

RESEARCH LABORATORY

Design Guide



Department of Veterans Affairs
Veterans Health Administration
Office of Research & Development
Office of Facilities Management
Facilities Quality Office
Standards Service

Foreword

The material contained in the Research Laboratory Design Guide is the culmination of a partnering effort by the Department of Veterans Affairs Office of Research and Development and the Facilities Quality Office. The goal of the Design Guide is to ensure the quality of VA facilities while controlling construction and operating costs.

This document is intended to be used as a guide and a supplement to current technical manuals and other VA criteria in the planning of Research Laboratory facilities. The Design Guide is not to be used as a standard design, and use of this Design Guide does not limit the project Architects' and Engineers' responsibilities to develop a complete and accurate project design that best meets the users' needs and applicable code requirements.

Lloyd H. Siegel, FAIA
Director, Facilities Quality Office

Dennis Roth
Director, Operations for Research and Development

Contents

[Section 1](#) Acknowledgments, Introduction, Abbreviations, and Legend of Symbols

[Section 2](#) Narrative

[Section 3](#) Relationship and Generic Layout Diagrams

[Section 4](#) Design Guide Plate Series: Laboratories

[Section 5](#) Design Guide Plate Series: Specialized Areas

[Section 6](#) Design Guide Plate Series: Laboratory Support

Section 1
Acknowledgments,
Introduction,
Abbreviations, and
Legend of Symbols

	Page
Acknowledgments	1 - 1
Introduction	1 - 3
Abbreviations.....	1 - 5
Legend of Symbols.....	1 - 7

Acknowledgments

Credit is due the following individuals whose guidance, advice, and effort made this publication possible:

CONSTRUCTION MANAGEMENT OFFICE

C.V. Yarbrough	Associate Chief Medical Director for Construction Management
Robert L. Neary, Jr.	Construction Management Office
Lloyd H. Siegel, FAIA	Director, Facilities Quality Office
Leo A. Phelan, AIA	Committee Co-chair; Director, Standards Service
Debra Bonarti, Assoc. AIA	Design Guide Developer, Project Coordinator
Wesley Wheeler	Architecture
William Leahy, RA	Architecture
Wilbur Wright, PE	Mechanical Engineering
Satish Sehgal, PE	Mechanical Engineering
E.T. Minter	Plumbing and Sanitary Engineering
Khim Chudasama, PE	Electrical Engineering
Barry Woods	Equipment Selection
Elizabeth Bunn, CIPE	Design Guide Coordinator

CRITERIA, POST OCCUPANCY EVALUATION, AND PLANNING SUPPORT SERVICE

John Sibenik	Space Planning Criteria
Al Wong	Equipment Criteria

OFFICE OF RESEARCH & DEVELOPMENT

Dennis B. Smith, MD	Associate Chief Medical Director for R&D
Dennis Roth	Director of Operations for R&D
Kari Hastings	Administrative Officer for Medical Research Service

FIELD ADVISORY COMMITTEE

Jeanette Landis	VAMC, Lexington, KY
David Johnson, Ph.D.	VAMC, Baltimore, MD
Gary Soule'	VAMC, Nashville, TN
Robert Guancial	VAMC, Buffalo, NY
Melvin Buck	VAMC, Atlanta, GA

PRIVATE SECTOR LAB CONSULTANTS

Earl L. Walls	Earl Walls Associates
Jerry Sullivan	Earl Walls Associates
Chris Cowansage	(formerly) Director of Lab Planning, CRSS Architects, Inc.

Introduction

The Research Laboratory Design Guide is intended to be a graphic consolidation of existing Department of Veterans Affairs standards and criteria. It contains data from the following sources:

- PG-08-1, Master Construction Specifications
- H-08-3, Construction Standards
- PG-08-4, Standard Details
- PG-7610, Equipment Guide List
- PG-08-6, Equipment Reference Manual
- H-7610, Space Planning Criteria
- PG-08-13, Barrier-Free Design Guide
- PG-08-14, Room Finishes, Door, and Hardware Schedule
- Various Design Manuals and other technical criteria pertaining to Architectural, HVAC, Plumbing, and Electrical.
- Consensus information from Research and Development Staff of various VA Medical Centers.
- Research Service

The Design Guide refers to the above mentioned sources when data is either too detailed or too broad to be included in this guide.

The Research Laboratory Design Guide was developed as a design tool to assist the medical profession in better understanding the choices that designers ask them to make, and to help designers understand the functional requirements necessary for proper operation of a Research Laboratory.

The guide plates contained in the Research Laboratory Design Guide are intended as illustrations of VA's furniture, equipment and personnel space needs. They are not meant to limit design opportunities. Equipment shown is not necessarily complete.

This Design Guide is not intended to be project specific. While it does contain the majority of spaces that now are required in Research Laboratory, it is not possible to encompass all possible future requirements. Therefore, it is recommended that the project-specific space program be the starting point for an individual project design. In addition, it is important to note that the guide plates are a **generic graphic representation** only. Equipment manufacturers should be consulted for actual dimensions and utility requirements. Use of this Design Guide does not diminish the project Architects' and Engineers' responsibilities to develop a complete and accurate design that meets the user's needs and appropriate code requirements.

Abbreviations

A.....	ampere	FACS	Fluorescent Activated Cell Sorter
AABC	Associated Air Balance Council	fc	foot-candle
ADA.....	Americans with Disabilities Act	fpm.....	feet per minute
ADP	automatic data processing	ft.....	foot
A/E	Architect/Engineer	G	fuel gas
ai	acquisition and installation	gal	gallon
AIHA.....	American Industrial Hygiene Association	GFI.....	ground fault interrupter
amp	ampere	gwb	gypsum wallboard systems
ANSI.....	American National Standards Institute	HEPA	high efficiency particulate air
AR	as required	hr.....	Hour
ASHRAE.....	American Society of Heating, Refrigeration, and Air Conditioning Engineers	HVAC	Heating, Ventilating, and Air Conditioning
at	acoustical ceiling tile	kg	kilogram
at (sp)	acoustical ceiling tile with sprayed plastic finish	kPa.....	kilopascal
c	concrete	kW.....	kilowatt
°C	degrees Celsius	L.....	liter
CC	Contractor Furnished and Installed — Construction Funds for Equipment and Installation	LA	laboratory air
CF	Construction Funds — For VA Furnishing of Equipment and/or Installation	lab	laboratory
cfm	cubic feet per minute	lb	pound
CM.....	Office of Construction Management	LV	laboratory vacuum
cmu	concrete masonry unit	lx	lux
CS	Construction Standard	m.....	meter
dB.....	decibel	MCS.....	Master Construction Specifications
ECC.....	Engineering Control Center	min	minimum
ELF.....	equivalent linear footage	mm	millimeter
erf	epoxy resinous flooring	NEBB	National Environmental Balancing Bureau
°F.....	degrees Fahrenheit	NFPA	National Fire Protection Association
		NMR.....	Nuclear Magnetic Resonance
		nsf.....	net square feet
		Ø	phase

September 30, 1995

OSHAOccupational Safety and Health
Administration

Papascal

PCProject Coordinator

PCRPolymerase Chain Reactor

preppreparation

psf.....pounds per square foot

psi.....pounds per square inch

psig.....pounds per square inch gauge

PVCpolyvinyl chloride

qty.....quantity

rbresilient base

REResident Engineer

recepreceptacle

RFI.....radiofrequency interference

RHrelative humidity

sc.....special coating (high build
glazed coating)

SDStandard Detail

temptemperature

typ.....typical

Vvolt

VA.....Department of Veterans Affairs

VAMCVeterans Affairs Medical Center

VAVvariable air volume

VCVA Furnished and Contractor
Installed — Medical Care
Appropriation for Equipment,
and Construction Funds for
Installation

vct.....vinyl composition tile

VV.....VA Furnished and Installed —
Medical Care Appropriation for
Equipment and Installation

Wwatt

Legend of Symbols

Section 2
Narrative

	Page
Narrative.....	2 - 1

Narrative

Assumptions:

The Research Laboratory Design Guide Narrative addresses new construction as well as renovation projects.

The discussion throughout the Design Guide focuses on biosciences labs "life sciences labs" as used by the Department of Veterans Affairs (VA).

Note: Dimensions are given in metric units with the English unit conversion in parentheses. For example: 1680 mm (5'-6").

Introduction:

It is imperative that laboratory planners are aware that the research facility must not be designed exclusively and permanently for any one pattern or type of research work. The focus of research is constantly changing. It should be expected that the direction of the facility's research program may change between design and activation. Therefore, the VA goal is to achieve a facility that is flexible enough to accommodate future programs while maintaining cost efficiency at the time of design.

The design of a laboratory is a response to four major challenges:

- ⇒ Flexibility: The nature of research can change in unpredictable ways. It is important to assess the kind and extent of flexibility that can be rationally planned while considering ADA guidelines.
- ⇒ Safety: High risk factors to researchers include possible contamination from specimens, explosion, and exposure to chemicals. Exits must be clearly marked and the location of fume hoods must eliminate the possibility of endangering the workers.
- ⇒ Quality of Environment: The presence of natural light, pleasing colors, and a quiet environment within the laboratory enhance productivity.

- ⇒ Cost Efficiency: Assuring quality facilities while maintaining cost efficiency is a strong VA goal.

Trends:

Present trends are toward research at the micro level (genes, cells, viruses, microorganisms). Trends toward micro level research are evidenced in the emergence of new research technologies such as mass spectroscopy and magnetic resonance imaging equipment. Design trends involve environmentally controlled atmospheres in the labs. Equipment is more automated with computer controlled processes combined with the need to frequently replace and update the equipment. Some of the new technology imposes stringent requirements on building utilities and environmental controls. It is imperative that labs be designed with mobile carts and shelving to allow for new equipment and a rearrangement of the work flow. To insure a successful project, planners must anticipate future trends of research study that will take place in the lab through contact with lab users.

Laboratory Space Planning:

There are two plan options: the open plan versus the closed plan. The open plan reduces construction costs (requiring fewer walls), improves square footage efficiency, and is oriented toward research teams. The closed plan allows tighter security and provides containment. Although large laboratory programs common in teaching institutions are not present at the VA, grouping of investigators by similar techniques (e.g.: molecular biology) is done frequently in the VA. VA investigator groups would benefit from the availability of open plan labs. As shown in Section 4 of this guide, the VA recommends the open plan concept for all future lab design.

With the adoption of the open plan concept, there is a need to consider flexible casework

options. Modular casework can be arranged in many ways to suit the needs of the researchers. For example, fixed casework can be located along the perimeter walls, with mobile casework units or split benches in the center space.

The VA standard for aisles between benches or equipment is 1500 mm (5'-0"), to allow space in which two people may work back to back at apparatus and a third person may pass between them. Aisles should be aligned in the direction of egress.

Main corridors in lab neighborhoods need to be 1800 mm (6'-0") wide to allow enough of a turning radius for equipment entering/exiting the labs. A corridor wider than 1800 mm (6'-0") is likely to become a storage area.

Cost savings proposals must be investigated during the process of planning these facilities. For example, minimizing the number of laboratory partitions and barriers improves flexibility and saves on cost. If possible, avoid locating plumbing in walls that may be moved in the future. Partitions used within labs to hang casework may be replaced by free-standing cabinets and shelving. A decision to locate the research labs on the upper building levels saves on ductwork length from fume hoods and makes the addition of future fume hoods less costly.

Disabled Persons Access: If a disabled researcher works in a VA laboratory, then all parts of the laboratory and its emergency equipment must be designed or adapted to meet the user's needs. (See Guide Plate 4-2.)

Modular Design:

In order to achieve flexibility, the design must be planned in terms of a basic planning concept, "the lab module". The module establishes a dimensioned method by which building systems, partitions, and casework work well together within the new or existing building structural framework. Some factors that affect the establishment of the lab module are:

⇒ the number of people working in the lab

⇒ the required length of continuous lab work surfaces per investigator

⇒ the width of the aisles in between benches

⇒ the number of fume hoods per laboratory

Lab support, offices, and corridors, can be planned to adhere to a basic module so that a high degree of flexibility is achieved.

Upon discussing user needs and spatial functions with VA investigators, it was decided that 3200 mm (10'-6") on center is a comfortable laboratory module width. The depth of the laboratory module is strongly influenced by safety considerations and codes. It is recommended that VA labs will utilize a 9300 mm (30'-6") on center lab module depth to sufficiently allow for adequate Equivalent Linear Footage (ELF) of bench space per investigator and to provide a secondary means of egress and equipment space. These module dimensions are strictly guidelines and should be evaluated for each project.

In renovation projects, the 9300 mm (30'-6") module depth can be maintained by removing existing partitions and orienting benchwork parallel to the corridor. These two neighboring spaces combine to form the new larger lab.

Once a module is chosen for a project, it forms the floor plate for the entire facility. It is essential that all labs and support spaces follow the established module. A great advantage to implementing the module system is the ability to convert research space with minimal interruption to the neighboring areas.

In cases where the research facility is separate from the Medical Center, the idea of future expansion is an important consideration. When possible, anticipate a master plan that reasonably allows for future growth.

Space Relationships: (See Section 3, Relationship and Generic Layout Diagrams)

Ideally, the research facility should be located near the Veterinary Medical Unit so that

specimens may be transported easily. A dedicated elevator can be used to connect these two areas in a vertically planned facility.

When possible, lab facilities should be conceived with a central-core approach. The central-core contains spaces (cold rooms, common instrument rooms, glassware room, and ultralow freezer rooms) and utilities necessary to support individual labs. Laboratory support spaces may be located on either side of the central core, separated by the main corridor. Investigators' offices should be planned as close as possible to the labs without taking space from the lab zone. To foster staff interaction, the offices should be grouped in clusters.

The "laboratory neighborhood" diagrams in Section 3 represent a planning concept that brings together all of the resources that researchers use on a daily basis. Lab neighborhoods include labs, lab support spaces, offices, and all shared equipment. They are successful in biological science labs because there is no need to duplicate expensive support spaces. Due to this sharing effort, lab neighborhoods create a sense of community by encouraging interaction among the lab workers.

Appropriate relationships and adjacencies are essential to permit a smooth flow of personnel, supplies, and equipment. Traffic flow is predominantly from laboratories to the core and administrative areas and then back to the laboratories. It is important that the distance between laboratories and common instrument rooms be as short as possible since samples, chemicals, and flammable materials are transported between the two areas. Several small rooms are preferable to one larger room for core items such as gamma counters, high-speed centrifuges and ultra centrifuges. As a result, these spaces can be placed in various locations in the center area and thus shorten the traveling distance throughout the laboratory area. In a large facility (with multiple floors or wings), it is important that several flammable, acid, and gas cylinder storage areas be located along exterior walls throughout the facility (or floor) for safety reasons.

Specialized areas (PCR, NMR, electron microscope, confocal microscope, cell irradiator) have specific requirements because the equipment housed there is particularly sensitive to vibration, heat, light, or a combination of factors. These requirements involve isolating certain specialized areas from mechanical rooms, dumbwaiters, and elevators.

Materials handling zones adjacent to dedicated service elevators allow for ease of dispensing and disposing of lab materials and supplies. The administration area should be located in an area separate from the traffic generated by the laboratory and close to elevators. In a single story facility, locate the administration area at one end, or in the center core of a one-floor "cross" design.

Renovation:

A considerable number of future VA Research Laboratory Facilities will be renovation projects as opposed to new construction. This includes both complete renovation of an existing facility as well as adaptive re-use of a facility. In general, the cost for renovation is lower than for new construction.

The existing VA facility must first be evaluated for the building's ability to house a modern research laboratory. There are certain requirements which must be met to indicate if the building would be suitable for renovation: a floor to floor height of 4200 mm (14'-0"); a live load capability of 500 kg/m² (100 psf); and a structural grid based on a module of 6000 mm (20'-0") to 7200 mm (24'-0") that will readily accept the lab module.

A general assumption must be made that the existing building's infrastructure will not fulfill the demands of a research program. The renovation must address increased needs for air supply, exhaust, chilled water supply, steam, and electrical power.

