box
- Conduit

Need for additional junction boxes is minimized by use of either a cable raceway system or a raised computer floor. Discovery LS uses prefabricated cables with large plugs. Therefore, conduit or pipe is not recommended for cable runs.

Table 6-8 lists customer-installed wiring and supplied cables. Actual length of each run is less than the length of supplied cables to allow for routing inside equipment. Cable diameters and sizes of connectors are provided to aid in sizing conduit and access plates.

6-3.10 Interconnect Runs Wiring and Cables

6-3-10.1 GEMS Supplied

STANDARD LENGTH SHORT CABLES

Table 6-6: GEMS Supplied Cables (Standard Run) - UL Information

Run #	Length Actual (Usable)		Part #	Description	UL Cable Information								Pull Size mm (in.)
	ft.	m			UL Style	Flammability Rating	Voltage Rating	Voltage Actual	Temperature	Diameter mm (in.)	# of Cond.	Size AWG	
001	55 (50)	16.9 (15.24)	2266879-2	Power - PDU to Console	2587	FT-4	600	208Y/120	90	12.3 (0.483)	4	10	56.4 (2.22) Diameter
002	43 (35)	13.2 (10.67)	2275844-3	Ground - PDU to Raceway	1284	VW-1 (FT-1)	600	0	105	15.5 (0.608	1	1/0	15.8 (0.62) Diameter
003	43 (35)	13.2 (10.67)	2267642-2	HVDC - PDU to Gantry	2587	FT-4	600	± 350 VDC	90	19 (0.751	2	6	19.8 (0.78) Diameter
004	40 (35)	12.3 (10.67)	2266880-2	Power - PDU to Gantry	2587	FT-4	600	208Y/120	90	13.8 (0.542)	5	8	56.4 (2.22) Diameter
005	42 (35)	12.9 (10.67)	2267644-2	HVAC - PDU to Gantry	Flexible Motor Supply Cable	FT-4 TC	1000	440Y/254	90	15.3 (0.604)	4	12	16.8 (0.66) Diameter
006	58 (50)	17.8 (15.24)	2275844-4	Ground - PDU to Console	1283	VW-1 (FT-1)	600	0	105	11.9 (0.467)	1	2	12.2 (0.48) Diameter
100	43 (35)	13.2 (10.67)	2266014-2	Signal - PDU to Gantry STC	UL	FT-4	300	<30 VDC	80	13.3 (0.525)	37	22	20 x 75 (0.78 x 2.95) 20 x 51 (0.79 x 2.01)
101	58 (50)	17.8 (15.24)	2271060-2	Signal - Console to Gantry STC	UL	FT-4	300	<30 VDC	80	11.2 (0.440)	25	22	17 x 58 (0.68 x 2.30) 19 x 51 (0.75 x 2.01)
102	55 (50)	16.7 (15.24)	2266887-3	Signal - LAN Console to Gantry	UL (RG-223/U)	FT-4	1900	<30 VDC		5.9 (0.234)	1	19	15 (0.59) Diameter
103	55 (50)	16.9 (15.24)	2117848-6	Fiber Optic - Console to Gantry			N/A	N/A			1	N/A	10 (0.39) Diameter

Figure 6-2: System Interconnect Diagram (with H2 OC and CPDU)

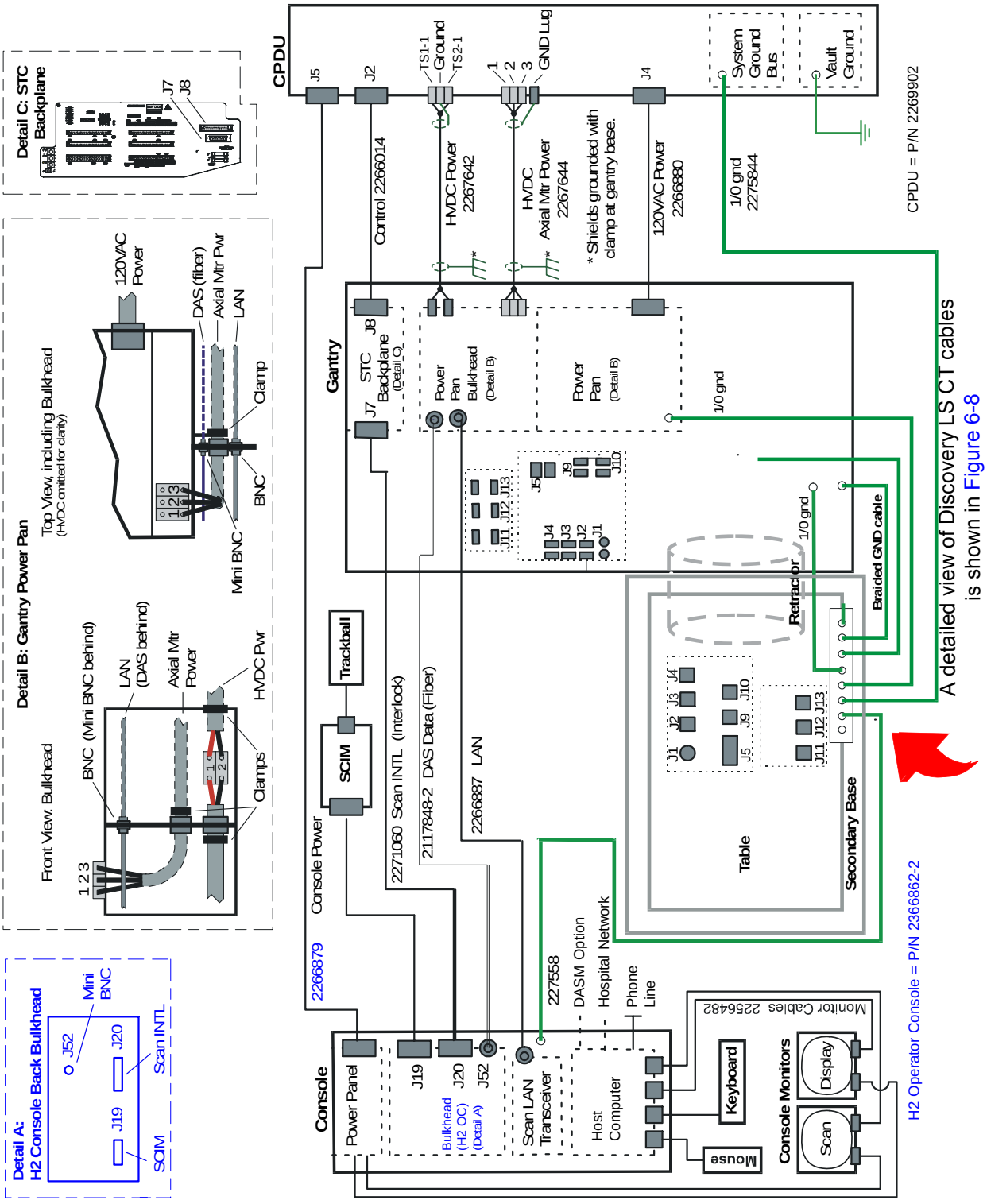


Figure 6-3: System Interconnect Diagram (with GOC1 and CPDU)