Communication:

The single most frequent source of user dissatisfaction during both the design and construction phases is the lack of clear communication and interaction among parties with an interest in and responsibility for the project. The Office of Construction Management selects the architecture/engineering firm (A/E) with VA Medical Center representation on the Selection Board. The A/E bases their design on established VA criteria. Costs are fixed at the end of design development, therefore extensive changes must be avoided beyond this point. Plans should be reviewed by a representative from the Research staff, the Administrative Officer, and the Associate Chief of Staff for Research at VA Central Office. At each phase, the reviewers must examine the plans thoroughly. Planning changes and design errors need to be addressed as early as possible to avoid costly change orders during construction.

The Office of Construction Management at VA Central Office assigns a Resident Engineer (RE) to a project prior to beginning construction. The RE is responsible for assuring that construction proceeds on schedule, stays within the budgeted cost and follows plans and specifications bid on by the contractor. Interaction between the RE and user representatives is crucial. The project coordinator, who may be either the Chief of the VA Medical Center Engineering Service, or another individual assigned by the VA Medical Center Director will have frequent contact with the RE. During construction, the Research staff representative and the VA Administrative Officer should be afforded the opportunity of touring the site at monthly intervals.

Engineering Considerations:

Electrical (Emergency power, power requirements, lighting):

Power needs for research laboratories far exceed those for typical commercial buildings. In

recent developments of research laboratories there is less dependence on gases and water than there is on electricity. Research is no longer bench bound; there is more writing and use of plug-in electronic devices.

Critical information regarding equipment needs and operations is required for each laboratory unit early in the design phase of the project. In the past, new equipment purchased for a VA facility was considered in the electrical power calculations; however, equipment moved from a previous VA facility to the new lab needs to be anticipated also. One solution is to allow a 10% over-design for the number of outlets in labs.

In laboratories, the total building load for preliminary design purpose is 430 W/m² (40 W/ft²) connected load with 160 W/m² (15 W/ft²) demand load at the power panels. Electrical power panels are to be located along the corridor for access by maintenance workers. Where access to electrical panels is restricted, consideration should be given to providing spare conduits inside the labs.

An emergency power system (including provisions for alarms wired to a centrally monitored station) for the following should be given significant consideration: elevator exits for disabled people, freezers, refrigerators, incubators, controlled temperature rooms, fume hoods, tissue culture areas, and other equipment responsible for maintaining costly experiments. Approximately half of the 120 V outlets in common instrument rooms are to be on emergency power.

Outlets should be clearly marked (color coded) so users can readily identify the proper type of power. Particular attention should be directed to each work station area within the laboratory to provide duplex 120 V - 20 A commercial power, and 120 V - 20 A emergency power as required. Laboratories are designed with enough 120 V circuits for the known equipment plus 20% spare circuits for future loads. (In calculations, each circuit should be loaded with no more than 1200 W.) Each laboratory unit needs adequate 208 V single phase receptacles to accommodate large

equipment such as high speed centrifuges. Critical equipment such as refrigerators, freezers and ultra-low temperature freezers may also require 208 V - 20 A emergency power receptacles. An automatic data processing (ADP) outlet should be appropriately located to provide access to local area networks. This will also provide access for environmental and equipment monitoring devices and alarm systems. Laboratories require duplex outlets along the benchtops at 610 mm (24") on center for bench equipment and computers. In areas designated for free standing equipment, duplex outlets shall be placed at 915 mm (36") on center.

Walk-in refrigerators (cold rooms) intended for procedures shall be provided with at least one outlet on each wall. Common instrument areas need to have dedicated 120 V strip outlets, in addition to occasional 208 V outlets. Determining the appropriate number of 120 V and 208 V outlets for common instrument rooms requires close collaboration between Research personnel and the A/E firm.

Hallways need outlets for maintenance purposes, but these outlets will not be on the same circuits as outlets located in labs, shared support areas, or offices.

In general, the more detailed a task, the higher the illumination required to perform it with accuracy. VA laboratories require 1080 lx (100 fc) for benchtop level lighting. A minimum of 810 lx (75 fc) is acceptable with minimum glare and maximum efficiency. Where the correct identification of color is important, special color-corrected lamps may be necessary. Energy efficient light fixtures with individual room switches should be considered as an aid in conserving energy.

Note: Electrical design information is located on the Design Standards accompanying the guide plates. See the VA Electrical Design Manual for further information.

Mechanical (Heating, Ventilating, and Air Conditioning):

GENERAL:

The HVAC designer shall coordinate with the VAMC Research Service Staff, Architect, Equipment Designers, and others as required, to satisfy the mechanical needs of the laboratory facility specified for the project. Equipment selection and location should be finalized early in the design stage to avoid redesign and schedule delays. Heat producing equipment for present and future use must be identified, quantified and satisfied.

The following represents the highlights of the HVAC system design for VA Research Laboratory facilities.

HVAC SYSTEM:

Laboratory, Specialized, and Support Areas: Lab areas should have a dedicated air handling unit, 100% outdoor air, a minimum of 12 air changes per hour of room supply air, a negative room pressure created by exhausting 15% more air than is supplied, a room noise level not to exceed NC-45, and room conditions of 24°C (76°F), 50% RH in summer, and 22°C (72°F), 30% RH in winter. See individual guide plates under Sections 4, 5, and 6 for these areas.

Fume Hood Exhaust: The ventilation system for the fume hood exhaust should conform to OSHA Regulation 29 CFR, Part 1910. The VA HVAC Design Manual shows exhaust air quantities for hoods based on sash openings of 710 mm (28 in.). Fume hoods with 450 mm (18 in.) sash stops may be specified to reduce the required fume hood exhaust and result in energy savings and noise reduction. This should be coordinated with the users.

Auxiliary make-up air hoods should be avoided due to energy cost for tempering air in winter, the discomfort caused by unconditioned air in summer, and drafts discharging directly onto the operator's head. This is discouraged by ANSI/AIHA Z9.5-1992, Laboratory Ventilation.

Polyvinyl chloride (PVC) coated galvanized ducts may be used for fume hood exhaust in lieu of stainless steel, except for perchloric hoods, which still require welded stainless steel ducts. As required by OSHA, the exhaust air from fume hoods should be terminated 3000 mm (10 ft.) above the roof level with a minimum discharge velocity of 15 m/s (3000 fpm). (More information on fume hoods is contained later in narrative discussion.)

System Type: The system may be either constant volume or variable air volume (VAV) based on life cycle cost analysis. Use of room by-pass is generally preferred by users in lieu of the integral hood by-pass. The use of room by-pass versus integral hood by-pass should be verified with the user, and requirements in PG-08-1 also should be verified and adjusted accordingly to ensure the project specifications reflect the user's requirements.

The constant volume system is less complicated and more easily balanced to maintain the necessary room negative pressure. VAV systems should be designed for a minimum 12 air changes per hour with a reduction to 6 air changes per hour for reduced loads. The reduction to 6 air changes per hour should also be verified to match the hood exhaust requirements. Controls for sash position and air flow control valves should be of industrial grade quality. The designer should note the following ASHRAE statement, "The decision to select a variable volume exhaust system should not be made without the understanding and approval of the research staff and local safety officials. The level of sophistication and ability of the maintenance staff to maintain such a complex system is also an important consideration."

Future Capacity: Refer to equipment sizing criteria in the HVAC Design Manual.

Shafts: Exhaust air from fume hoods, ducts carrying flammable vapors, and piping shall not be installed in the same shaft used for movement of environmental air as per NFPA 90-A.

Noise: Excessive noise and inadequate testing and balancing of the air system, especially the fume hoods, are common problems that must be

addressed. The designer must comply with the VA HVAC Design Manual requirements for sound calculations. Sound attenuation in the ductwork should be provided, as required, to achieve desired sound levels. Maintain air velocity through the exhaust ducts within the ASHRAE recommended range of 5 to 6 m/s (1000 to 1200 fpm). Lower range of velocity is preferred to achieve desired sound levels. Specifications shall reference compliance with the Associated Air Balance Council or National Environmental Balancing Bureau testing and balancing procedure for fume hoods.

The 5 dB room attenuation credit should not be taken in hard surfaced rooms, as is the case in many laboratories. Noise levels of NC-50 to NC-55 are not uncommon in laboratories. Biohazard safety cabinets with their internal HEPA filters and fans may have sound ratings of 63 to 67 dB (approximately NC-60) and are inherently noisy. Sound ratings for fume hoods are not published but are believed to be in the range of NC-40 to NC-50. Where it can be shown that the design noise level (NC-45) cannot be achieved, the designer may specify a higher value subject to VA approval.

Local and Remote Alarms: Coordinate with research personnel and engineering staff to identify critical points to be monitored with readouts and alarms at the Engineering Control Center (ECC) and/or local panels. For example, the temperature in controlled temperature rooms and the status of air flow for fume hoods should be continuously monitored, and a local audible and visible alarm, and alarm at the ECC for each fume hood and biological safety cabinet should be provided. See individual guide plates under Sections 4, 5, and 6 for other requirements that must be met.

Cooling Loads: Common instrument rooms and ultralow freezer areas contain numerous heat producing items which must be reflected in the cooling loads.

Air Distribution: The Microtome/Cutting Room air distribution system must be designed so that there are no drafts at the cutting tables.

Intake Louvers: Ensure that intake louvers are located to prevent entry of contaminated air. See recommendations listed in the HVAC Design Manual.

Location of Exhaust Fans: Exhaust fans for fume hoods and biological safety cabinets should be located at the end of exhaust ducts to maintain negative pressure in the exhaust ductwork inside the building.

Emergency Power: Emergency power shall be provided to equipment such as exhaust fans serving fume hoods, Flammable Storage Rooms, and Reagent Grade Water Treatment Rooms, and to other equipment listed in the HVAC Design Manual.

Note: Refer to the VA HVAC Design Manual for further design recommendations. Pertinent design information is shown on the Design Standards page accompanying the guide plates.

Plumbing:

Use chemical resistant waste and vent pipe for all laboratory sinks and equipment intended to receive acids and chemicals. Route the waste through a chemical neutralizing device prior to connecting to the drainage system. Extend the acid system vents through the roof separately.

Provide a reagent grade water piping system, without dead ends exceeding 300 mm (12"), to all required locations within the building. Piping for reagent grade water systems must be arranged in a loop and/or continuously recirculating configuration to eliminate stagnant water conditions. Size the piping for a minimum velocity of 8 minutes per second. Provide floor space, with valved and capped hot and cold water and a chemical resistant combination floor/funnel drain, for a central reagent treatment system. The reagent water treatment equipment will be selected to produce the degree of treatment required and furnished by the VA Medical Center.

Air compressors and vacuum pumps shall be multiplexed with single receivers. The units shall be sized so that 100 percent of the design

load will be available with any one unit out of service.

Provide a minimum of 240 kPa (35 psi) water pressure at the highest fixture. Coordinate this pressure with other equipment requirements; some special washers require pressures above 275 kPa (40 psi).

Lab facilities need a recirculating domestic hot water system with 50°C (120°F) water available at the tap.

Design a wet pipe fire sprinkler system with quick response sprinklers throughout the building in accordance with NFPA 13. In multi-storied buildings, provide fire protection standpipes in accordance with NFPA 14.

Note: Refer to the VA Plumbing Design Manual for additional information. All plumbing systems shall be designed in accordance with the latest National Standard Plumbing Code. Plumbing information is located on the Design Standards accompanying the guide plates.

Energy Conservation:

Energy conservation begins at the macro level with building siting and envelope, and it continues to the micro level inside the energy-intensive Research Facility. For example, freezer rooms and cold rooms may be located back-to-back or side-by-side to save energy. Where economically feasible, ultralow freezers should be grouped together in one location and heat recovery systems for non-fume hood exhaust should be considered, if found cost effective through life cycle cost analysis.

Zoning of spaces, and separate air handling units for the administrative areas do result in energy conservation. Turning energy systems off will save the largest amount of energy. If it is feasible, heating, ventilating, and air conditioning systems should be on only during the hours of lab operation. If the ventilation system cannot be turned off, the next best approach is to reduce the airflow to the minimum required at all times. This practice may be done in each lab independently by turning down or off a chemical fume hood when it is not in use. However,

minimum air changes and negative room pressure must be maintained in occupied labs. Refer to the VA HVAC Design Manual, section "Energy Conservation."

Concerns Specific To Research Facilities:

Finishes:

Interior finishes selected must allow for ease of cleaning and provide a pleasing work environment for Research staff. Early communication between Research staff, Interior Designer, and Architect is necessary to achieve successfully the desired finish.

The finishes in labs must be impervious to contaminants and able to withstand washing with detergents. Lab floors should be of a non-slip finish. Common instrument rooms have latex mastic floors and coved bases to allow for ease of maintenance. Since common instrument rooms and specialized equipment rooms (NMR) often house equipment of considerable weight, floor loading capacity should be determined early in the project design phase.

Laboratory ceilings should be set at a minimum of 2700 mm (9'-0") from floor to ceiling, with 600x1200 mm (2'x4') acoustical tile. If a 2700 mm (9'-0") ceiling height is planned, call for a fume hood sash that will open fully within the space. Ceilings in glassware washing rooms and biohazard containment labs are required to be gypsum board or plaster to tolerate the treatment of water and detergents.

Walk-in refrigerator and freezer rooms consist of prefabricated units designed for field assembly. The inside facing of walls and ceilings are stainless steel metal finishes. Metal casework and shelving must be rust-resistant. Lighting fixtures should be of watertight design.

Note: Finishes are noted on the Design Standards pages accompanying the guide plates.

Doors and Hardware:

Doors should swing out from laboratories as a means of safe egress; however they can create hazardous conditions by blocking the corridor traffic if not recessed into an alcove. VA labs typically have doors that swing into the lab; however, when corridors are wide enough, the doors should swing out. In new construction with 1830 mm (6') wide corridors, 1120 mm (3'-8") door widths are appropriate permitting larger equipment to be moved into the lab.

Doors to laboratories and offices should be of a metal or metal clad type, with sound deadening material applied to the inside and a viewing window of shatter-proof glass. Doors to laboratory units should be self-closing and lockable. Doors to offices shall be lockable but not self-closing. Cylinder handles rather than knobs are preferable in laboratories to facilitate ease of opening. All doors shall be provided a full width kick-mop plate to a minimum height of 250 mm (10") from the bottom of the door. All doors will conform to current NFPA fire rating codes. Floor mounted door stops should be provided when wall mounted bumpers will not provide an effective stop mechanism. Floor mounted stops need to be positioned so as to provide unobstructed movement of equipment and pedestrian traffic.

Furniture:

Furniture may include laboratory equipment or casework.

Laboratory equipment is usually metal with a chemical resistant coating to resist corrosion. It includes but is not limited to tables, cabinets, shelves, sinks, etc., and is usually installed by the General Contractor. It is generally specified for technical areas.

Casework may include laboratory equipment, but is more likely to be used in administrative areas. It has more general use and is likely to have more combinations of colors and textures than laboratory equipment. It can be plastic, metal, or wood. It is often installed by the manufacturer under a separate contract.

Casework and laboratory equipment should be addressed early in the facility design phase. Consideration will be given to functionality without sacrificing safety and comfort. As the design is developed, attention should be directed to utility and equipment configurations as well as to the type and number of fume hoods required and their placement in the laboratory. When feasible, modular or adjustable systems should be employed in common core areas as an alternative to fixed casework thus offering maximum flexibility for future needs.

With the increased use of electronic equipment, more work is done by researchers sitting in a U-shaped array of instruments. The modern researcher less often stands at a bench; he or she sits at equipment. The traditional fixed work top does not allow for flexibility, so free standing benches are advantageous. To provide ultimate flexibility, sinks are built into the benches where required, but are connected to the main drainage system by plastic pipes with screwed connections. The spines behind the benches are two levels; the low level for gases and water, and the upper level with nearly continuous electrical outlets.

Self-supporting casework systems allow great flexibility as they exist independent of a partition. The piping and electrical systems become an integral part of the casework as in traditional systems. The components are interchangeable and have flexible features built-in. The drawback to these systems is that they require substantial storage space when not in use.

Placement of dry-erase boards along the corridor walls and in gathering areas encourages investigators to discuss their work with other researchers.

Glassware Washers And Dryers:

Washers and dryers are used to wash, dry, and sanitize; they do not sterilize. This equipment can be heated by steam or electrical power with steam heating having a lower operating cost. In planning glassware rooms, the following should be kept in mind: floor drains

must be large enough to accommodate the vast quantities of water disposed by the washers (a large floor sink with a minimum 100 mm (4") outlet); vapors produced by the machines need to be vented; and, the walls between the glassware area and adjoining rooms should be acoustically treated due to the high noise factor. There is also an increasing need for high temperature dryers for glassware used in RNA work. Highly contaminated areas also need their own sterilization and glassware washing equipment.

The location of washers and dryers needs to allow maintenance crews access to the equipment for repairs. The space behind the washers should have a floor drain to accommodate any leakage by the equipment. An exhaust canopy over the chamber opening to both the washers and dryers vents steam vapors.

Note: Operation and maintenance manuals for all equipment should be secured in the administration area to insure proper equipment care.

Reagent Grade Water Systems:

Reagent grade water systems are important for performing contaminant-free experiments in the lab, and for the final rinse in the glassware and sterilization room. The four basic methods of producing pure water are: distillation, deionization, reverse osmosis, and filtration. Depending on the contaminants in the water supply, and the Reagent Grade Type (purity level) of water needed, one or more of these methods will be indicated.

A raw water analysis must be done before a purification method can be selected. Equipment sizes vary greatly depending on the method selected, and the flow rate required. Where use is limited, or purity requirements stringent, point-of-use cartridge-type polishing stations can be provided. Where there is a strong need in all laboratories, a central system should be considered from the onset of design.

Security:

VA laboratory facilities are utilized 24 hours a day, thus requiring tight security. The location and layout of laboratories and specialized areas must be planned so as to restrict visitors as much as possible. The laboratory/core area should be located on a level other than the main entry floor of the building with access from keyed elevators which do not open into the receiving area on the main level. Access to the individual laboratories can be by a standard key system. Electronic perimeter security to the lab area is necessary if labs are adjacent to clinic and/or public areas.

Life Safety:

In order to achieve the desired quality of life in laboratories, a safe and secure work environment for investigators must be provided. Laboratories conducting procedures involving pathogens or carcinogens must be designed to eliminate cross-contamination. A safe environment can be maintained by: providing positive pressure for clean rooms; negative pressure and prohibition of recirculation of air from contaminated areas; adequate ventilation; and proper air filters. Air locks at entries to these areas and decontamination areas (shower and clothes changing rooms) may be needed for personnel.

In addition, emergency showers are located in the hallways with a contrasting spot painted on the floor to indicate the shower location, with the number of showers per area to be based on Occupational Health and Safety Agency (OSHA) requirements. There are no drains below emergency showers in corridors because of their infrequent use. Lastly, the emergency shower water should be tempered for a person to endure the full 15 minute wash. To permit privacy, selected showers should have curtains so that contaminated clothing may be removed. Eye and face wash units should be installed on the gooseneck faucets of sinks in each lab and in lab support areas where chemicals are used.

Materials Management:

Materials management involves storing lab materials and supplies as well as storing and disposing of chemical and biohazardous waste.

Hazardous chemicals in one area should be compatible (not cause dangerous chemical reactions), use storage space well, and be convenient to store and retrieve in addition to being near the loading dock.

Flammable liquid storage cabinets in the laboratories are intended to protect the contents from the heat and flames from outside the cabinet. These OSHA approved cabinets should be located remotely from operations in the lab which could lead to fire. The cabinets are not required by NFPA 30 to be ventilated. In addition to the provision for a few days' chemical supply in each lab, there should be a central chemical storage room for bulk supplies. Chemical storage rooms need open shelves with edge lips, cabinets for toxic materials, and exhaust hoods over unsealed toxins. Chemical storage rooms typically utilize a water fire sprinkler system.

Compressed gas cylinders, as well, need dedicated storage with local exhaust hoods to remove possible gas leakage. This room should be located along an exterior wall with a blow-out panel for each 1.1 to 1.7 m³ (40 to 60 ft³) of volume as outlined in NFPA-68 and more specifically in NFPA 55. Gas cylinders should be secured in supports designed to provide flexibility.

Disposal Of Waste:

VA laboratory facilities designate an area or areas for collecting and storing hazardous chemical, biological, and radioactive wastes before disposal. The disposal area should be located with reasonable proximity to the elevators which connect to the loading dock area for convenience of waste disposal. The disposal of waste depends in large part on local Medical Center policy and OSHA regulations. General waste consisting of paper and glass should be

stored in a separate area of the facility not associated with hazardous waste.

Fume Hoods:

The main purpose of a fume hood is to contain and dispose of the effluent generated by work performed inside the hood. It is a safety device to protect the users from hazardous chemicals as outlined in ANSI Z 9.5. Fume hoods should not be located closer than 3000 mm (10'-0") to the primary exit door for two reasons: the traffic past the hood may cause a backdraft into the laboratory, and fume hoods may be the location of an explosion or fire thereby blocking the path of exit. Strict attention must be paid to fume hood safety; including color-coding utilities, installing automatic dry fire extinguishing systems, prohibiting the presence of spark producing devices (outlets) inside the hood, and proper signage for use and warnings.

Biological and chemical stand-alone hoods (ductless) with HEPA filters are more flexible than fixed hoods which must be connected to dedicated exhaust ducts. They allow for flexibility as to location, and lower first cost due to the elimination of ductwork and exhaust fans. However, their use is limited because they are not compatible with certain chemicals used in laboratories. The air purification system in the fume hood must be evaluated for each chemical used.

A fume hood exhaust system may serve up to four chemical hoods. This combined system may be used because vapors drawn through the hood are diluted to such low levels that chemical reactions yielding significant energy levels are highly unlikely. Consider aligning hoods back-to-back to save on ductwork. Separate dedicated exhaust systems are required for biosafety lab cabinets, radioisotope hoods, and perchloric-acid hoods. The combination vertical and horizontal sash in 1800 mm (6'-0") fume hoods should be considered, as they better control the amount of air through the hood. Fume hoods with larger exhaust discharge collar sizes tend to reduce noise.

Fume hood noise is a common complaint among laboratory users. (See "Mechanical Considerations" in narrative discussion.)

Any provisions for the addition of future fume hoods must be provided in the initial planning stages, including supply and exhaust air, plumbing, and electrical. However, caution should be exercised to ensure that any extra initial cost for future provisions is not wasted. Interstitial floors above Research Laboratories would better provide for additions and relocation of fume hoods. The VA Building System (interstitial space) lends itself to future design of the mechanical and electrical systems with less disruption to occupied space.

Bibliography

- Weeks, John. "Laboratories for Medical Research." World Hospitals, Vol. XVII, No. 2, May 1981.
- Braybrooke, Susan, ed. Design for Research. New York: John Wiley & Sons, 1986.
- Ruys, Theodorus. Handbook of Facilities Planning, Volume 1. New York: Van Nostrand Reinhold, 1990.
- Lees, R., and A. F. Smith, ed. Design, Construction, and Refurbishment of Laboratories. Chichester, England: Ellis Horwood Limited, 1984.
- Diberardinis, Louis J., et al. Guidelines for Laboratory Design: Health and Safety Considerations, 2nd ed. New York: John Wiley & Sons, 1993.
- Arcidi, Philip. "Inquiry: Laboratories." Progressive Architecture, August 1990.
- Sennewald, Bea. "Flexibility by Design." Architecture, April 1987.
- Cattan, Simon V., P.E., Salvatore X. Debono, P.E., and William W. White, P.E. "Modular Design for High-Tech Laboratories." Consulting-Specifying Engineer, September 1992.
- von Kanel, Hans K. "Standardisation and Rationalisation of Research Buildings and

September 30, 1995

Laboratories." World Hospitals, Volume XVII, No. 2, May 1981.

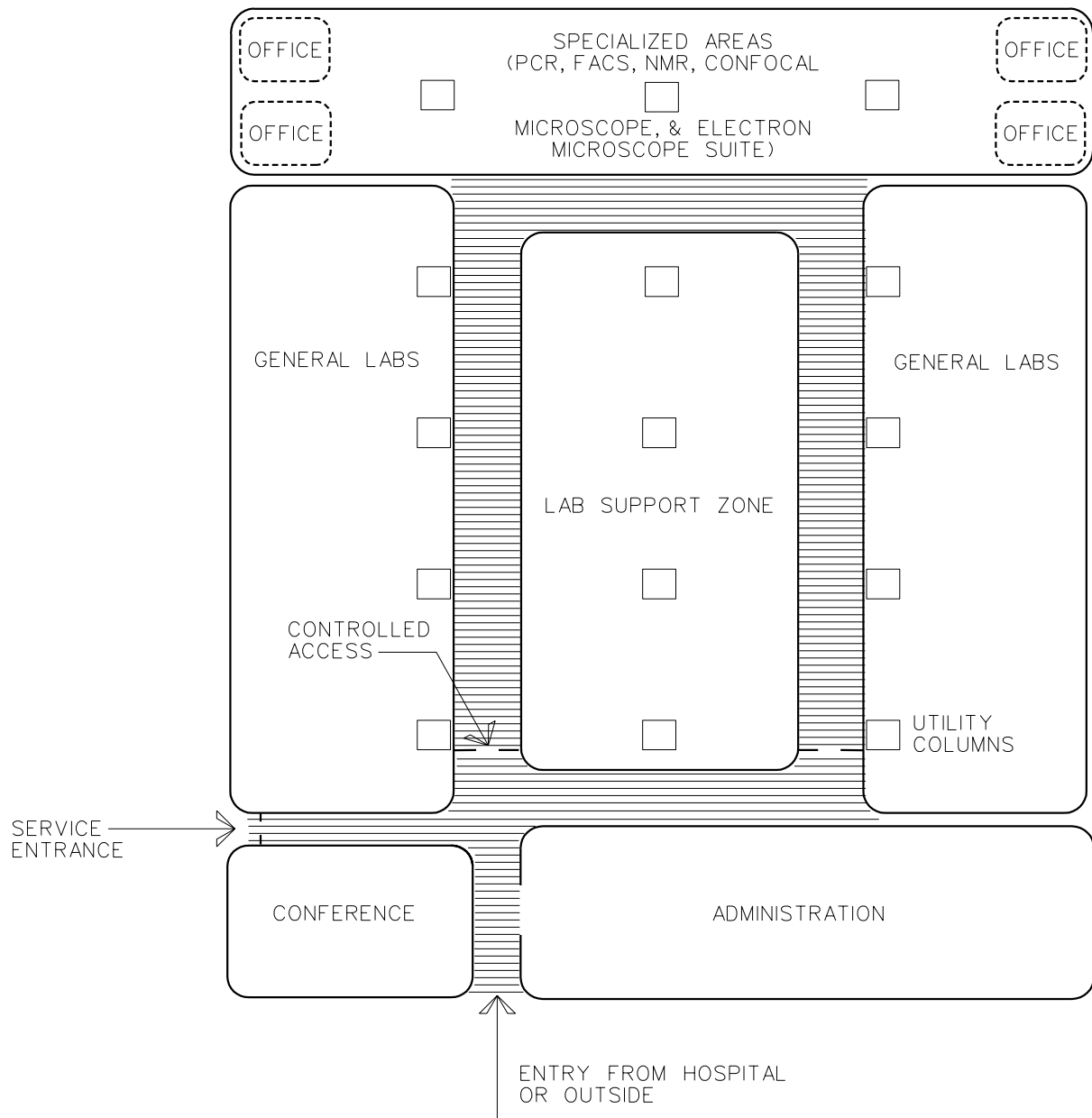
Zeidler, Eberhard H. "Life Cycle Use of Medical Research Buildings." World Hospitals, Vol. XVII, No. 2, May 1981.

Planning Academic Research Facilities: A Guidebook. National Science Foundation, March 1992.

Section 3
Relationship Diagrams and
Generic Layout Diagram

	Diagram
One Lab Neighborhood (Racetrack Corridor)	3 - 1
One Lab Neighborhood (Internal Lab Support)	3 - 2
Large Research Facility — Six Lab Neighborhoods.....	3 - 3
Laboratory Module	3 - 4
Quadruple Module Laboratory	3 - 5
Electron Microscope Suite.....	3 - 6

Relationship Diagram One Lab Neighborhood (Racetrack Corridor)



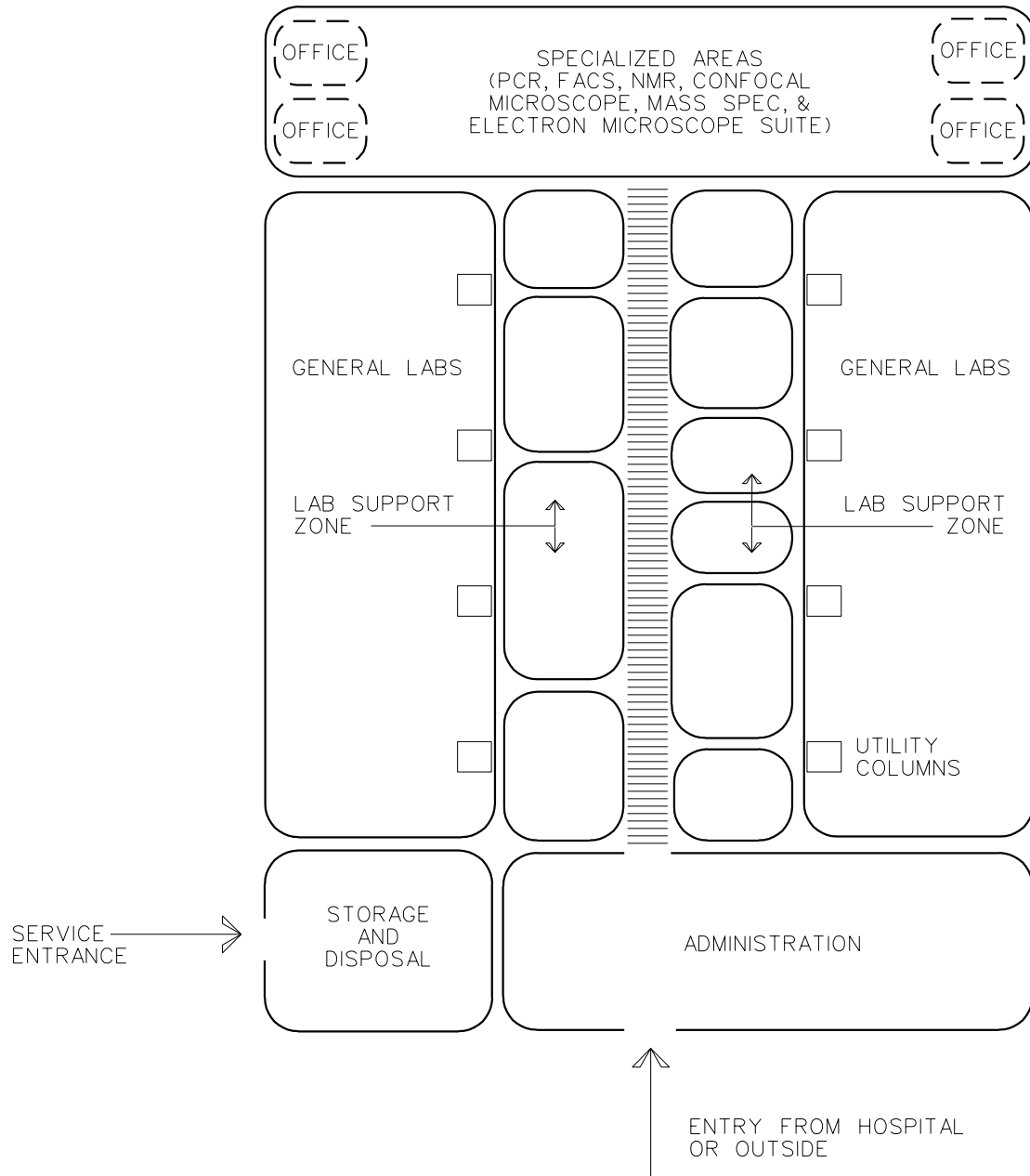
NOTE:
SEE NARRATIVE "SPACE RELATIONSHIPS"
FOR A DISCUSSION OF THE LAB
NEIGHBORHOOD.