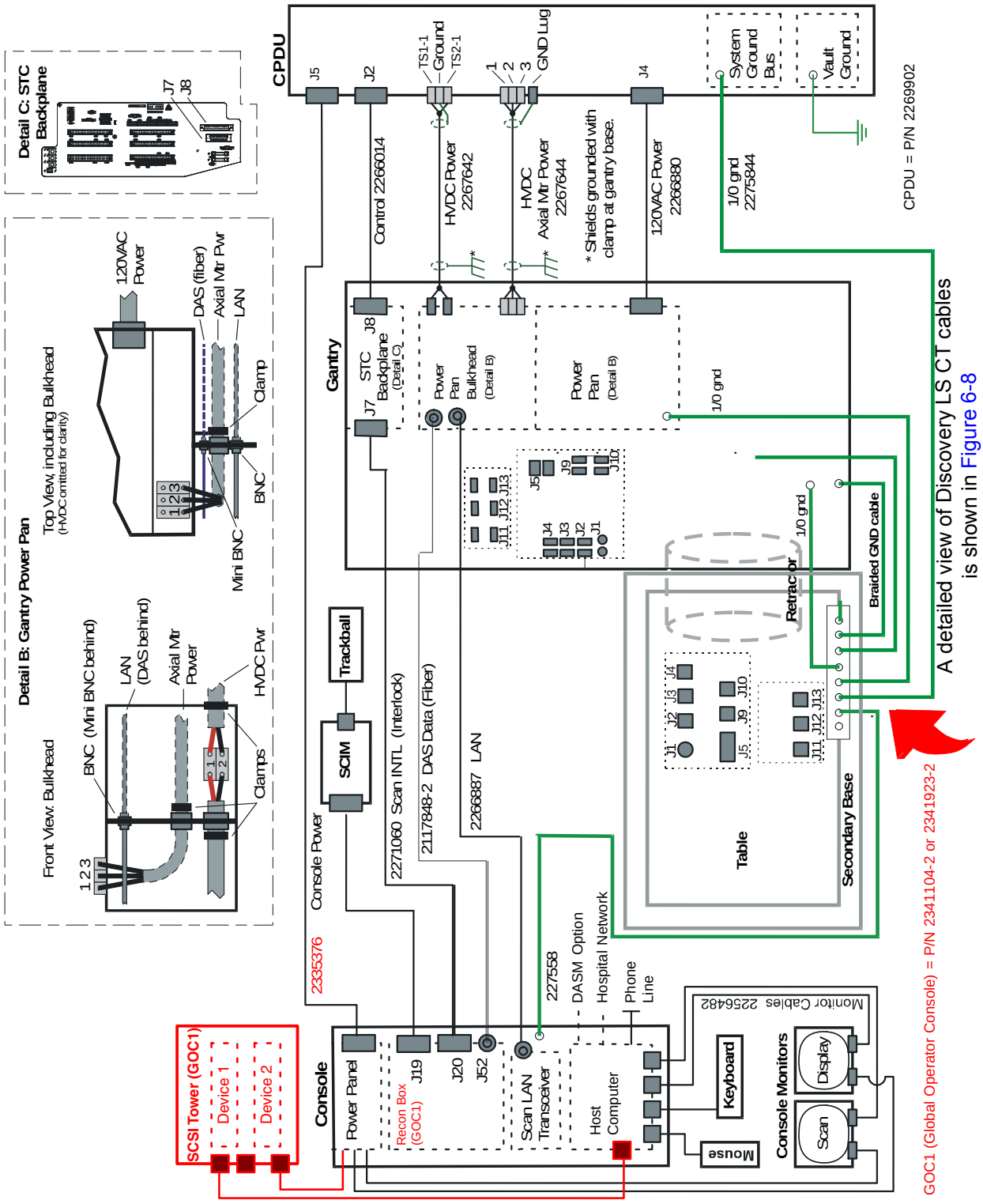
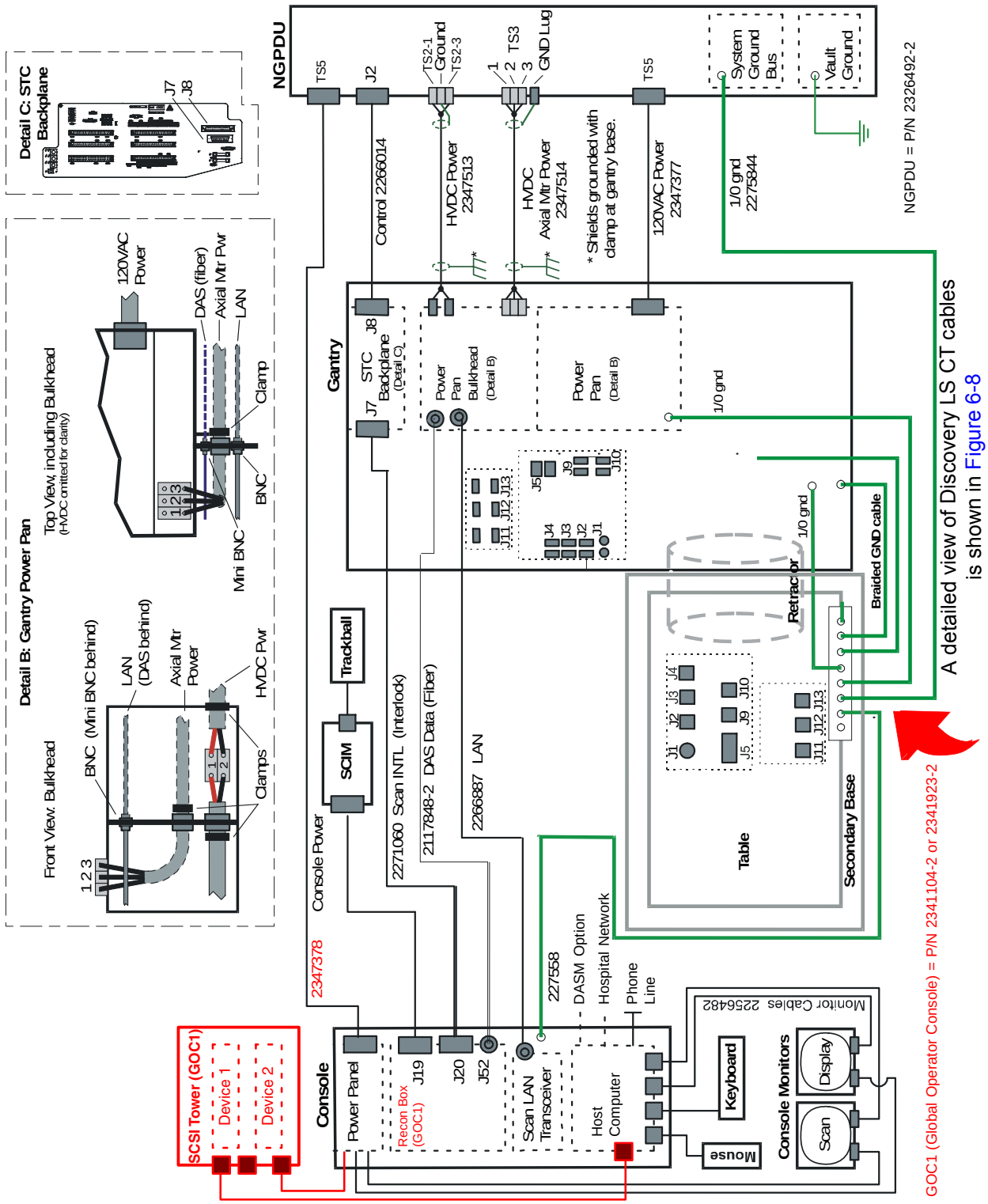


Figure 6-4: System Interconnect Diagram (with GOC1 and NGPDU)



NON-STANDARD LENGTH (LONG) CABLES

Table 6-7: GEMS Supplied Cables (Long Run) - UL Information

Run #	Length, Actual (Usable)		Part #	Description	UL Cable Information								Pull Size mm (in.)
	ft.	m			UL Style	Flammability Rating	Voltage Rating	Voltage Actual	Temperature Rating (C)	Diameter mm (in.)	# of Cond.	Size AWG	
001	80 (75)	24.5 (22.86)	2266879* 2335376** 2347378N	Power - PDU to Console	2587 2586N	FT-4	600	208Y/120	90 105N	12.3 (0.483)	4	10	56.4 (2.22) Diameter
002	63 (55)	19.3 (16.76)	2275844	Ground - PDU to Raceway	1284	VW-1 (FT-1)	600	0	105	15.5 (0.608)	1	1/0	15.8 (0.62) Diameter
003	63 (55)	19.3 (16.76)	2267642 2347513N	HVDC - PDU to Gantry	2587 2586N	FT-4	600	± 350 VDC	90 105N	19 (0.751)	2	6	19.8 (0.78) Diameter
004	60 (55)	18.5 (16.76)	2266880 2347377N	Power - PDU to Gantry	2587 2586N	FT-4	600	208Y/120	90 105N	13.8 (0.542)	5	8	56.4 (2.22) Diameter
005	62.5 (55)	19 (16.76)	2267644 2347514N	HVAC - PDU to Gantry	Flexible Motor Supply Cable 2586N	FT-4 TC	1000 600N	440Y/254	90 105N	15.3 (0.604)	4 3N	12	16.8 (0.66) Diameter
006	83 (75)	25.5 (22.86)	2275844-2	Ground - PDU to Console	1283	VW-1 (FT-1)	600	0	105	11.9 (0.467)	1	2	12.2 (0.48) Diameter
100	63 (55)	19.3 (16.76)	2266014	Signal - PDU to Gantry STC	UL	FT-4	300	<30 VDC	80	13.3 (0.525)	37	22	20 x 75 (0.78 x 2.95) 20 x 51 (0.79 x 2.01)
101	83 (75)	25.5 (22.86)	2271060	Signal - Console to Gantry STC	UL	FT-4	300	<30 VDC	80	11.2 (0.440)	25	22	17 x 58 (0.68 x 2.30) 19 x 51 (0.75 x 2.01)
102	80 (75)	24.3 (22.86)	2266887	Signal - LAN Console to Gantry	UL (RG-223/U)	FT-4	1900	<30 VDC		5.9 (0.234)	1	19	15 (0.59) Diameter
103	80 (75)	24.3 (22.86)	2117848-2	Fiber Optic - Console to Gantry			N/A	N/A			1	N/A	10 (0.39) Diameter

* For H2 Console with CPDU only

** For GOC1 with CPDU Only

N For NGPDU

6-3-10.2 Contractor (Customer) Supplied

Table 6-8: Connections for Runs 1, 2, 3, 8 and 9

Customer Installed Wiring		Description	Cables Supplied			Plug Pulling Dimensions		Wire and Cable Pigtails ft. (m)	
Quantity	Size AWG (mm^2)		Part #	Length ft. (m)	Diameter in. (mm)	From	To	From	To
Run No. 1 from primary power source to facility disconnect (Power Source - A1); Maximum Run Length*									
3	*	Power						3 (1)	3(1)
1	1/0 (50)	Ground						3 (1)	3 (1)
1	*	Neutral						3 (1)	3 (1)
Run No. 2 from facility disconnect to Power Distribution Unit (A1 - PDU); Maximum Run Length*									
3	*	Power						3 (1)	3(1)
1	1/0 (50)	Ground						3 (1)	3 (1)
1	*	Neutral						3 (1)	3 (1)
Run No. 3 from facility disconnect to System Emergency Off (A1 - SEO)									
2	14 (2)	Power						6 (2)	6 (2)
1	14 (2)	Ground						6 (2)	6 (2)
Run No. 8 Power Distribution Unit to Warning Light Control (PDU - WL)									
2	14 (2)	Warning Light 24 Volt Control A3J2-1, 2, 3, 4							
Run No. 9 Power Distribution Unit to Scan Room Door Interlock (PDU - Door Switch)									
2	14 (2)	Scan Room Door Interlock A3J6-1, 2							
*Refer to NEC Code manual for AWG (mm^2) wire sizes.									