NOTE:
IDEAL SIZE FOR A LAB NEIGHBORHOOD
IS 1100 m² (12,000 ft²) INCLUSIVE

LAB SHARED SUPPORT AREAS:

OFFICE AREA
GLASSWARE WASHING ROOM
ULTRALOW FREEZER ROOM
COMMON INSTRUMENT ROOM
COLD PROCEDURE ROOM
DARK ROOMS
TISSUE CULTURE LAB
MEDIA PREP ROOM
STORAGE AREAS

Relationship Diagram One Lab Neighborhood (Internal Lab Support)



NOTE:
SEE NARRATIVE "SPACE RELATIONSHIPS" FOR
A DISCUSSION OF THE LAB NEIGHBORHOOD.

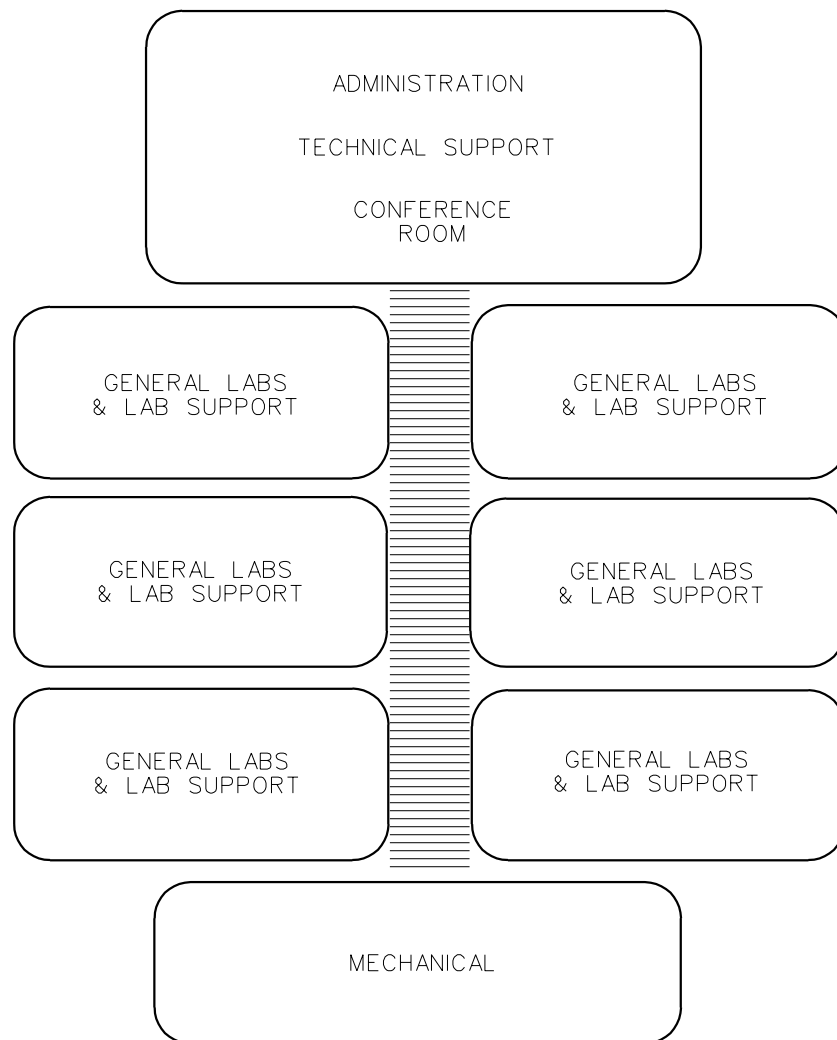
NOTE:
FLOW TO CORRIDOR IS THROUGH
SUPPORT ZONE.

NOTE:
IDEAL SIZE FOR A LAB NEIGHBORHOOD
IS 1100 m² (12,000 ft²) INCLUSIVE.

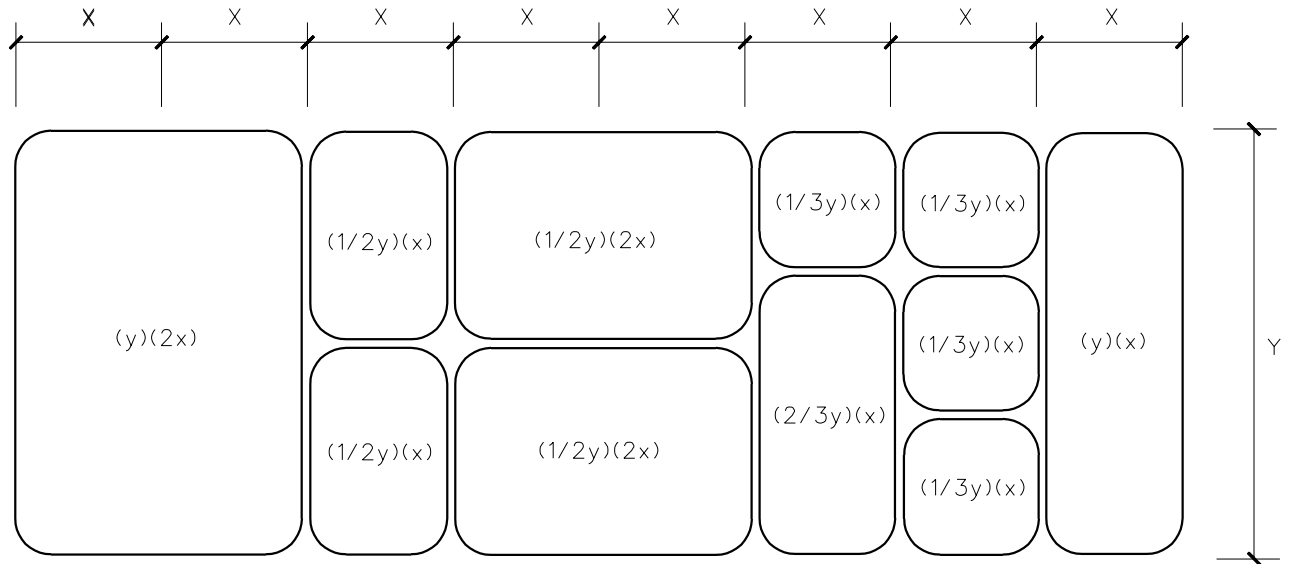
LAB SHARED SUPPORT AREAS:

OFFICE AREA
GLASSWARE WASHING ROOM
ULTRALOW FREEZER ROOM
COMMON INSTRUMENT ROOM
COLD PROCEDURE ROOM
DARK ROOMS
TISSUE CULTURE LAB
MEDIA PREP ROOM
STORAGE AREAS

Relationship Diagram Large Research Facility - Six Lab Neighborhoods



Relationship Diagram Laboratory Module



X = 1 LABORATORY MODULE WIDTH

Y = 1 LABORATORY MODULE DEPTH

GENERAL NOTES:

LAB MODULE WIDTH AND DEPTH MUST BE DETERMINED EARLY IN THE PLANNING STAGE.

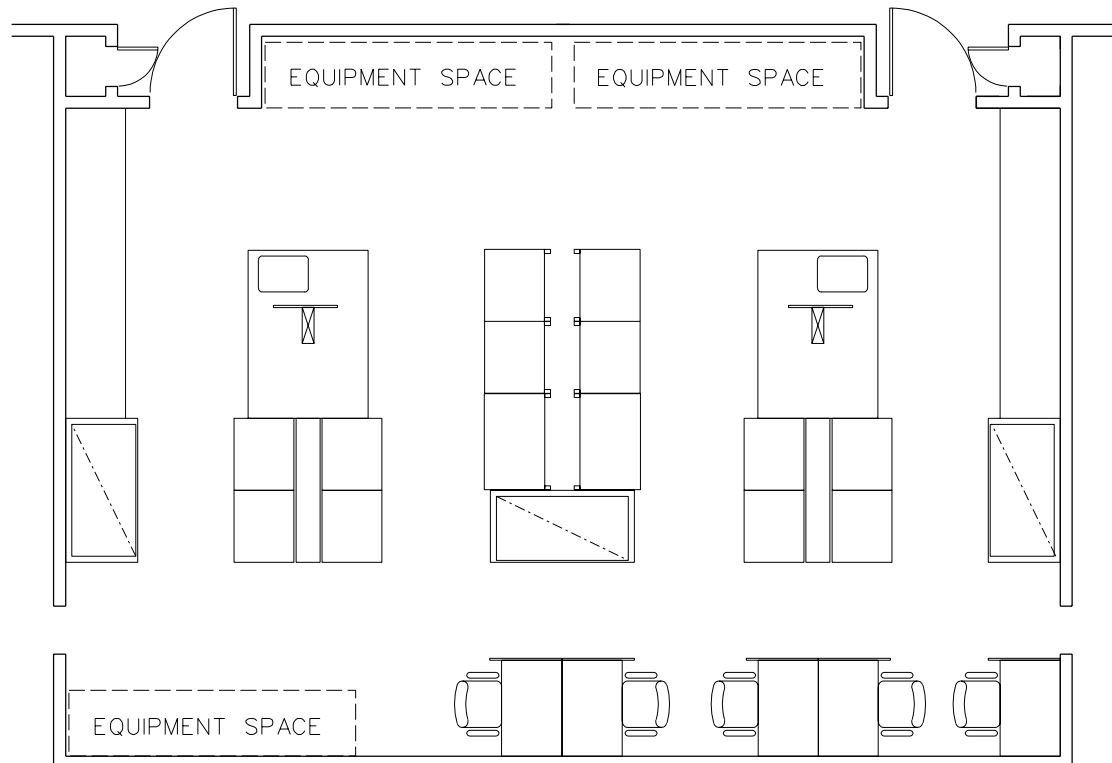
ESTABLISHED MODULE CONTINUES THROUGHOUT FACILITY, INCLUDING LAB SUPPORT AREAS.

SPACE FOR THE CORRIDOR IS GENERATED FROM THE LAB MODULE.

THIS DESIGN GUIDE ASSUMES:

X = 3200 mm (10'-6") Y = 9300 mm (30'-6")

Generic Layout Diagram Quadruple Module Laboratory

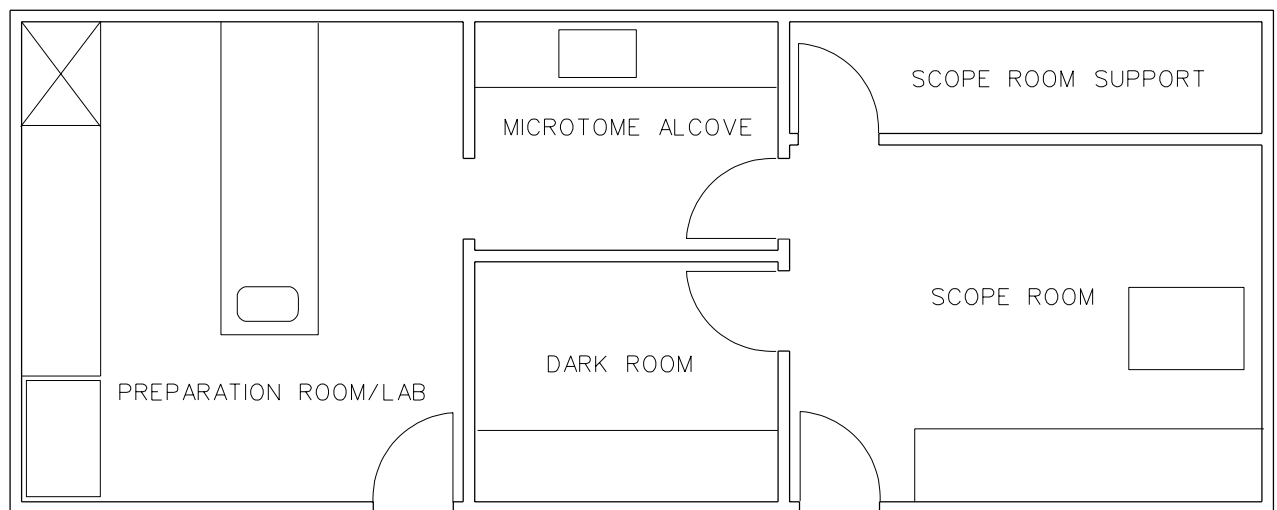


NOT TO SCALE

NOTE:

THIS DIAGRAM EXPANDS UPON THE LAB MODULE CONCEPT. REFER TO SECTION 4 FOR SINGLE AND DOUBLE MODULE LABORATORY PLANS.

Relationship Diagram Electron Microscope Suite



NOT TO SCALE

NOTE:
THIS DRAWING IS SOLELY A
RELATIONSHIP DIAGRAM.
PLANNED SPACES MUST COMPLY
WITH THE ESTABLISHED MODULE.

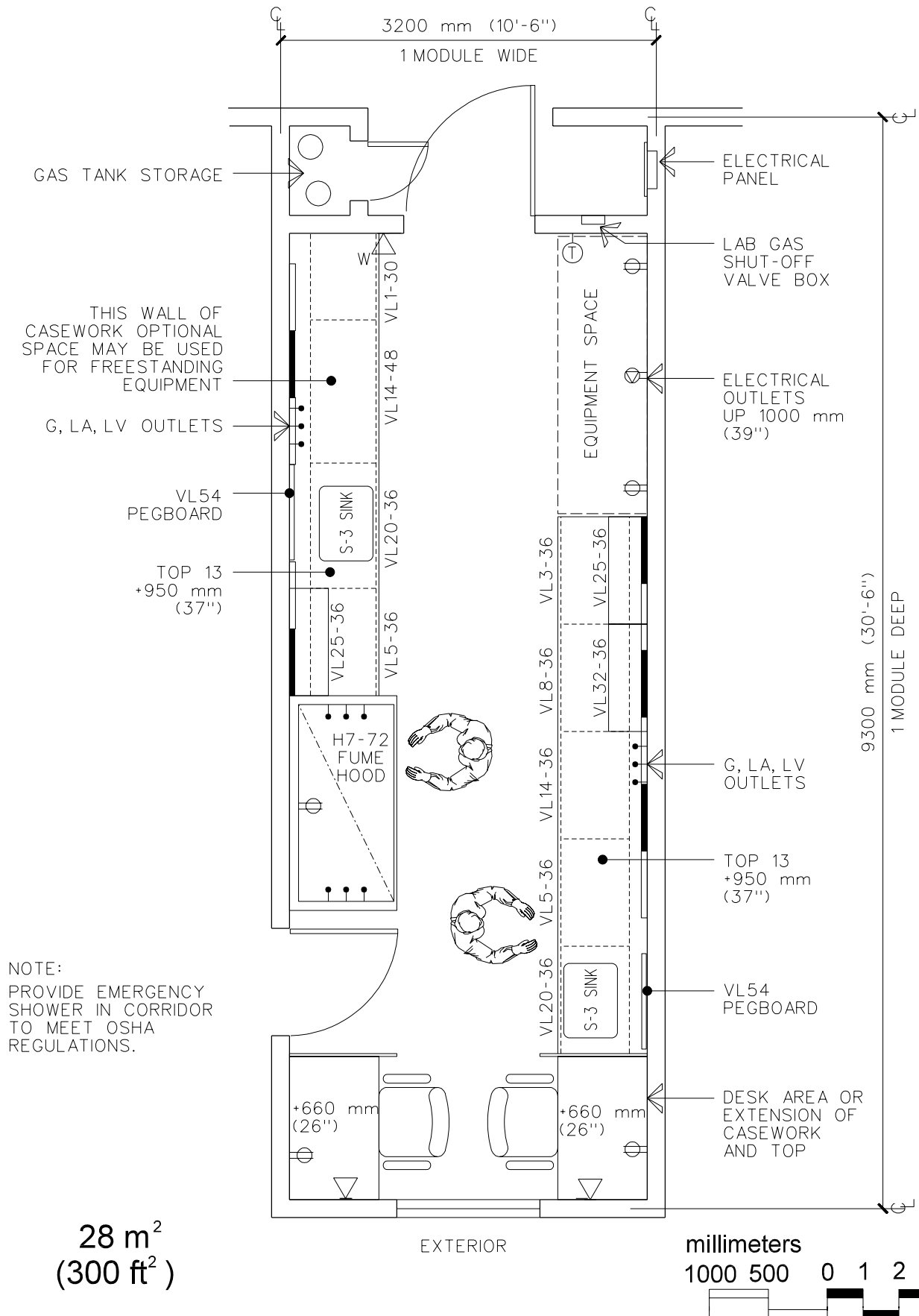
Section 4

Design Guide Plates: Laboratories

Guide
Plate
Series

- 4 - 1 Single Module Laboratory
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 4 - 2 Single Module Laboratory (Accessible)
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List (same as 4-1)
- 4 - 3 Double Module Laboratory I
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List (same as 4-1)
- 4 - 4 Double Module Laboratory II
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List (same as 4-1)
- 4 - 5 Double Module Laboratory III
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List (same as 4-1)