Figure 6-5: Interconnect Runs

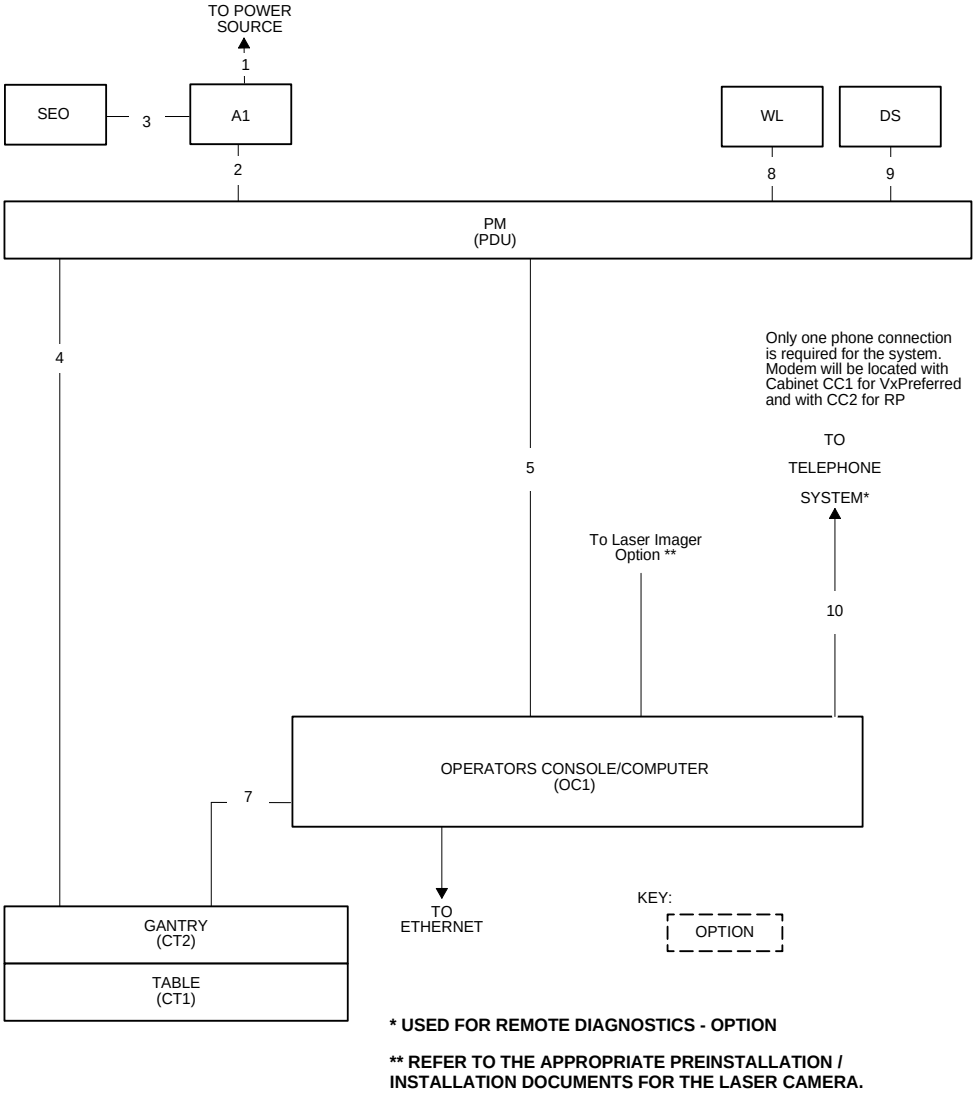


Table 6-9: Contractor-Supplied Components

Reference	Associated Equipment	Material/Labor Supplied by Customer Contractor	USA Vendor/ GE Catalog No.
A1 (50 Hz)	Main Disconnect Panel	400/480 VAC, Surface or Flush Mount, On/ Off Control	GE Supplied
ITL	Telephone Lines	Supply 2 Voice-Grade Telephone Lines. One line must be a direct number from outside the facility. Do not route this line through a telephone switchboard. Telephone line operating charges are paid by the customer.	
	System Components	Reference the system installation drawings supplied by Installation Support Services within your geographic area.	

6-3.11 Typical Customer Supplied Wiring

6-3-11.1 Primary Power Disconnect (Including PET Power System)

See Section 6-4.

6-3-11.2 Scan Room Warning Light and Door Interlock

Figure 6-6: Customer-Supplied Scan Room Warning Light Connection to PDU

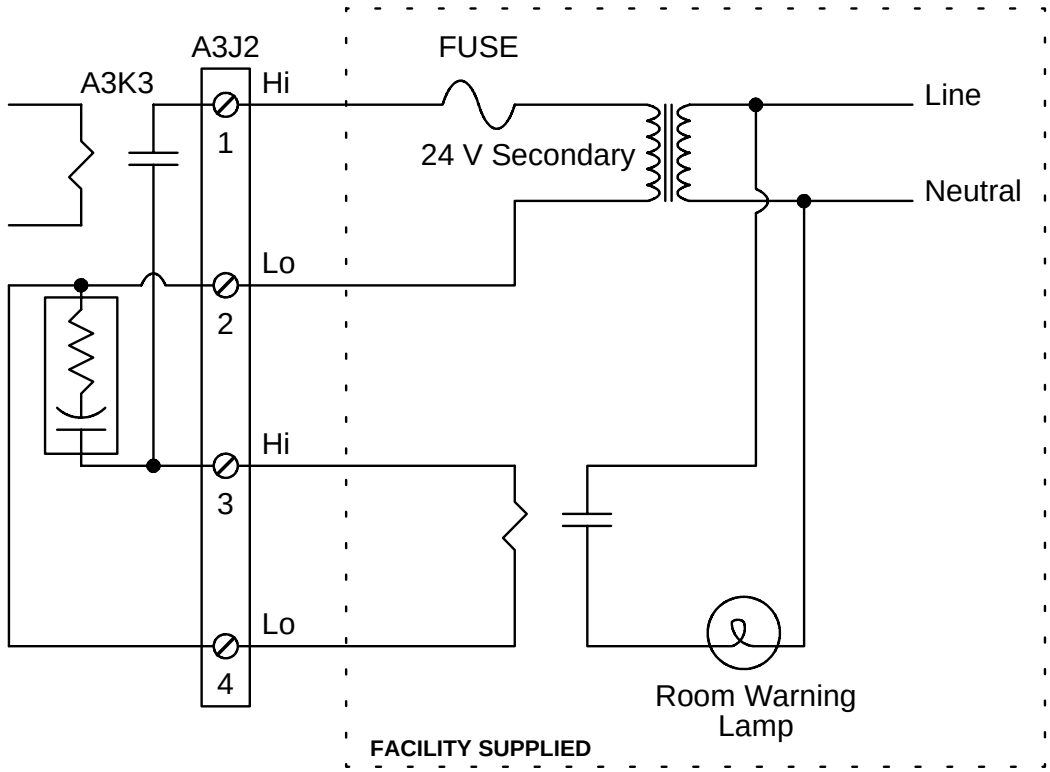


Figure 6-7: Typical Door Interlock

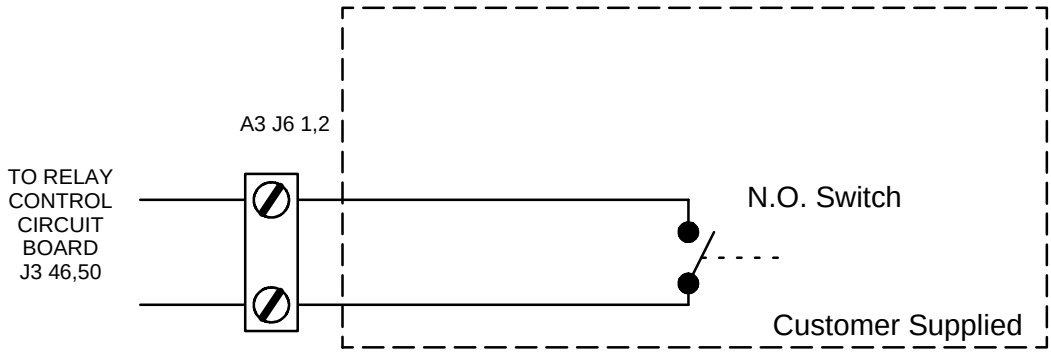


Figure 6-8 shows the CT cable connections.