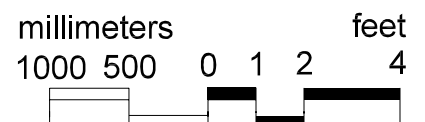
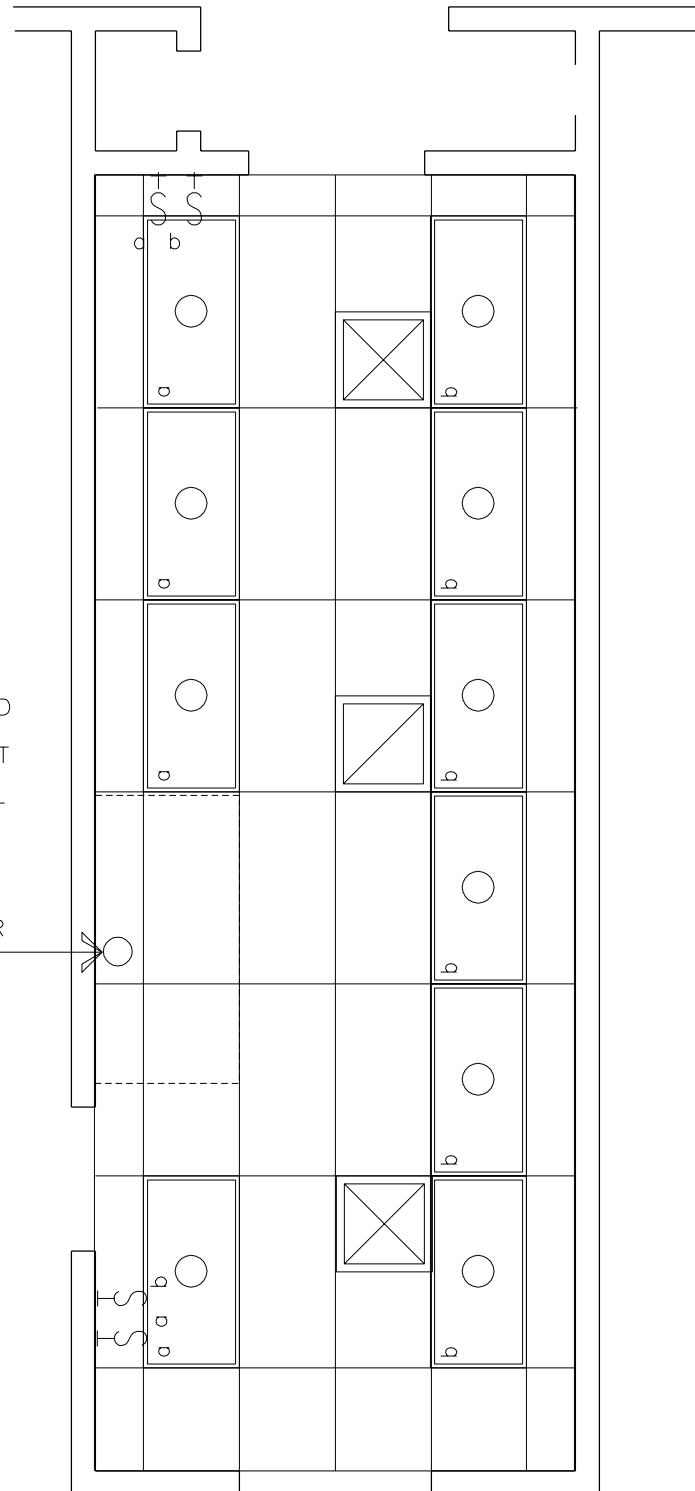
Equipment & Utility Plan Single Module Laboratory



Reflected Ceiling Plan Single Module Laboratory

NOTE:
USE ALL SURFACE MTD
LIGHTING FIXTURES IF
CEILING GRID WILL NOT
ALLOW LIGHTS TO BE
PLACED WITH CENTER-
LINE OVER EDGE OF
WORK SURFACE

CONNECTION FOR
FUME HOOD



Design Standards

Single Module Laboratory

ARCHITECTURAL

Floor Area	28 m ² (300 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9'-0") min*	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-
*2850 mm (9'-6") preferred			

SPECIAL EQUIPMENT

H7-72 Fume Hood			
	Lighting	ELECTRICAL	Power
General	550 lx(50 fc)	General	-
Special	1100 lx (100 fc) task	Special	**
Emergency	-	Emergency	fume hood(s)***
Louvered deep cell parabolic fixtures, T-8 lamps		**Recep: 5000 W, 208 V, 1Ø; Recep: 3000 W, 120 V	
***Fume hood recep: 1200 W, 120 V dedicated circuit			

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	1050 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	52 W/m ² (4.8 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	3	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes****
****H7: 0.65 m ³ /s (1375 cfm), 60 Pa (0.24 inches of water), 724 mm (28½") sash opening			

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

Equipment Guide List

Laboratories, General

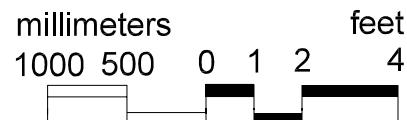
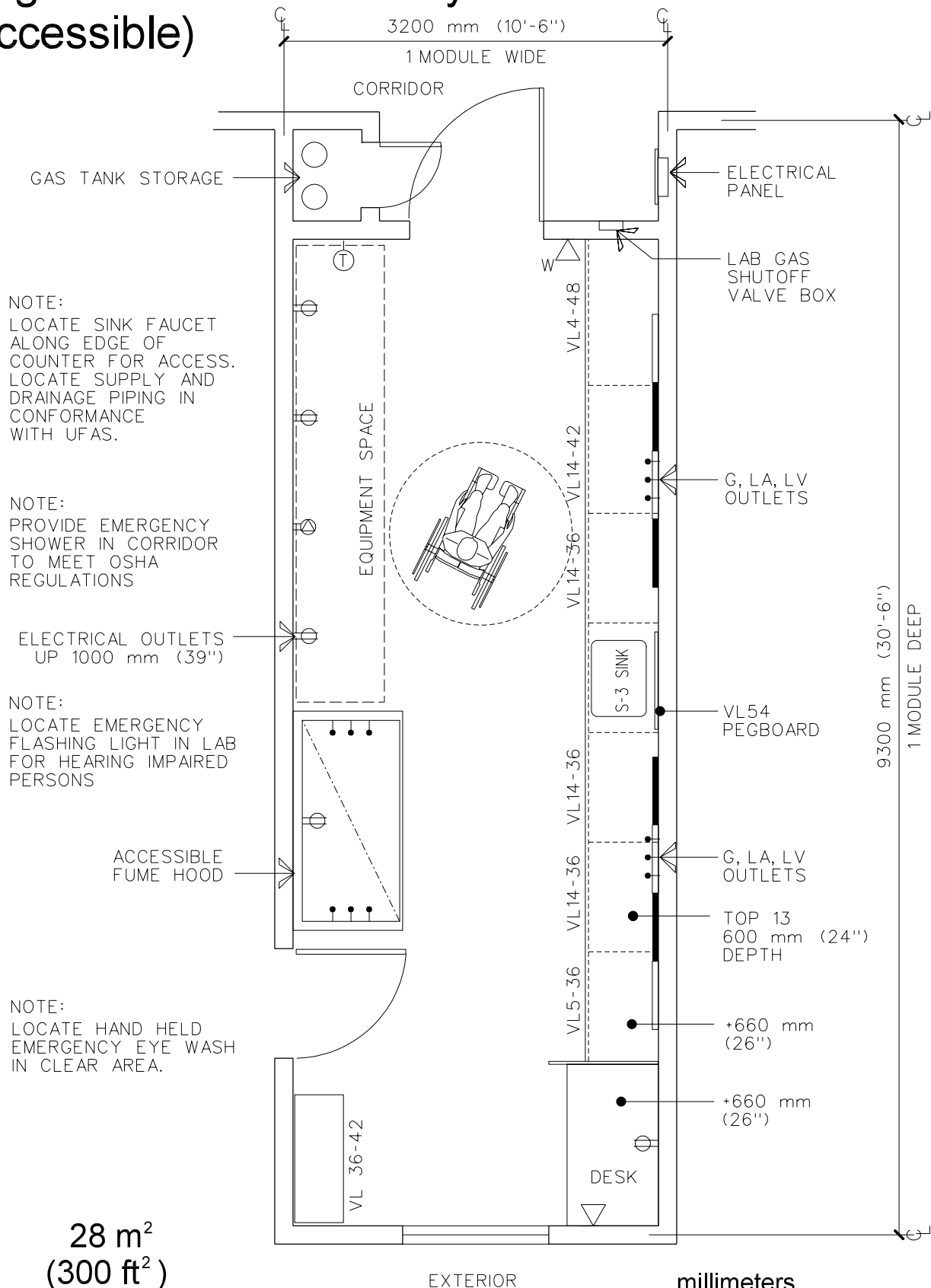
qty	symbol	ai	description
NOTE: IN ADDITION TO VL (FIXED) CASEWORK SHOWN ON THE EQUIPMENT GUIDE LIST; MODULAR CASEWORK MAY ALSO BE SELECTED.			
1	H7-72	CC	FUME HOOD, AIR BY-PASS, 1829 MM X 787 MM X 2438 MM, (72" X 31" X 96") WITH CUP SINK, LAB AIR, FUEL GAS, LAB VACUUM, AND COLD WATER OUTLETS, 120 VOLT, 20 AMP, RECEPTACLES (DEDICATED CIRCUIT) (PG-08-1 & PG-08-6, MCS 11610)
AR	H12B2-48	CC	CABINET, BIOLOGICAL SAFETY (LAMINAR FLOW), CLASS II, TYPE B2, 100% DIRECT EXHAUSTED AIR THROUGH THE WORKSPACE, WITH FUEL GAS, LAB AIR AND LAB VACUUM OUTLET, 120 VOLT, 20 AMP, RECEPTACLE (PG-08-1 & PG-08-6, MCS 11604)
NOTE: THE TYPE (A, B1, B2 OR B3) OF CLASS II BIOLOGICAL SAFETY CABINET REQUIRED FOR ANY GENERAL LABORATORY MODULE WILL BE DETERMINED ON AN INDIVIDUAL PROJECT BASIS BY RESEARCH SERVICE AT THE MEDICAL CENTER. REFER TO GENERAL INFORMATION 16.			
AR		CC	CONNECTIONS, PLUMBING, ELECTRICAL OR MECHANICAL AS REQUIRED
AR	TOP 13/13A	CF	COUNTER TOP, EPOXY, RESIN, WITH DRIP GROOVE, 25 MM (1") THICK, 762 MM (30") DEEP ALONG WALL (PG-08-1 & PG-08-6, MCS 11602)
AR	S-3	CF	SINK, MOLDED, RESIN WITH END OR CORNER DRAIN OUTLET, 635 MM X 457 MM X 406 MM (25" X 18" X 16") (PG-08-1 & PG-08-6, MCS 11602)
AR	VL1/1A	CF	CABINET, UNDERCOUNTER, WITH 4/3 DUST SEAL DRAWERS, WIDTH - 762 MM (30"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL3/3A	CF	CABINET, UNDERCOUNTER, WITH 5/4 DUST SEAL DRAWERS, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL4/4B	CF	CABINET, UNDERCOUNTER, WITH 2 DUST SEAL DRAWERS, 2 HINGED DOORS AND 1 ADJUSTABLE SHELF, AVAILABLE WIDTHS - 762 MM, 914 MM, 1219 MM (30", 36", 48"); DEPTH - 559 MM (22"); HEIGHTS - 787 MM, 635 MM (31", 25"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL5/5B	CF	CABINET, UNDERCOUNTER, WITH 4/3 DUST SEAL DRAWERS, 1 HINGED DOOR AND 2/1 ADJUSTABLE SHELVES, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHT - 635 MM (25"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL8/8A	CF	CABINET, UNDERCOUNTER, WITH 1 DRAWER, 1 DOOR AND 1 ADJUSTABLE SHELF, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)

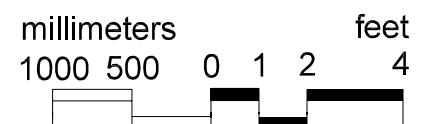
Equipment Guide List

Laboratories, General

qty	symbol	ai	description
AR	VL14	CF	TABLE FRAME, WITH DRAWER(S), KNEE SPACE UNIT, WIDTHS - 914 MM, 1067 MM (36", 42"); DEPTH - 559 MM (22"); HEIGHT - 635 MM (25") (PG-08-1 & PG-08-6, MCS 12345)
AR	VL20/ 20B	CF	CABINET, UNDERCOUNTER, SINK UNIT, 2 HINGED PANEL DOORS, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHT - 635 MM (25"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL25	CF	CABINET, WALL, WITH SLOPING TOP, 2 GLAZED SLIDING DOORS AND 2 ADJUSTABLE SHELVES, WIDTH - 914 MM (36"); DEPTH - 330 MM (13"); HEIGHT - 762 MM (30") (PG-08-1 & PG-08-6, MCS 12345)
AR	VL32	CF	CABINET, WALL, OPEN WITH SLOPING TOP AND 2 ADJUSTABLE SHELVES, WIDTH - 914 MM (36"); DEPTH - 330 MM (13"); HEIGHT - 762 MM (30") (PG-08-1 & PG-08-6, MCS 12345)
AR	VL54	CF	PEGBBOARD, EPOXY, 53 PEGS, 813 MM X 762 MM (32" X 30") (PG-08-1 & PG-08-6, MCS 11602)
AR		CC	OUTLETS, ONE EACH, LAB AIR, FUEL GAS AND LAB VACUUM GROUPED OVER COUNTER (PG-08-1 & PG-08-6, MCS 11602)
AR		CC	FAUCET, REAGENT GRADE OR MINERAL FREE WATER (PG-08-1, MCS 11602)
1		CC	OUTLET, ADP (EMPTY CONDUIT SYSTEM) (SEE ELECTRICAL ENGINEERING SERVICE GUIDE LINES)
AR		CC	RECEPTACLE, ELECTRICAL, 208 VOLT, 20 AMP, 1 PHASE, ON WALL, WEATHERPROOF (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP, 610 MM (24") ON CENTERS ON FREE WALLS (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP, STRIP MOLD WITH OUTLETS ON 610 MM (24") CENTERS, 229 MM (9") ABOVE COUNTER (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 30 AMP, DEDICATED CIRCUIT (PG-08-1, MCS 16140)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

Equipment & Utility Plan Single Module Laboratory (Accessible)





Design Standards

Laboratory (Accessible)

ARCHITECTURAL

Floor Area	28 m ² (300 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft) min*	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-
*2850 mm (9'-6") preferred			