Figure 6-8:Discovery LS CT Cables

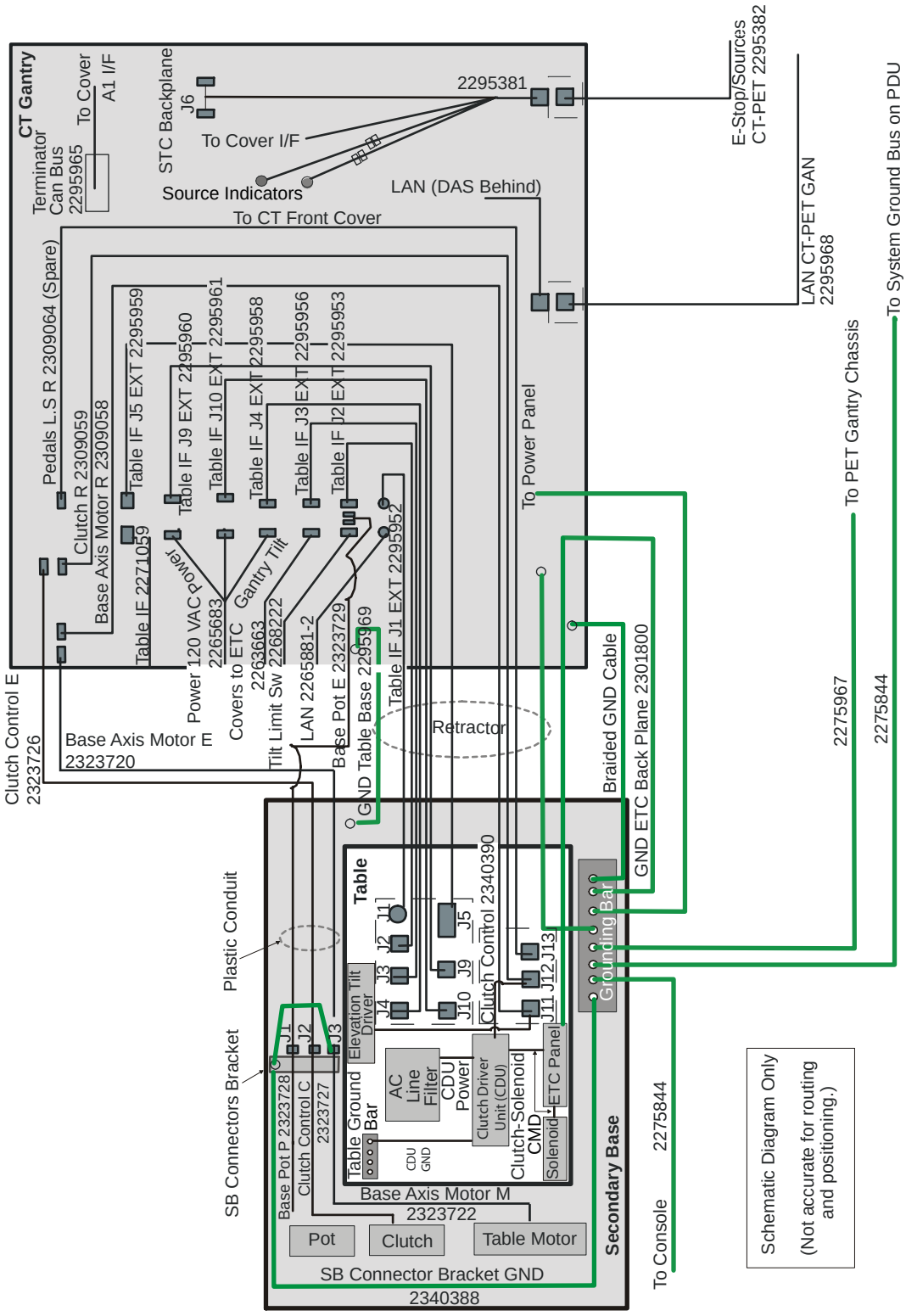


Figure 6-9 shows the power wiring.

Figure 6-9: PET System Power Interconnections

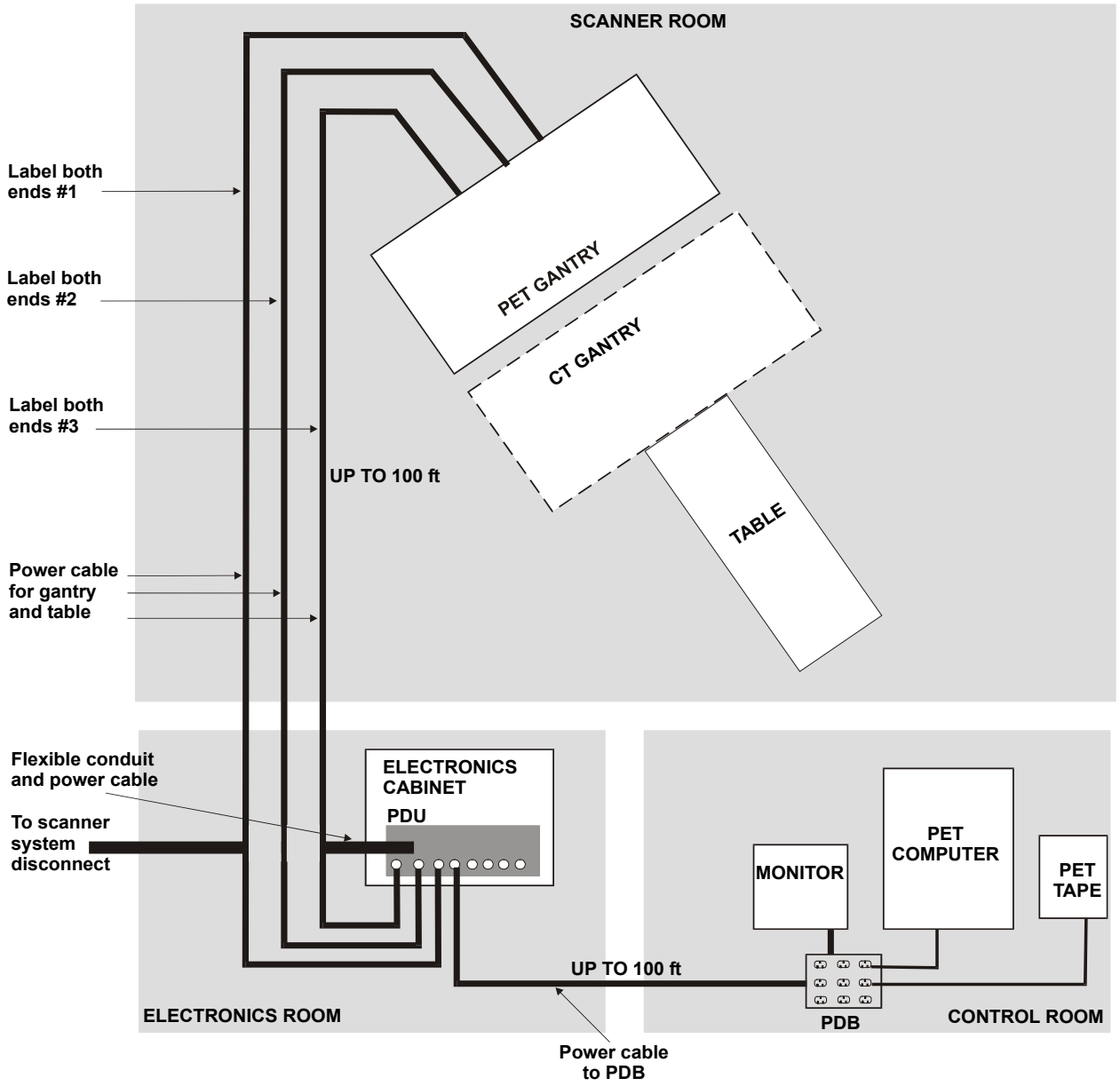
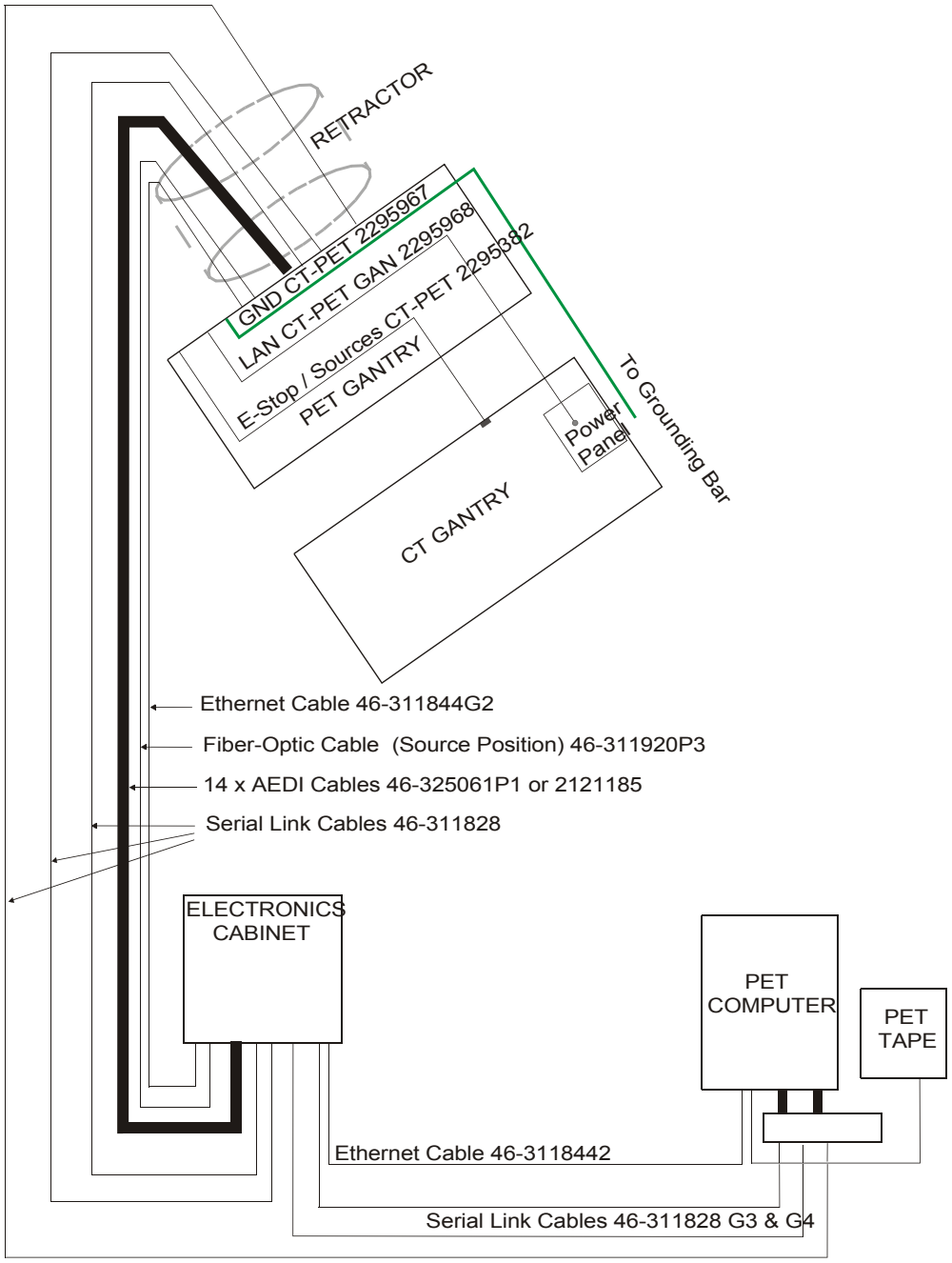


Figure 6-10 shows the system interconnections.

Figure 6-10: PET System Interconnections (Plan View, Excluding Power)



6-3-11.3 Routing of PET Power Cables

NOTICE **Run all Power and Control cables for 120 VAC or greater, independently from the signal cables.**

Table 6-10: Cable Lengths

Cable Description	Part #/ Run Length	From	To	Bending Radius	Cross Sectional Area
Ethernet 46-311844G2	100 ft. (30 m)	Electronics Cabinet	Gantry	5.08 cm (2.0 in.)	0.17² cm 0.27² in.
Ethernet 46-311844G4	100 ft. (30 m)	Electronics Cabinet	Operator Console	5.08 cm (2.0 in.)	0.17² cm 0.27² in.
Data I/F Cable (Qty. 14) 46-325061P1 or Data I/F Cable (Qty. 14) 2121185 (EMC)	100 ft. (30 m)	Electronics Cabinet	Gantry	12 mm (0.5 in.)	13.442² cm 2.08² in.
Serial Links (Qty. 2) 46-311629P1	100 ft. (30 m)	Electronics Cabinet	Gantry	12 mm (0.5 in.)	1.54² cm 0.23² in.
Serial Links (Qty. 2) 46-311828G3 and G4	100 ft. (30 m)	Operator Console	Electronics Cabinet	12 mm (0.5 in.)	1.54² cm 0.23² in.
Serial Links (Qty. 2) 46-311828G3 and G2	100 ft. (30 m)	Operator Console	Gantry	12 mm (0.5 in.)	0.54² cm 0.23² in.
Fiber Optic Cable 46-311920 P3	100 ft. (30 m)	Electronics Cabinet	Gantry	12 mm (0.5 in.)	0.77² cm 0.012² in.
Power (Qty. 3) 46-311772P1	Cut to length on site.	Electronics Cabinet	Gantry	5.08 cm (2.0 in.)	8.49² cm 1.32² in.
Power (Qty. 1) 46-311772P1	Cut to length on site.	Electronics Cabinet	Power Distribution Box (Operator Console)	5.08 cm (2.0 in.)	2.83² cm 0.44² in.

Section 6-4: System Primary Disconnect

Power to the system should be supplied by a dedicated feeder from the nearest Main Distribution Panel (MDP). A protective disconnect device must be provided in the power line supplying the PDU in accordance with National Electric Code and applicable local codes. (See Section 6-2.2.)

NOTICE **The disconnect device must be located within forty feet of the PDU, visible to PDU service personnel, and must have provision for lockout/tagout. It is identified as "A1" in the interconnection schematic diagrams.**

The rating of the disconnect device depends on the nominal line voltage. It must provide overcurrent protection and have a low voltage release, with multi-point remote control capability. The power requirements are summarized below:

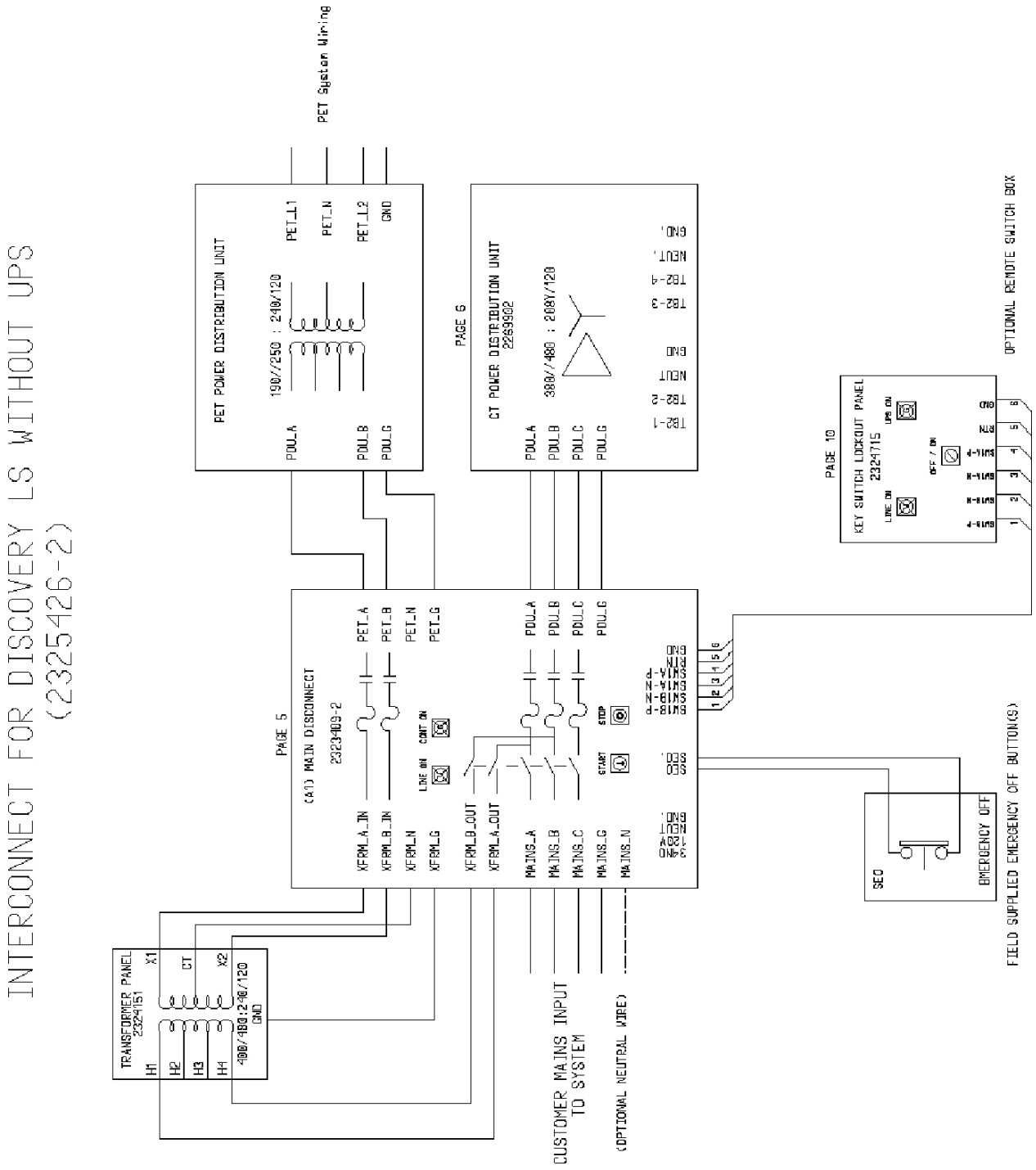
Table 6-11: DLS System Power Requirements

Discovery LS System Power Requirements	
Nominal Voltage	400/480 VAC (± 8%) Three-Phase, 4 Wires L1, L2, L3, N, GND (Neutral is optional.)
Frequency	50/60 Hz (± 5%)
Maximum Power	95 kVA
Average Power	25 kVA

The following A1 disconnects can be ordered from GE:

- P5050AH - Discovery LS Main Disconnect 480 V.
- P5050AL - Discovery LS Main Disconnect 400 V.

Figure 6-11: System Primary Disconnect



Section 6-5: CT-PET Local Area Networks (LANs)

6-5.1 Network Cable Routes

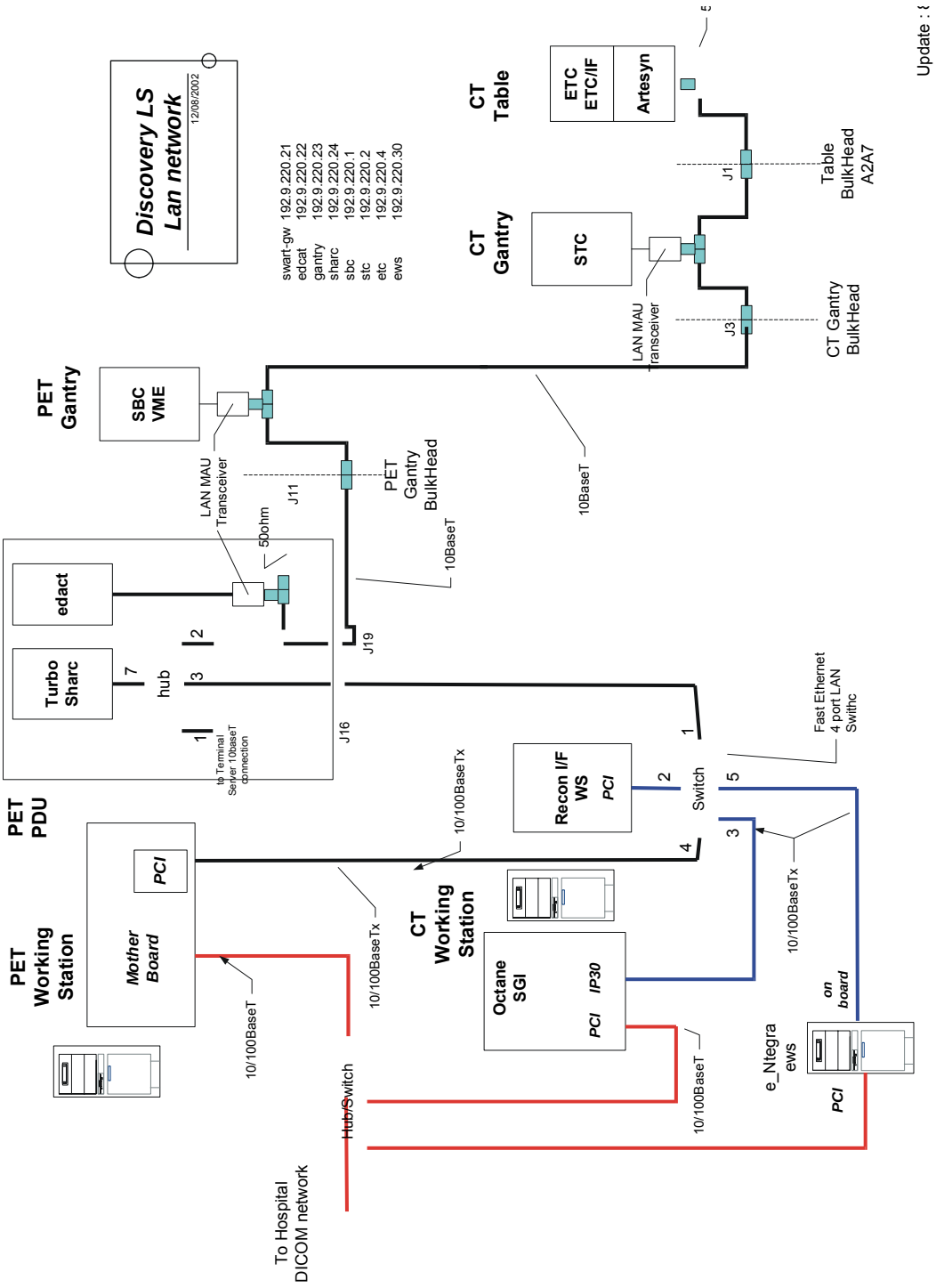
All major components of the imaging system are joined together by means of a network called Ethernet. This network consists of coaxial cable, resistors, and BNC connectors. If any remote viewing stations are installed off site, these stations must participate as drops on this network. The remote station cable may be up to 300 m (1,000 ft.) in length.