SPECIAL EQUIPMENT

H7-72 Fume Hood			
	Lighting	ELECTRICAL	Power
General	550 lx (50 fc)	General	-
Special	1100 lx (100 fc) task	Special	**
Emergency	-	Emergency	fume hood(s)***
Louvered deep cell parabolic fixtures, T-8 lamps		**Recep: 5000 W, 208 V, 1Ø; Recep: 3000 W, 120 V	
		***Fume hood recep: 1200 W, 120 V dedicated circuit	

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	1050 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	52 W/m ² (4.8 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	2	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes****
****H7: 0.65 m ³ /s (1375 cfm), 60 Pa (0.24 inches of water),, 724 mm (28½") sash opening			

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

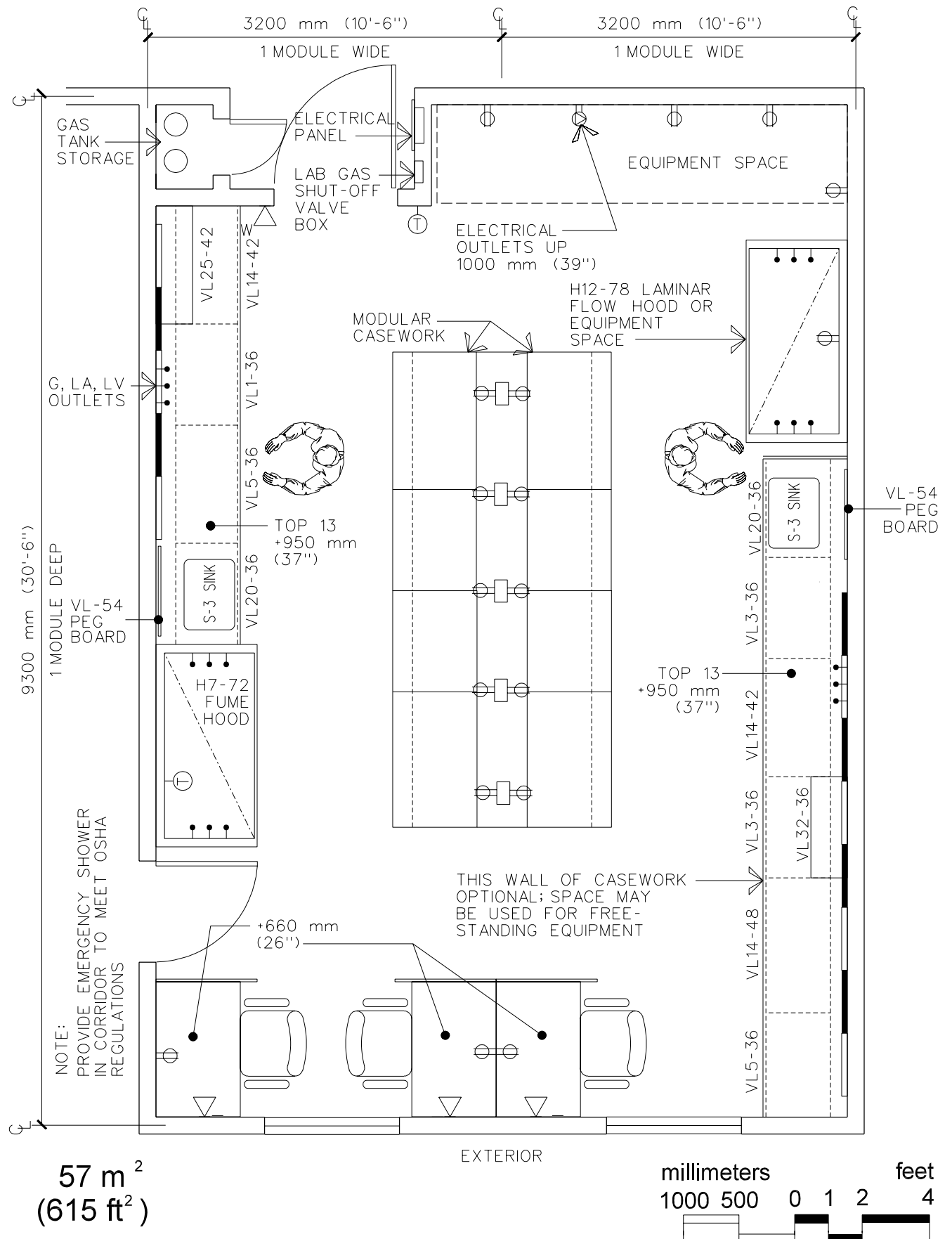
Equipment Guide List

Laboratories, General

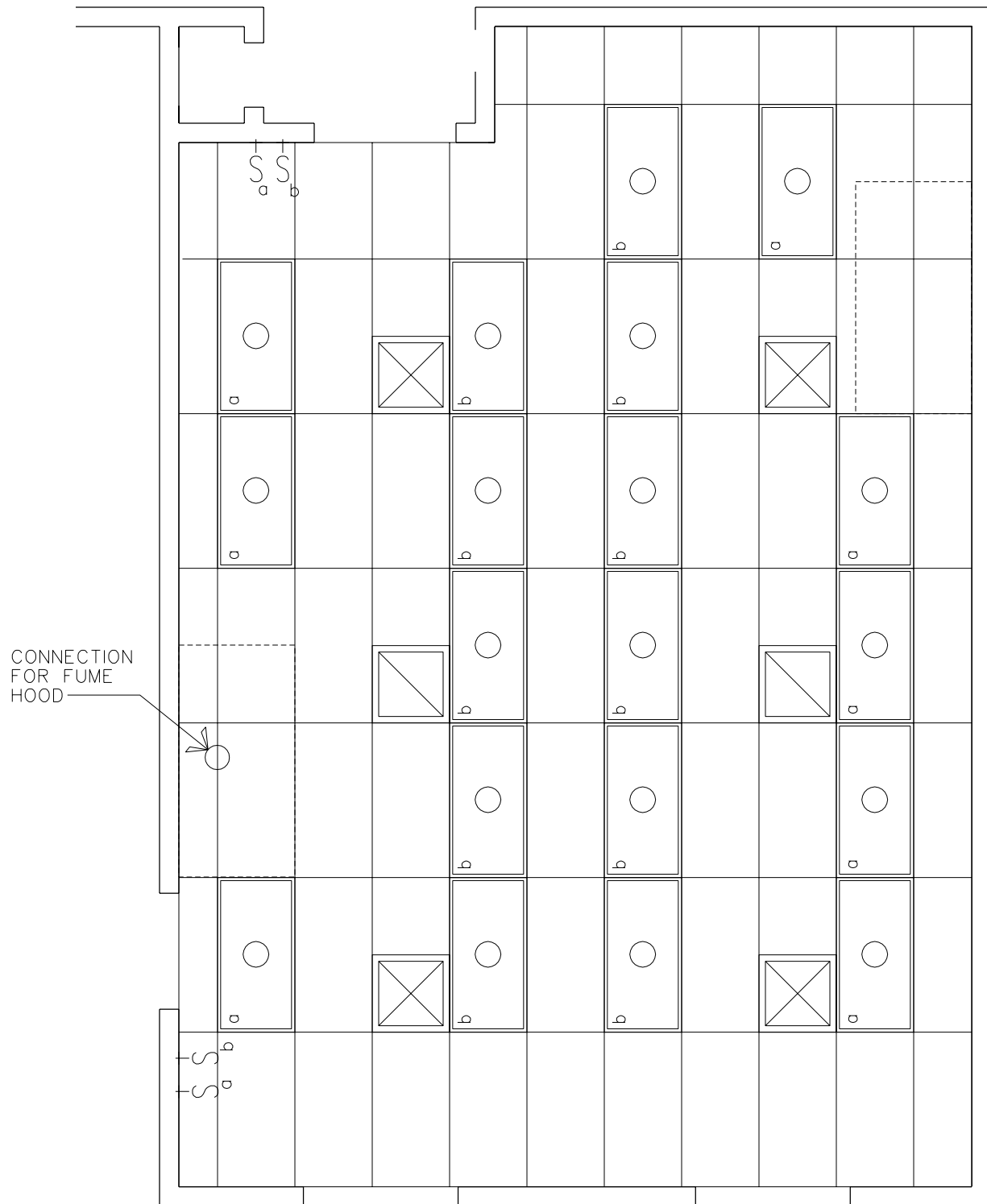
qty	symbol	ai	description
-----	--------	----	-------------

See Guide Plate 4-1.

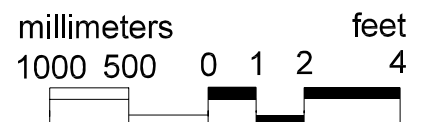
Equipment & Utility Plan Double Module Laboratory I



Reflected Ceiling Plan Double Module Laboratory I



NOTE:
USE ALL SURFACE MTD LIGHTING FIXTURES
IF CEILING GRID WILL NOT ALLOW LIGHTS
TO BE PLACED WITH CENTERLINE OVER
EDGE OF WORK SURFACE.



Design Standards

Double Module Laboratory I

ARCHITECTURAL

Floor Area	58 m ² (615 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft) min*	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-
*2850 mm (9'-6") preferred			

SPECIAL EQUIPMENT

H7-72 Fume Hood			
H12 B2-48 Laminar Flow Hood			
Lighting		ELECTRICAL	
General	550 lx (50 fc)	General	-
Special	1100 lx (100 fc) task	Special	**
Emergency	-	Emergency	fume hood(s)***
Louvered deep cell parabolic fixtures, T-8 lamps		**Recep: 5000 W, 208 V, 1Ø; Recep: 8000 W, 120 V	
		***Fume, flow hoods: 1200 W, 120 V dedicated circuit each	

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	1995 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	75 W/m ² (7.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	6	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes****

****H7: 0.65 m³/s (1375 cfm), 60 Pa (0.24 inches of water), 724 mm (28½") sash opening
H12 B2: 0.40 m³/s (840 cfm), 523 Pa (2.10 inches of water), requires dedicated exhaust system

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

Equipment Guide List

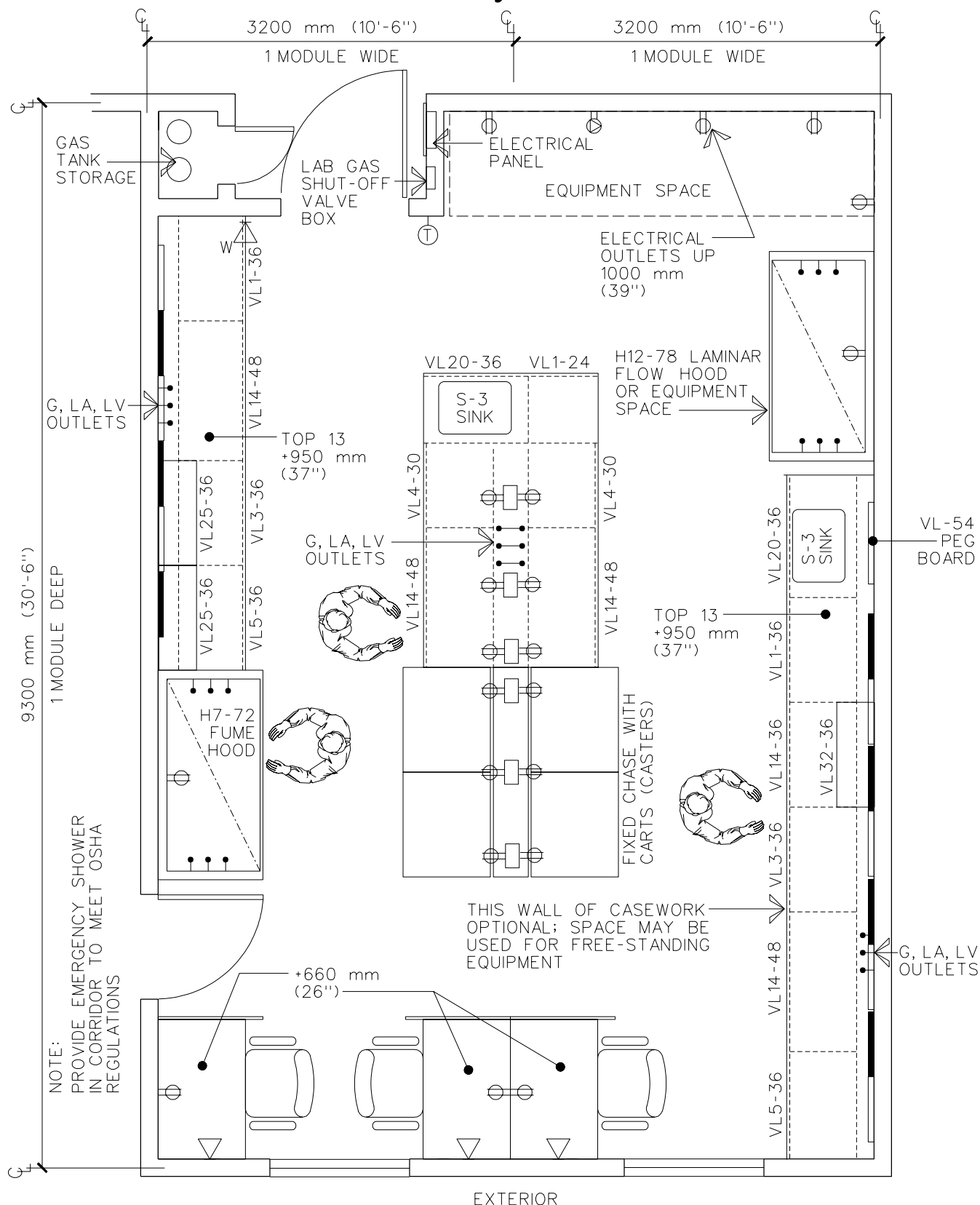
Laboratories, General

qty	symbol	ai	description
-----	--------	----	-------------

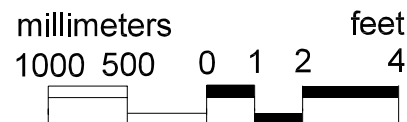
See Guide Plate 4-1.