A gigabyte Ethernet connection is recommended for optimal network speed.

NOTICE **Any extra remote viewing stations will require 50 W coax that must be supplied and installed by the purchaser, except by special arrangement with GE Healthcare.**

Figure 6-12 shows a standard network.

Figure 6-12: Standard Ethernet Configuration



6-5.2 Data Cable Routes

Table 6-10 on page 95 shows the routing, description, length, cross-sectional area, and bending radius of cables supplied by GE Healthcare. This data is provided to aid in the process of specifying the required conduit and cable tray runs. GE will install these cables as part of the pre-installation or installation process.

Section 6-6: Lighting

6-6.1 General

The lighting requirements in the Discovery LS suite require more attention than most ordinary space lighting arrangements. Special attention must be given to the needs of the patient, medical staff and service personnel, and each is different.

The patient is often placed face-up on the patient table. Harsh down lighting would be offensive to the eyes of the patient. Soft, soothing, indirect lighting is generally the best choice for patient areas. In order to view the patient in the Scan Room through the window of the Control Room, there must be at least a three foot candle (32.1 LUX) differential between the two rooms. The Control Room should be slightly darker than the Scan Room. This will also help reduce eye strain when viewing terminals.

All space in the suite should be illuminated to 50 foot candles (535 LUX) to aid service personnel. Controls must be incorporated into the lighting design to accomodate this need.

6-6.2 Determining Lighting Power Requirements

The lighting requirements for the suite will impact the power requirements. After specifying the desired lighting fixtures, the watt density can be determined. With this information, the branch circuits can be properly sized.

6-6.3 Scan Room

Since the patient may be placed on his/her back, facing the lights, the Scan Room should be illuminated using an indirect method. This will help comfort the patient. Some procedures may require that the patient be sleeping. Controls should allow for the adjustment of light levels to less than 5 foot candles (53.5 LUX) for these types of studies. For most other operations, 10 foot candles (107 LUX) is appropriate. At least 15 foot candles (160.5 LUX) is needed for injecting patients.

6-6.4 Electronics Room

This room should have the lighting turned off when it is not occupied. This room should be flooded with 50 foot candles (535 LUX) for servicing the equipment. Generally there will be no need to dim this room.

6-6.5 Control Room

The Control Room is generally maintained slightly darker than the rest of the suite for viewing monitors more efficiently. Normally this room should be maintained at five foot candles (53.5 LUX) with provisions for local lamp lighting over desk space. Twenty-five foot candles (267.5 LUX) is a typical desk space level in this type of environment.

Chapter 7 Delivery Data

Section 7-1: Van Delivery

The Discovery LS System is packed for van shipment with minimum tear down of components.

7-1.1 Shipping and Delivery Requirements and Considerations

The Discovery LS Gantry, Console, Table and Electronics cabinets must NEVER be dropped. This system is not designed to tolerate excessive mishandling. A drop from a height greater than 1/2 inch may induce structural damage to the frame or other major components. Damage resulting from a drop (e.g., bent frame, misalignment) may not be obvious until after system installation is complete.

To avoid dropping the Gantry, Dock to Dock shipment is recommended. Other methods are acceptable, provided that the system is not dropped or otherwise mishandled. For example, the system may be moved via flat-bed wrecker or by rolling it across SMOOTH sidewalks or other paved surfaces.

The Discovery LS Console is not designed to tolerate the excessive shock or vibration that may occur during unloading. For example, rolling the Console across a washboard-style ramp may vibrate components to the extent of loosened or broken connections, etc. Damage resulting from shock or vibration (e.g., monitor, CD-ROM, hard drive or Octane failure) may not be evident until after system installation is complete.

7-1.2 Site Environmental Considerations

7-1-2.1 Dust/Dirt Contamination

The Discovery LS Console, Electronics cabinets, Table and Gantry are highly susceptible to airborne contaminants, especially concrete and drywall dust. Due to the possibility of contamination, this system should NEVER be installed in a construction site. Any site with unfinished floors, walls or ceilings is considered a construction site, and is not suitable for system installation.

7-1-2.2 Chemical Contamination

Film processors should not be installed in the same room as the scanner, due to the possibility of chemical contamination of Discovery LS components.

Section 7-2: Crated Delivery

The Discovery LS system is packed for overseas air shipment. Total weight of the system components is shown in Table 7-2 and Table 7-4. Total weight depends upon the wood used for crating.

Section 7-3: Storage Requirements

If the Discovery LS system is to be stored before installation, store in a warehouse. Protect from weather, dirt and dust. Storage temperature should not exceed -20^0 to $+120^0$ F (-30^0 to $+50^0$ C). Maintain relative humidity (non-condensing) between 0 and 80%. Do not store the Discovery LS system for more than 90 days.

Section 7-4: Transport Route Through the Building

The route taken when transporting the equipment from the off-loading ramp, through the building's pathways, entrances, doors and elevators must be planned in advance, taking into account the dimensions and weights of the packed system components.

7-4.1 Transport Route Considerations

To move gantry from the receiving location to the Scan Room, consider elevator capacity and size. Shipping weights and sizes are shown in Figure 7-1. By removing side rails and one dolly after the gantry is placed in the elevator, gantry weight and elevator depth requirements are reduced. Refer to Table 7-3 for gantry weights and sizes and delivery options.

Important: Contact the elevator manufacturer representative if the gantry weight exceeds elevator capacity.

Clearance for door openings when moving equipment into building must be 1,067 x 2,083 mm
(42 in. x 82 in.) minimum with a 2,439 mm (8 ft.) corridor width. Minimum hallway and door sizes for a gantry (with covers and dollies attached and side rails removed) are provided in Table 7-3. Refer to Figure 3-2 on page 36 for corridor clearance for the secondary base.

- The CT gantry is shipped while mounted between two dollies. See Figure 7-1. Two side rails are bolted to the dollies to stabilize the dollies and protect the gantry. Use dolly elevating casters to lift gantry off its base and roll it into position.
- The PET gantry is also shipped installed on its dollies, which are operated in a similar way to the CT dollies. (See Table 7-4 for dimensions and weights.)
- The table is shipped in a wooden crate with an interface to external dollies that should be connected to the table after unpacking. For a field upgrade option to a Discovery LS, a special upgrade kit is delivered. (The field upgrade kit is shipped in two boxes that may be unpacked before transporting through the building if necessary.)

For alternative lifting arrangements and instructions, contact GE Healthcare Installation Support Services.

7-4.2 Conveyance Safety Measures

1.) **Before** moving the Gantry components:

   a.) Select the safest and most direct route.

   b.) Walk the designated route, and clear any obstacles from the path before beginning to move the subsystems into the facility.

   c.) Verify that the designated route has no potholes, thinly covered ducts, electrical wires, pipes, or any other material which could hamper transportation.

   d.) Do not convey the equipment up a slope in excess of 2^{o} (4 cm/100 cm).

   e.) Verify proper height and width of the entire path and door frames. (Refer to Section 7-5 for system measurements.)

   f.) **Remember**: During transit, the bottom of the system components must clear the floor by 30 mm (1.18 in.), which should be sufficient to clear elevator thresholds. (The component dollies may be raised as needed to increase the floor clearance.)

   g.) If an unusual obstacle is encountered in the designated route, consult with the site engineer or advisor. Watch for unusual obstacles such as:

   * Bridges
   * Stairways
   * Elevators (usually elevators only support 1,800 kg or 3,968 lbs)
   * Path slant greater than 4%

2.) Do **not** move the units over sand or gravel.

3.) Do **not** convey the DST table, gantry components and PDU over a tar-based pathway. If this route must be used, verify that the path contains no potholes or grooves.

4.) Always enlist the help of at least two people to move the DST components on dollies, or at least four people to transport the CT Gantry with the moving kit.

5.) Do not place hands or feet beneath the wheels when moving equipment on dollies.

6.) Always slowly and smoothly lift and lower the DST HP60 Gantry components and Table to prevent damage to the equipment.

CAUTION **Do not attempt to lift more than more than 23 kg (50 lbs) alone.**

Section 7-5: CT System Shipping Dimensions (Van Delivery)

Table 7-1 lists the shipping packages of the CT system by box or skid number. The provided dimensions and weights are typical inside North America. They are for catalog numbers: B7850NP (CPDU), B7850NG (Gantry), B7850NC (Console), and B7850NT (Table).

Table 7-1:CT System Component Shipping Specifications

No.	Item (Packed)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Manuals (Box)	21	533	22	559	23	584	55	25
2	Gantry (Dollies)	109	2,769	54	1,372	82	2,083	3,992	1,811
3	PDU (See Note below.)	30	762	22	559	50	1,270	900	408
4	Console/Computer (Skid) --> Octane	50	1,270	36	915	35	889	530	241
5	Color Display Monitor 1	27.5	700	24.75	630	23	585	85	39
6	Color Display Monitor 2	27.5	700	24.75	630	23	585	85	39
7	Table Panel (Box)	65	1,651	14	356	11	280	50	23
8	Table Panel Box)	65	1,651	14	356	11	280	50	23
9	Side Covers (Box)	70	1,780	22	560	5	127	25	11
10	Side Covers (Box)	70	1,780	22	560	5	127	25	11
11	Cables (3 boxes on a skid)	48	1,219	40	1,016	32	813	400	181
12	Parts and Accessories – Software/Bay Collector (2 boxes on a skid)	48	1,219	40	1,016	48	1,219	450	204
13	Chair (Box)	25	635	25	635	42	1,067	46	21
Weight of basic system (Items 1 through 14):								**7,379**	**3,347**
For equipment on dollies, height includes a 1 inch (25.4 mm) floor clearance.									

Note: The values listed for the PDU are for the Compact PDU only. The NGPDU is smaller than the CPDU by 62 mm in width x 9 mm in depth x 208 mm in height. Weight of the NGPDU is 350 kg (771.6 lbs).

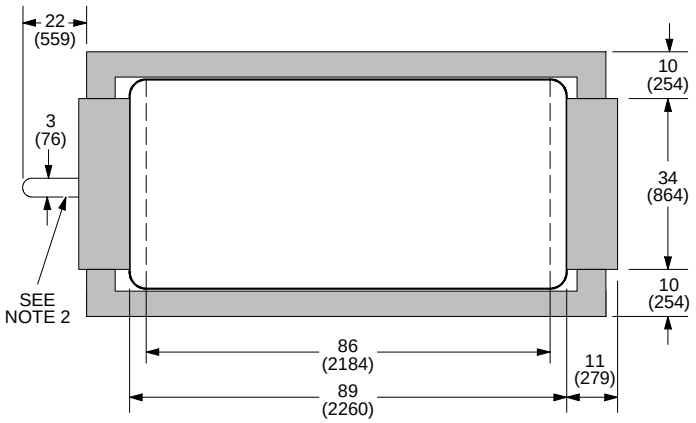
Section 7-6: CT System Shipping Dimensions (Crated Delivery)

Table 7-2 shows the packages for catalog numbers: B7500JK, B7500JB, B7500JA, B7500JG, B7500JD, B7500JE. The shipping dimensions and weights specified are for crated delivery outside North America.

Table 7-2: CT System Shipping Specifications (Outside North America)

No.	Item (Packed)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Gantry - Dolly in raised position extends beyond end of skid. (Slat Crate)	120	3,048	56	1,423	86	2,185	4,573	2,074
2	CPDU (Crate)	41	1,042	29	737	86	2,185	950	431
ALT	NGPDU (Crate)	40.5	1,030	37	940	60	1,580	953	432
3	Console/Computer (Crate)	56	1,422	40	1,016	38	965	600	272
4	Trim Panels (Skid)	38	966	31	788	31	788	94	43
5	Collector (Skid)	28	712	28	712	17	432	42	19
6	Miscellaneous Parts (Skid)	38	966	31	788	31	788	391	178
Weight of basic system (Items 1 through 7):								**8,163**	**3,703**
Dimensions shown are ±1 inch (25.4 mm).									

Figure 7-1: CT Gantry Shipping Configuration



NOTES:

DIMENSIONS ARE IN INCHES (MILLIMETERS).

1 DRAWING NOT TO SCALE

2 EACH DOLLY* IS EQUIPPED WITH A THIRD DEMOUNTABLE CASTER TO STABILIZE IT DURING ASSEMBLY TO GANTRY.

3 DIMENSIONS SHOWN ARE WITH DOLLY CASTERS RETRACTED AND GANTRY RESTING ON ITS BASE PLATE.

4 SIDE RAILS MAY BE REMOVED FOR HALLWAY OR DOOR CLEARANCE

* Gantry only

Table 7-3: CT Gantry Delivery Size Options

Configuration	Weight lbs (kg)	Dimensions					Comment
		Width in. (mm)	Depth in. (mm)	Height in. (mm)	Persons Needed	Add'l Person Hours	
Normal Shipping Configuration	3,800 (1,724)	109 (2,769)	54 (1,372)	82 (2,083)	2	0	Van drivers deliver equipment to room. GE reps. supervise and assist. Height includes 1 in. (25.4 mm) clearance from floor.
Remove protective side rails.	3,712 (1,684)	109 (2,769)	43 (1,092)	83 (2,108)	2	0.5	With rails removed, be careful to avoid damage to covers.
Remove side rails and one dolly.	3,476 (1,577)	99 (2,515)	43 (1,092)	83 (2,108)	2	1.5	This configuration is used to move gantry into a nine-foot elevator.
Gantry - Set on auxiliary dollies.	3,400 (1,542)	88 (2,235)	43 (1,092)	84.3 (2,141)	2	2.5	Do **not** push on gantry covers. Push only on frame components. Auxiliary dollies provide 2.3 in. (58 mm) clearance from floor.
Remove Covers - Use shipping dollies.	3,392 (1,539)	110 (2,794)	40 (1,016)	77 (1,956)	4	1.5	Use extreme care in removing, handling and installing covers. Refer to the procedure in *LightSpeed 2.X Installation Manual, Direction 2243312-100*.
Remove Covers - Use auxiliary dollies.	3,080 (1,397)	83 (2,108)	40 (1,016)	78.3 (1,989)	4	3.5	(See two previous comments.)

Section 7-7: PET System Shipping Dimensions

Table 7-4 shows the shipping dimensions and weights for crated delivery outside North America.

Table 7-4: PET Component Shipping Specifications (Outside North America)

No.	Item (Packed)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Gantry installed on shipping dolly (with detectors and lead bricks).	115	292	42	1,067	81	2,058	6,000	2,700
2	Electronics Cabinet	49	1,245	41	1,041	82	2,083	962	436
Weight of basic system (Items 1 and 2):								**7,962**	**3,136**
Dimensions shown are ±1 in. (25.4 mm).									

Section 7-8: Discovery LS Patient Table

Table 7-5 shows the shipping dimensions and weights for crated delivery.

Table 7-5: Discovery LS Patient Table

No.	ITEM (PACKED)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Table, Secondary Base and Cradle	122	3,100	37.4	950	44.5	1,130	Approx. 1,323	Approx. 600
Dimensions shown are ±1 in. (25.4 mm).									

Section 7-9: Discovery LS Field Upgrade Kit

Table 7-6 shows the shipping dimensions and weights for crated delivery.

Table 7-6: Discovery LS Field Upgrade Kit

No.	Item (Packed)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Box 1	39.3	1,000	39.3	1,000	70.8	1,800	771	350
2	Box 2	TBD	1,200	TBD	1,200	TBD	400	330	150
Total weight of field Upgrade Kit (Items 1 and 2):								**1,101**	**500**
Dimensions shown are ±1 in. (25.4 mm).									

Section 7-10: Gantry Covers Kit

Table 7-7 shows the shipping dimensions and weights for crated delivery.

Table 7-7: Discovery LS Gantry Cover Kit

No.	Item (Packed)	Width		Depth		Height		Weight	
		in.	mm	in.	mm	in.	mm	lbs	kg
1	Box	43.3	1,100	82.7	2,100	47.2	1,200	397	180
Dimensions shown are ±1 in. (25.4 mm).									

Chapter 8 Final Pre-Installation Review

Complete all pre-installation requirements **before** beginning the Discovery LS system installation. For best results, complete the tasks in this chapter before the system arrives on site.

Section 8-1: Site Ready for Installation

Site-specific items must be verified before beginning the installation.

8-1.1 Dust/Dirt Contamination

The Discovery LS System (consisting of Console, PDUs, Table and Gantries) is highly susceptible to airborne contaminants, especially concrete and drywall dust. Due to the possibility of contamination, this system should NEVER be installed if a site is under construction. Any site with unfinished floors, walls or ceilings is considered a construction site, and is not suitable for system installation.

8-1.2 Chemical Contamination

Never install wet film processors in the same room as the scanner, due to the possibility of chemical contamination of LightSpeed components. Such chemicals can contribute to increased equipment failures, increased system down time, and decreased reliability. Film processor equipment installation must meet the manufacturer's requirements (e.g., ventilation specifications) and all applicable national and local codes. Also, equipment and chemical fumes relative to human contact should be considered when locating the equipment and chemicals in the control room.

8-1.3 Walls, Ceiling, and Floor

All walls, ceiling and flooring construction must be completed before beginning the installation.

8-1.4 Phone Line

Installation of phone line(s) must be complete and operational.

Section 8-2: Pre-installation Checklists

The following checklist and the Site Assignment Matrix need to be completed prior to commencing installation of the Discovery LS System.