Equipment & Utility Plan

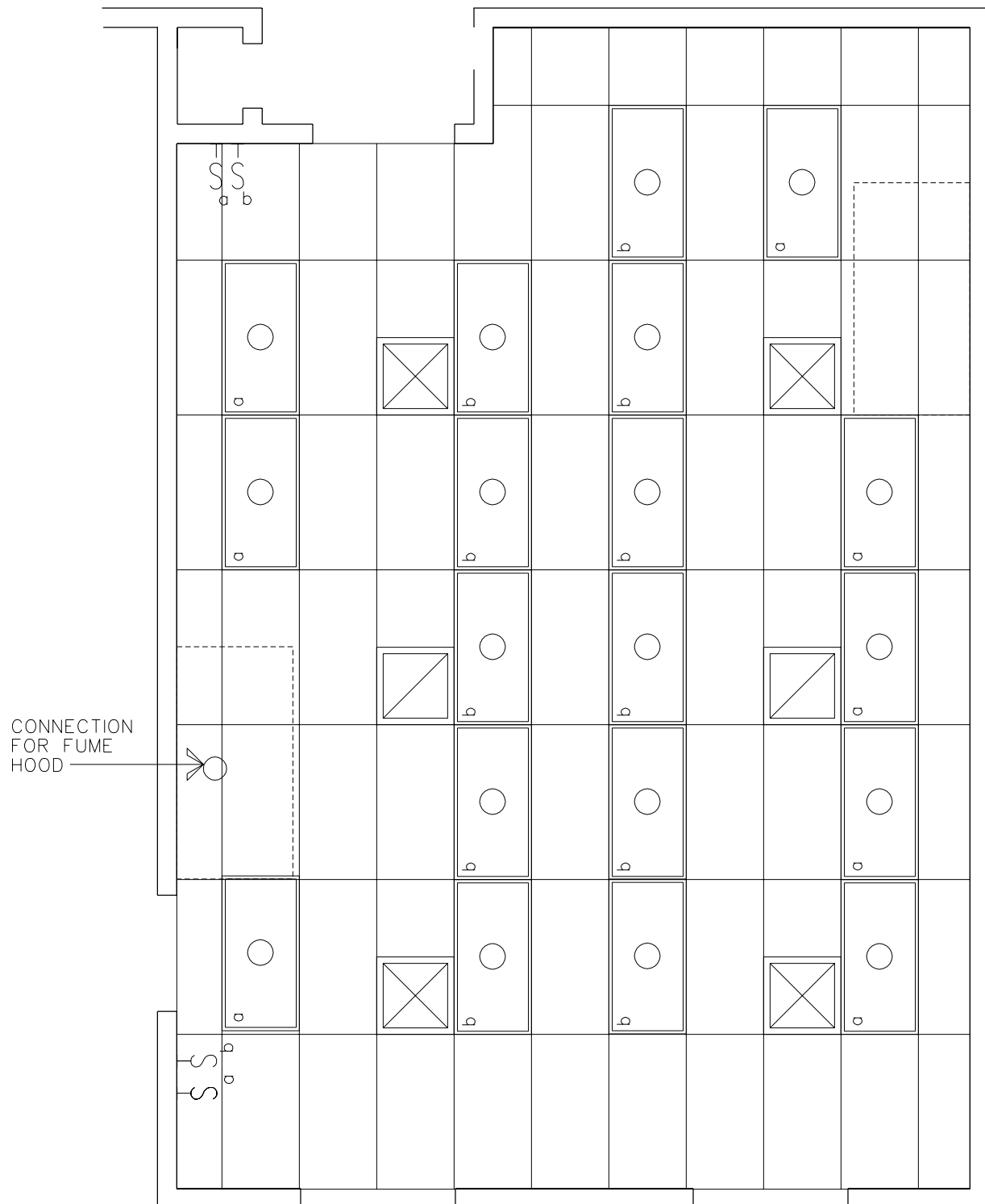
Double Module Laboratory II



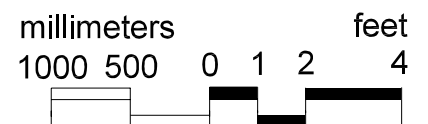
57 m²
(615 ft²)



Reflected Ceiling Plan Double Module Laboratory II



NOTE:
USE ALL SURFACE MTD LIGHTING FIXTURES
IF CEILING GRID WILL NOT ALLOW LIGHTS
TO BE PLACED WITH CENTERLINE OVER
EDGE OF WORK SURFACE.



Design Standards

Double Module Laboratory II

ARCHITECTURAL

Floor Area	58 m ² (615 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft) min*	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-
*2850 mm (9'-6") preferred			

SPECIAL EQUIPMENT

H7-72 Fume Hood			
H12 B2-48 Laminar Flow Hood			
Lighting		ELECTRICAL	
General	550 lx (50 fc)	General	-
Special	1100 lx (100 fc) task	Special	**
Emergency	-	Emergency	fume hood(s)***
Louvered deep cell parabolic fixtures, T-8 lamps		**Recep: 5000 W, 208 V, 1Ø; Recep: 8000 W, 120 V	
		***Fume, flow hoods: 1200 W, 120 V dedicated circuit each	

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	1995 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	75 W/m ² (7.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	6	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes****

****H7: 0.65 m³/s (1375 cfm), 60 Pa (0.24 inches of water), 724 mm (28½") sash opening
H12 B2: 0.40 m³/s (840 cfm), 523 Pa (2.10 inches of water), requires dedicated exhaust system

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

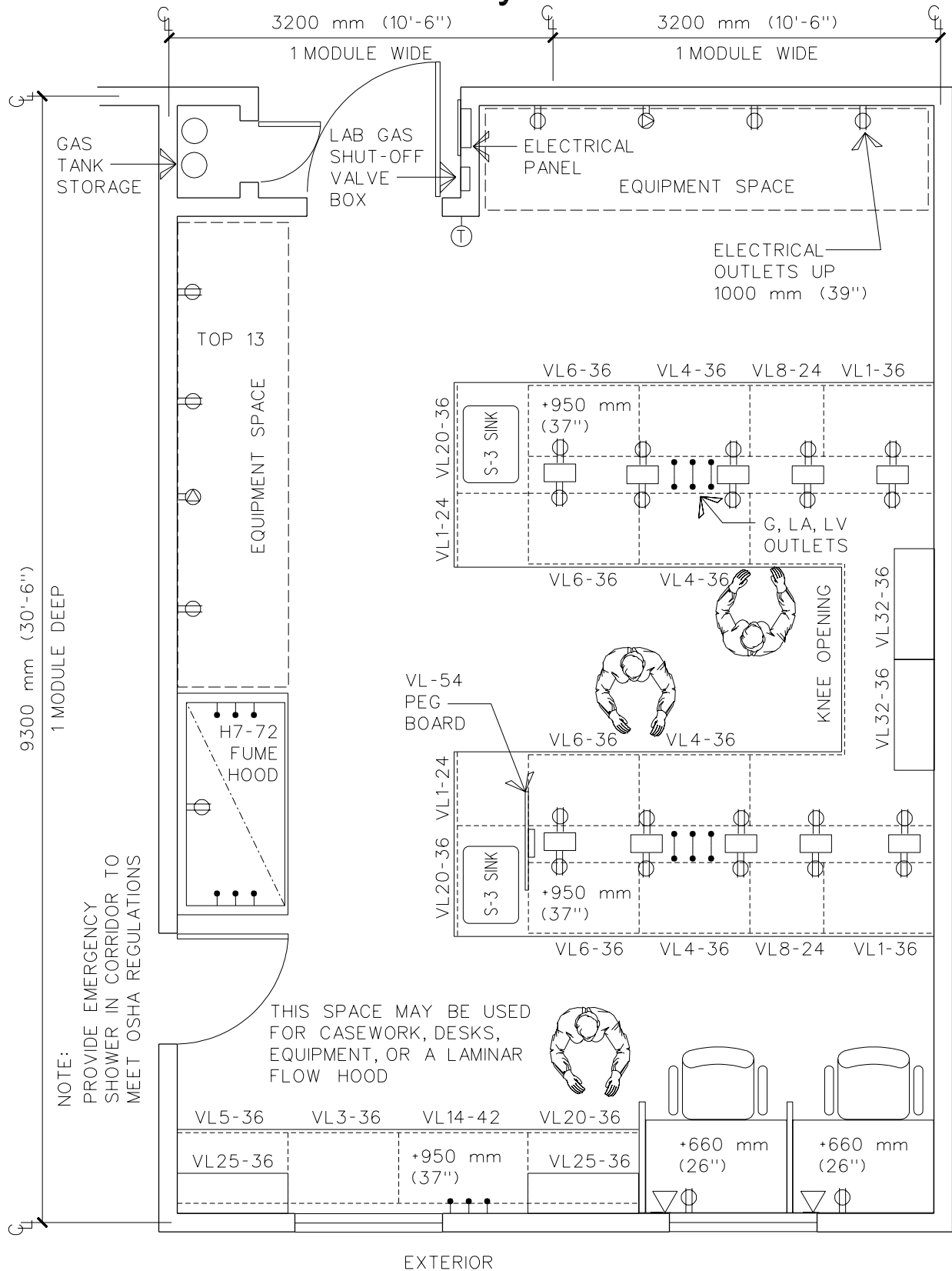
Equipment Guide List

Laboratories, General

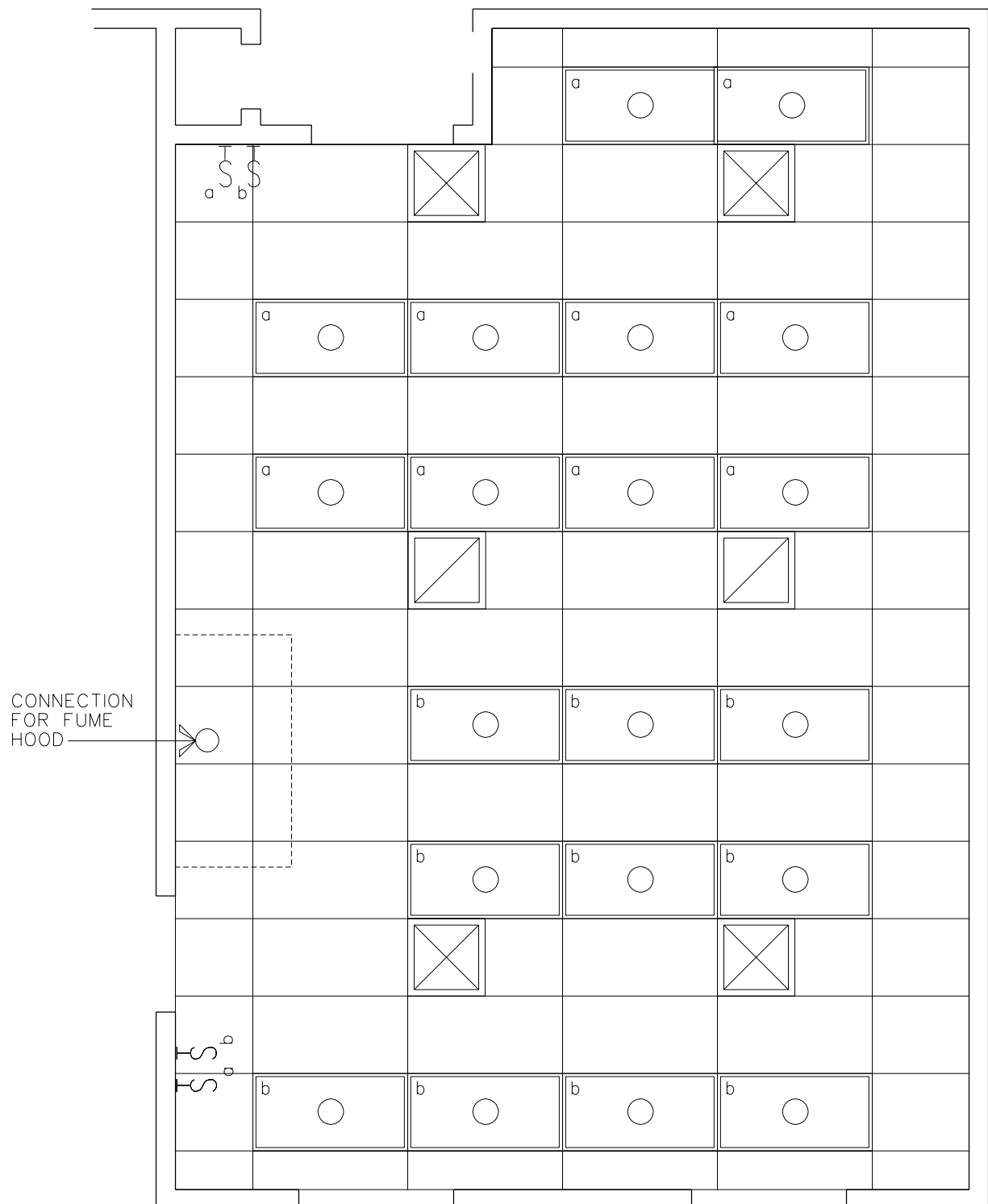
qty	symbol	ai	description
-----	--------	----	-------------

See Guide Plate 4-1.

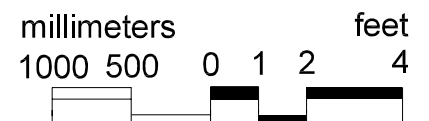
Equipment & Utility Plan Double Module Laboratory III



Reflected Ceiling Plan Double Module Laboratory III



NOTE:
USE ALL SURFACE MTD LIGHTING FIXTURES
IF CEILING GRID WILL NOT ALLOW LIGHTS
TO BE PLACED WITH CENTERLINE OVER
EDGE OF WORK SURFACE



Design Standards

Double Module Laboratory III

ARCHITECTURAL

Floor Area	58 m ² (615 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft) min*	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

*2850 mm (9'-6") preferred

SPECIAL EQUIPMENT

H7-72 Fume Hood			
Lighting		ELECTRICAL	Power
General	550 lx (50 fc)	General	-
Special	1100 lx (100 fc) task	Special	**
Emergency	-	Emergency	fume hood(s)***
Louvered deep cell parabolic fixtures, T-8 lamps		**Recep: 5000 W, 208 V, 1Ø; Recep: 3000 W, 120 V	
		***Fume hood recep: 1200 W, 120 V dedicated circuit	

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	2100 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	75 W/m ² (7.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	6	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes****

****H7: 0.65 m³/s (1375 cfm), 60 Pa (0.24 inches of water), 724 mm (28½") sash opening

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

Equipment Guide List

Laboratories, General

qty	symbol	ai	description
-----	--------	----	-------------

See Guide Plate 4-1.

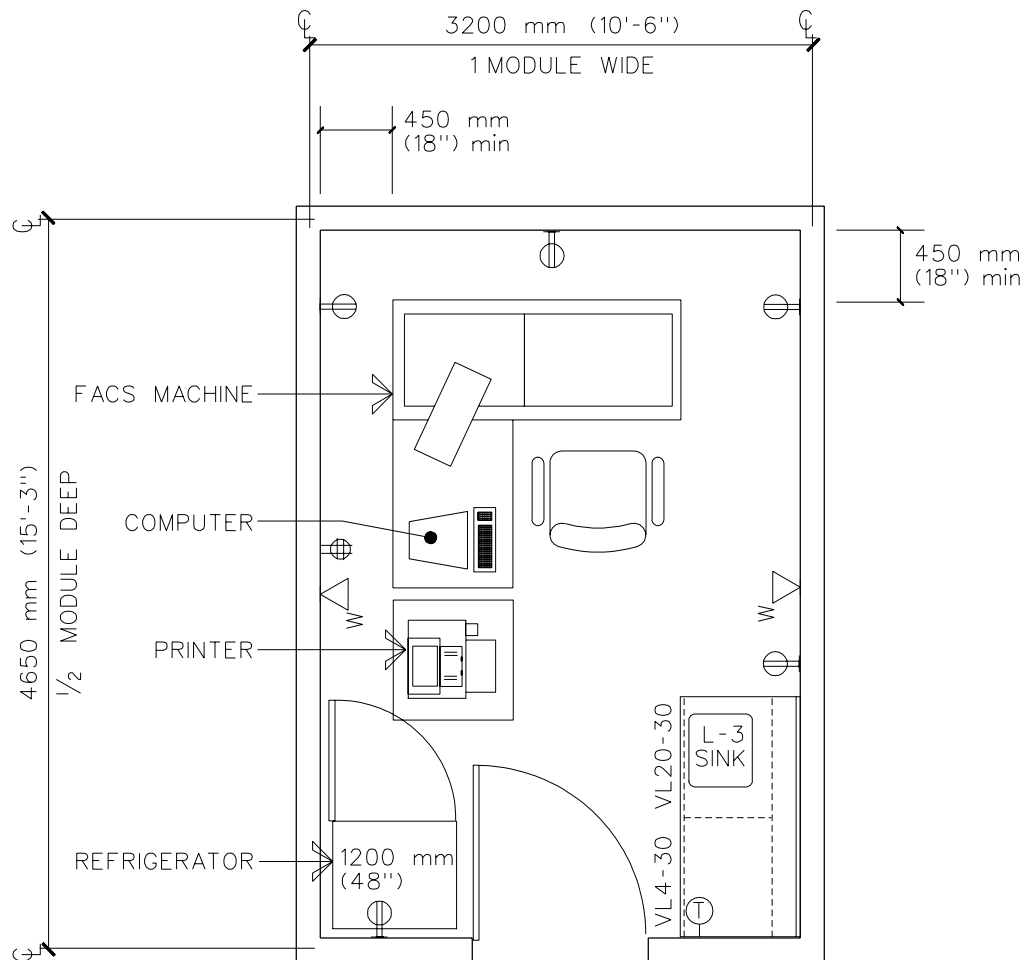
Section 5

Design Guide Plates: Specialized Areas

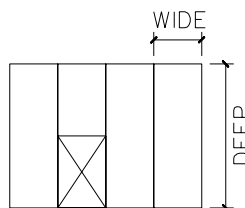
Guide
Plate
Series

- 5 - 1 Fluorescent Activated Cell Sorter Room
(FACS)
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 5 - 2 Nuclear Magnetic Resonance Room
(NMR)
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 5 - 3 Polymerase Chain Reactor Suite (PCR)
- 5 - 3a Polymerase Chain Reactor Room
(PCR)
- 5 - 3b Electrophoresis Room
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 5-4 Confocal Microscope Room
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 5-5 Cell Irradiator Room
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List

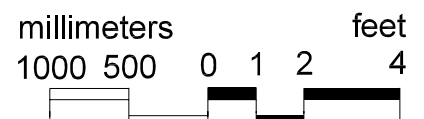
Equipment & Utility Plan Fluorescent Activated Cell Sorter Room (FACS)



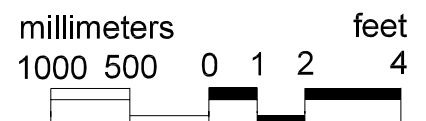
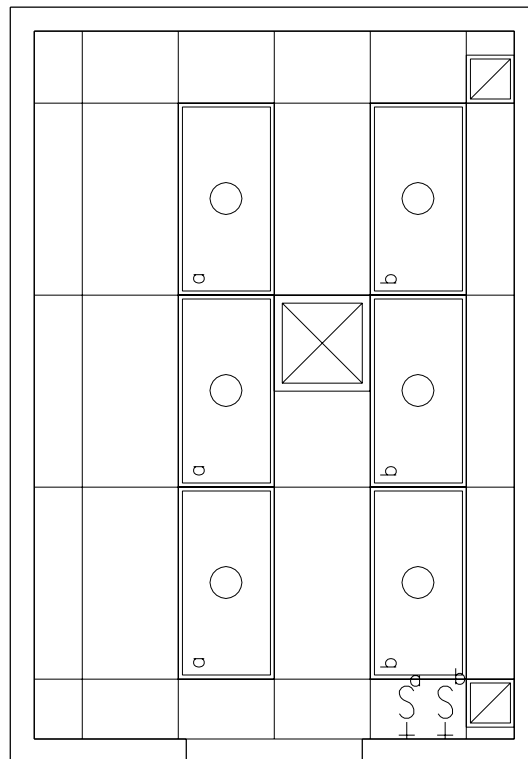
NOTE:
THIS ROOM IS 1/2 MODULE
DEEP AND 1 MODULE WIDE.