Table 8-1: Site-Required Information

Required Information for Site
Hospital name as it appears on the system screens: _____
Network ID numbers / IP addresses for: Camera:_____ PACS: _____ AWW: _____ Other (Specify type and ID:)_____ Other (Specify type and ID:)_____
Camera Setup Information: _____ _____ _____
AW Direct Connect Address:_____
Do you want HIPAA enabled? No___ Yes ___
Do you want automatic downloads enabled? No___ Yes ___

Table 8-2: Schedule Date Commitments

GE		Customer		Dates
Y	N	Y	N	
		❒	❒	Was the project schedule verified with facilities department, contractor, and GE?
		❒	❒	Will the committed site-ready date be met?
❒	❒	❒	❒	Does the completion date for any/all construction meet or preceed the delivery date?
❒	❒	❒	❒	Is the Power and Ground survey complete? Date: _____ Hospital contact: _____
		❒	❒	Site-ready visit is scheduled for: _____
		❒	❒	Delivery date is scheduled for: _____
		❒	❒	Installation date is scheduled for: _____
❒	❒	❒	❒	Installation timing: A: Weekdays___ B: Weekend___ C: Quick Installation___ If B or C, were all subcontractors notified? No___ Yes ___
❒	❒	❒	❒	Does the delivery and/or installation date need to be adjusted?
		❒	❒	First-use date is scheduled for: _____
❒	❒	❒	❒	Applications/Training dates: On-Site Training Date: _____ Healthcare Institute Training Date: _____

Table 8-3: General Site Planning

GE		Customer		General / Site Requirements (Must be completed 5 weeks before scheduled delivery date.)
Y	N	Y	N	
❒	❒	❒	❒	Were final drawings approved and distributed to the contractors?
❒	❒	❒	❒	Are final drawings “signed off” to approve equipment layout/orientation?
❒	❒	❒	❒	Do the actual room dimensions match those on the final drawings?
		❒	❒	Has the radiologist health physician reviewed and approved the room layout and shielding requirements?
		❒	❒	Were any additional requirements/questions about the installation discussed with GE? List: _____ _____ _____ _____
		❒	❒	Is there a person assigned to review and verify all installation requirements are met? Name: _____
		❒	❒	Were the specific site requirements discussed with the contractor? Refer to the GE final drawing specifications. (See Table 8-4 below.)
		❒	❒	Was the responsibility of cabling, installing, and interfacing accessories **not** on the order discussed?
		❒	❒	Are all third-party vendors identified, notified and scheduled? (Examples: Netcom, Medrad, etc.)
		❒	❒	Were all regulatory requirements met?
		❒	❒	Will existing network, broadband, and camera cable drops reach new locations and meet the requirements and function with the Discovery LS? If not, what are the requirements? List: _____ _____ _____
❒	❒	❒	❒	Were all required radioactive material licenses and approvals obtained for the equipment and facility?
		❒	❒	Does the site have a radiation license allowing PET isotopes and GE68? (A copy of customer's site radiation license must accompany the order entry package. Otherwise, installation will be delayed.)

Table 8-4: References for Specific Site Requirements

Sections for Specific Requirements	
• Room Planning: Recommended and Minimum Room Dimensions on page 33	• Floor Loads and Weights: Structural Considerations on page 54
• Environment: page 109	• Power: Power Requirements on page 78
• Radiation Protection: Radiation Protection Considerations on page 43	• Delivery: Doors Entrances and Elevator Clearances on page 36
All work by contractors **must** be completed before the scheduled delivery date.	

Table 8-5: Equipment Compatibility

GE Y	GE N	Customer Y	Customer N	Equipment (Must be completed 5 weeks before scheduled delivery date.)
❒	❒	❒	❒	Was the order reviewed for completeness and compatibility with existing equipment? Typical equipment: Remote monitors ____ AWW relocation ____ Gating option ____ Injectors ____
❒	❒			Are interfaces to existing and/or new accessories ordered and planned for accordingly?
❒	❒	❒	❒	Were the following peripheral locations included in the site drawings? EKG Monitor___ Injector Control___ Laser Camera ___ UPS ___ 2nd Monitor___
❒	❒	❒	❒	Will GE Healthcare provide additional services per contract negotiations?
❒	❒			Are the correct length cables on order?

Table 8-6: Network Connections

GE Y	GE N	Customer Y	Customer N	Network Installation and Setup (Must be completed 5 weeks before scheduled delivery date.)
❒	❒	❒	❒	Were IP addresses and host names obtained? No___ Yes ___
❒	❒	❒	❒	Will a network camera be used? No___ Yes ___
❒	❒	❒	❒	**Mandatory:** Are the network and network jacks installed, and is the entire network tested?
❒	❒	❒	❒	**Mandatory:** Broadband VPN installed/setup?
❒	❒	❒	❒	**Mandatory:** Are network software options ordered? HIS RIS Option ___ DICOM Print ___ AWW ____
		❒	❒	**Optional:** Was the modem option ordered? _____ (requires a site escalation)
❒	❒	❒	❒	**Optional:** Is the Discovery LS service telephone line identified and installed? (electrical, mechanical, etc.)

Table 8-7: Miscellaneous Tasks

GE Y	GE N	Customer Y	Customer N	Other (Must be completed 5 weeks before scheduled delivery date.)
		❒	❒	Were arrangements made in the schedule to allow adequate time for remodeling if required (such as wall, floor or ceiling repair work, painting and other cosmetic finishes)?
		❒	❒	Were arrangements made to clean the floor **after** equipment removal and **prior** to the installation of the new equipment?
❒	❒	❒	❒	Is de-installation of existing equipment required? No__ Yes ___ Removal Date _____
❒	❒	❒	❒	Is there a trade in of existing equipment? No __ Yes __ GoldSeal _____
❒	❒	❒	❒	Delivery route identified and verified with the proper hospital personnel?No__ Yes __ Elevators and doors checked for size and weight constraints? No__ Yes __
❒	❒	❒	❒	Were appropriate arrangements made with traffic for delivery? No__ Yes __
❒	❒	❒	❒	Will acceptance/performance testing or biomedical testing be required? No__ Yes __ Date: _____
❒	❒	❒	❒	Are trash and/or recycling bins available for the removal of papers, boxes, etc. during the installation? No__ Yes __

Section 8-3: Site Assignment Matrix

The following information is required to configure the Discovery LS system.

Table 8-8: Assignment Matrix - Page 1

Workstation Parameters				
Institution ID		Network Type (Thin, Thick, Twisted Pair, Fiber)		
Administrator Password		Default Gateway (Optional)		
IP Address		DNS Server (Optional)		
Subnet Mask		WINS Server (Optional)		

OSI-Based Systems		
System Name	System Type	Ethernet Address

DICOM Stations and Printers					
System Name	System Type	IP Address	Application Entity	Service (Q, F, S)	Port #

Table 8-9: Assignment Matrix - Page 2

Remote Database	
Remote eNTEGRA System Name	IP Address

TCP/IP Network Printer		
Printer Name	Printer Type	IP Address

Remote Connectivity				
Host Name	IP Address	Phone Number	User Name	Password

Modem Phone #	
CARES/MUST ID	

Appendix A Safety Considerations

Section A-1: General Safety

Construction in general is an inherently hazardous activity. The construction of a Discovery LS suite poses no less danger than any other kind of construction activity. This particular activity becomes more dangerous when personnel are unfamiliar with this very specialized type of construction. The preparation of a Discovery LS suite involves exposure to some significant dangers. The dangers are present at the beginning of the construction of the project, and continue into the operation of the suite. No set of standard practices can assure that the installation and operation of a PET-CT system will be completely safe at all times. This chapter provides some guidelines that can contribute to making the Discovery LS project, and the subsequent use of the equipment, as safe as possible.

The following sections outline some very basic precautions which, when observed, can greatly reduce the chances of injury or damage to the equipment.

Section A-2: Electrical Safety

The construction, installation, and maintenance of a Discovery LS suite involves the handling of electrical power. The hazard of electrical shock is one real danger associated with the handling of electrical power, but it is by no means the only one. The possibility of being burned or falling are also very real dangers. The vast majority of accidental injuries in an electrical working environment are not caused by electrical shock. Actually the possibility of electrical shock injury is far less likely to accrue than burns or falling accidents. Most of these accidents befall the more inexperienced workers.

The best way for inexperienced personnel to escape injury is to avoid working in the unfamiliar environment. Only personnel with specific training in electrical systems should be engaged in electrical work.

A-2.1 Burns

As large amounts of electrical current are passed through a conductor, the potential of generating significant amounts of heat exists. In some instances involving electrical faults, conductors actually become hot enough to melt. As this occurs, temperatures approach the flash point of the wire insulation. Therein lies the possibility of burn related injuries. At times, fires are started which can cause serious, life threatening situations.

⚠ **WARNING** **IN THE EVENT OF FIRE, USE ONLY A FIRE EXTINGUISHER DESIGNED FOR USE ON ELECTRICAL FIRES. NEVER USE WATER ON ELECTRICAL FIRES. FIRE CONTROL EQUIPMENT MUST BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH LOCAL CODES AND REGULATIONS.**

A-2.2 Falling

Working in elevated areas poses a danger in itself. When electrical power is involved, that danger is greatly intensified. Invariably, when a person receives an electrical shock, involuntary muscular convulsions cause uncontrolled jerking and twisting movements. This often results in fall. The injuries sustained are generally from the fall, rather than from the electrical shock.

When working in elevated areas, use only stable devices such as fiberglass stepladders with rubber feet, or locked scaffolding. Never use chairs or devices that are designed to be rolled about the room.

A-2.3 Shock

Very little electrical current is required to cause serious injury. Never underestimate the danger of working with even a low level of electrical power. A good rule of thumb is to treat all electrical conductors as though they are carrying lethal levels of electrical current.

Whenever possible, the handling of electrical wires should be done when power is not applied to the circuits. Sometimes this is not practical. In those situations, it is advisable to observe the following precautions:

1.) Never use conductive ladders, such as aluminum. Fiberglass or wood are much safer materials.
2.) Be sure to use tools that are properly insulated.
3.) Use insulated gloves when handling high voltage.
4.) Avoid using both hands on bare conductors, as this could pass a current directly through the heart.
5.) Avoid coming into contact with other conductive material, especially those that are grounded.
6.) Avoid contact with any measurable quantity of water.
7.) Never work alone. Always work with other knowledgeable workers.
8.) Use lockout/tagout devices and keep track of the keys.
9.) Use eye protection.

Note: For information about radiation safety, see Section 3-5 on page 43.

Appendix B Network Map and Data Table

Table 8-10: Network Map

Description (Acquisition Station, Table, Gantry)	Suite	Suite Name	Network	IP Address	Host Name	Subnet

Table 8-11: Data Table

	Port Address (Future)	System ID	Location				Notes (e.g., Transceiver Location if Applicable)
			Department	Floor	Room	Telephone	

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