14 m²
(148 ft²)



Reflected Ceiling Plan Fluorescent Activated Cell Sorter Room (FACS)



Design Standards

Fluorescent Activated Cell Sorter Room (FACS)

ARCHITECTURAL

Floor Area	14 m ² (148 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	750 lx (70 fc)	General	-
Special	-	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	630 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	86 W/m ² (8.0 W/ft ²)*	Dry Bulb Temp Heating	22°C (72°F)
Number of People	2	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	(0)	Minimum % Outside Air	100
Min Air Changes per Hour	6	100% Exhaust Air	yes
Steam	-	Special Exhaust	-

*Based on water cooled laser generators

PLUMBING AND LABORATORY GASES

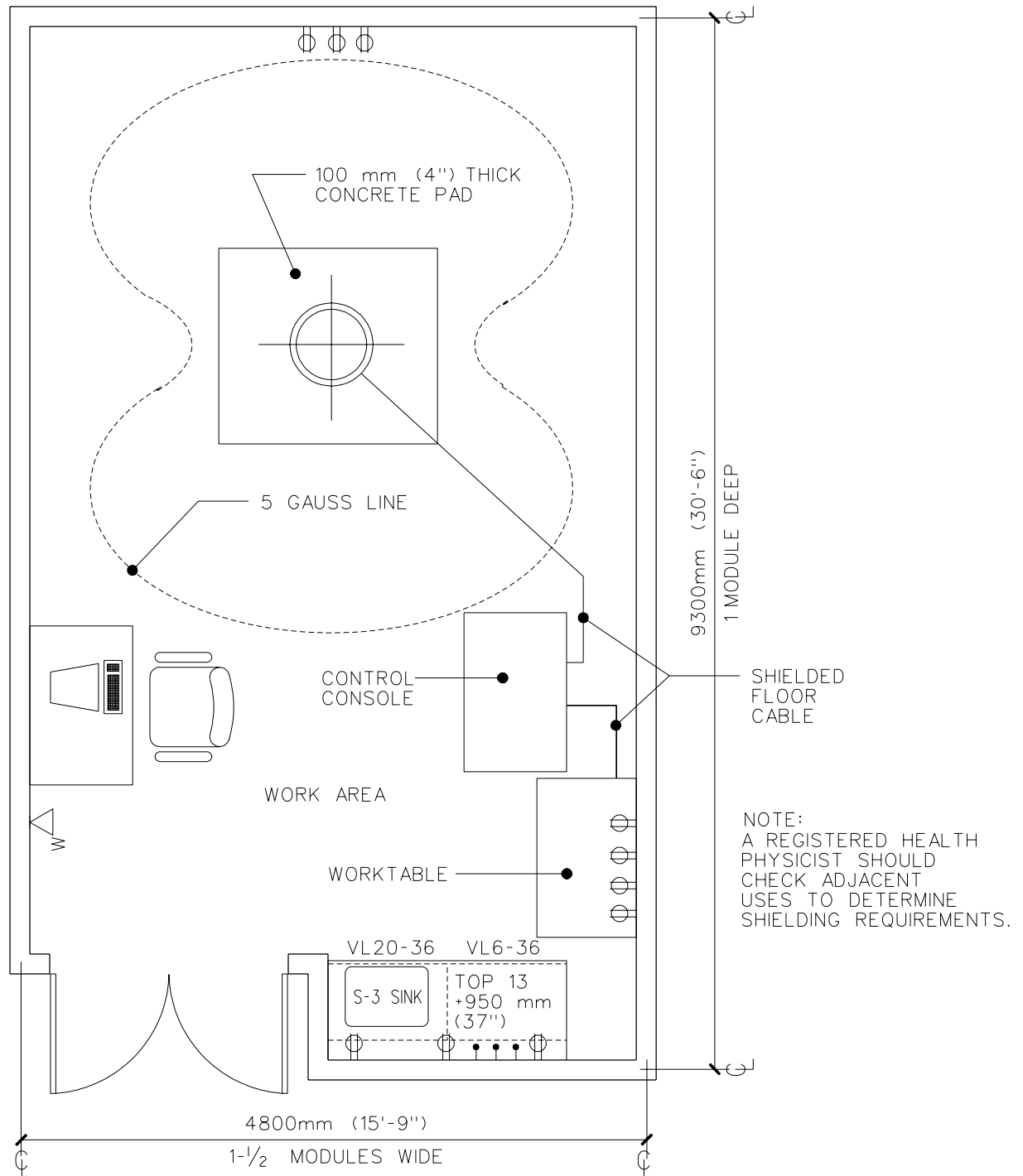
Sanitary Drain	yes	Cold Water	yes
Acid Waste	-	Hot Water	yes
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

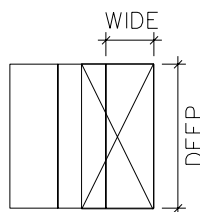
Fluorescent Activated Cell Sorter Room (FACS)

qty	symbol	ai	description
1		VV	MACHINE, FLUORESCENT ACTIVATED CELL SORTER (FACS), 1778 MM X 1422 MM (70" X 56") WITH 457 MM (18") CLEARANCE ON ALL SIDES
1		VV	CRT, COMPUTER SYSTEM, WITH KEYBOARD
1		VV	TABLE, COMPUTER, APPROX., 762 MM X 762 MM X 660 MM (30" X 30" X 26")
1		VV	PRINTER, COMPUTER SYSTEM
1		VV	STAND, COMPUTER PRINTER, APPROX., 610 MM X 610 MM X 660 MM (24" X 24" X 26")
AR		CC	OUTLET, ADP (EMPTY CONDUIT SYSTEM) (SEE ELECTRICAL ENGINEERING SERVICE GUIDE LINES)
1		CC	RECEPTACLE, ELECTRICAL, QUADRUPLX, FOR COMPUTER EQUIPMENT ITEMS (PG-08-1, MCS 16140; H-08-3, CS 866-1)
1		VV	CHAIR, ROTARY, WITH ARMS
1	VL20/20 A	CF	CABINET, UNDERCOUNTER, SINK UNIT, 2 HINGED PANEL DOORS, WIDTH - 762 MM (30"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
1	L-3	CF	SINK, MOLDED, RESIN WITH END OR CORNER DRAIN OUTLET, 457 MM X 381 MM X 279 MM (18" X 15" X 11") (PG-08-1 & PG-08-6, MCS 11602)
1	VL4/4A	CF	CABINET, UNDERCOUNTER, WITH 2 DUST SEAL DRAWERS, 2 HINGED DOORS AND 1 ADJUSTABLE SHELF, WIDTH, 762 MM (30"); DEPTH - 559 MM (22"); HEIGHT 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
1		VV	CLOCK, BATTERY OPERATED
2		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 30 AMP, DEDICATED CIRCUIT (PG-08-1, MCS 16140)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

Equipment & Utility Plan Nuclear Magnetic Resonance Room (NMR)



NOTE:
THE SIZE OF THIS ROOM
IS DEPENDENT UPON THE
MAGNET MANUFACTURER'S
REQUIREMENTS



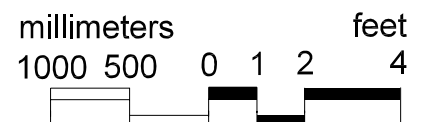
42 m²
(457 ft²)

GENERAL NOTES:

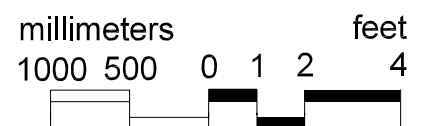
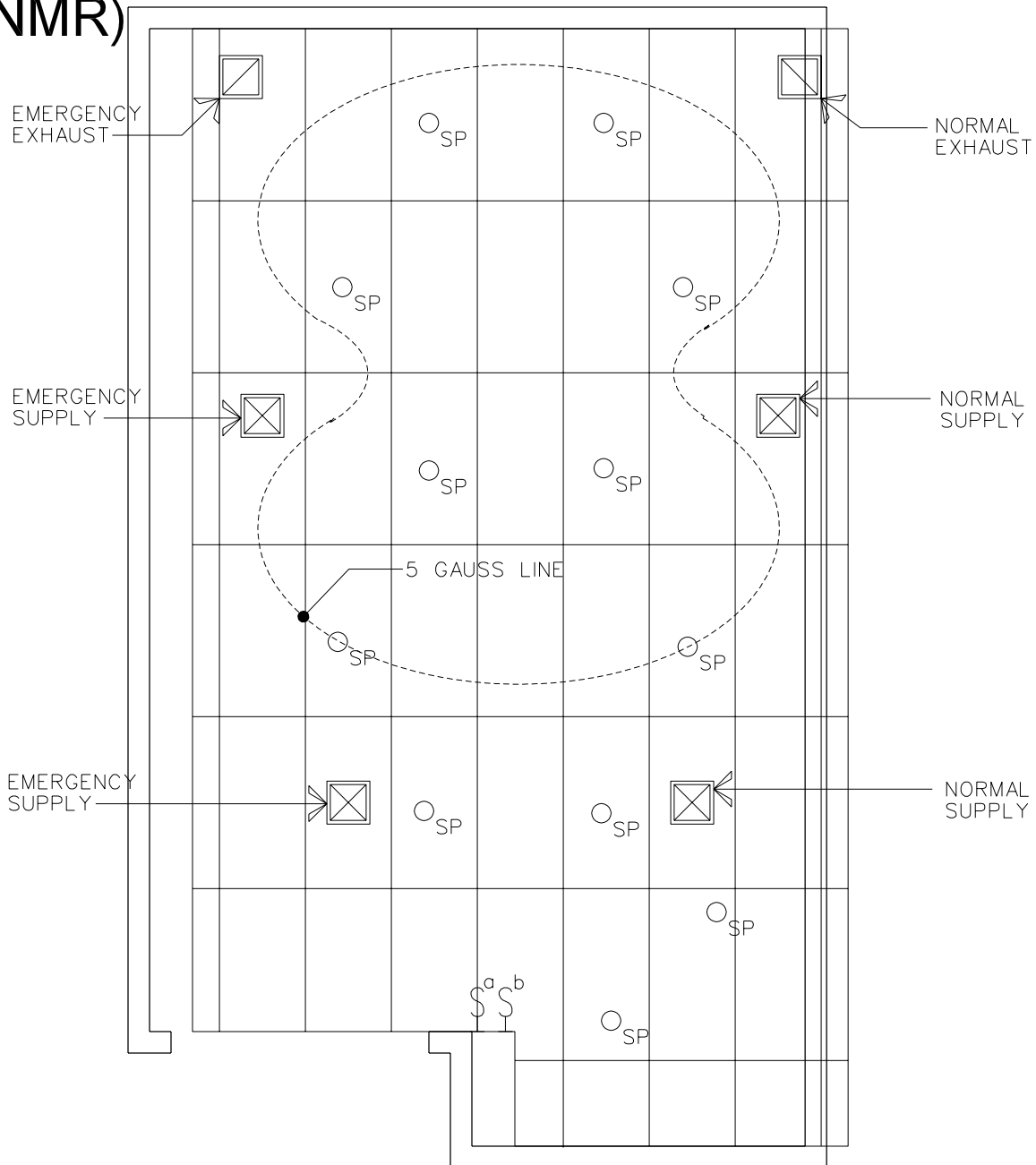
MARK THE 5 GAUSS LINE OF MAGNET
AND POST WARNING SIGNS.

VERTICAL MAGNETIC FIELDS ARE LARGER
THAN HORIZONTAL FIELDS.

LOCATE MAGNET ON A LOWER FLOOR.



Reflected Ceiling Plan Nuclear Magnetic Resonance Room (NMR)



Design Standards

Nuclear Magnetic Resonance Room (MNR)

ARCHITECTURAL

Floor Area	42 m ² (457 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)*	Floor Finish	vct
RFI Shielding	yes	Slab Depression	-
Soundproofing	-	Floor Load	-

*4100 mm (13'6") min over magnet 1.5 m² (16 ft²) min

SPECIAL EQUIPMENT

Nuclear magnetic resonance machine			
	Lighting	ELECTRICAL	Power
General	750 lx (70 fc)	General	-
Special	-	Emergency	ventilation system
Direct current, non-ferrous, incandescent fixtures with PAR38 halogen flood lamps on dimmer switches		Copper cladding on wiring	

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	2760 W	Dry Bulb Temp Cooling	23°C (74°F)
AC Load Equipment	70 W/m ² (6.5 W/ft ²)**	Dry Bulb Temp Heating	22°C (72°F)
Number of People	3	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	(0)	Minimum % Outside Air	100
Min Air Changes per Hour	6	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes***

**Minimum requirement

***Use only copper piping and aluminum or PVC ductwork inside the room.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	-
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

Additional Notes:

1. Utility requirements for magnets vary greatly among manufacturers. There are different kinds of magnets with specific utility requirements. Requirements also vary if gradient power supply and gradient coils are used, and whether they are air-cooled or water-cooled. A water-cooled system, consisting of a closed loop water supply with water-to-water heat exchanger to a refrigerator type heat exchanger, is recommended for gradient power supply and gradient coils. The water must be filtered to protect equipment. Provide domestic water back-up for cooling water in case of emergency.

Equipment Guide List

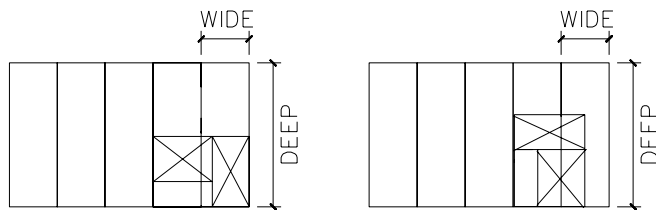
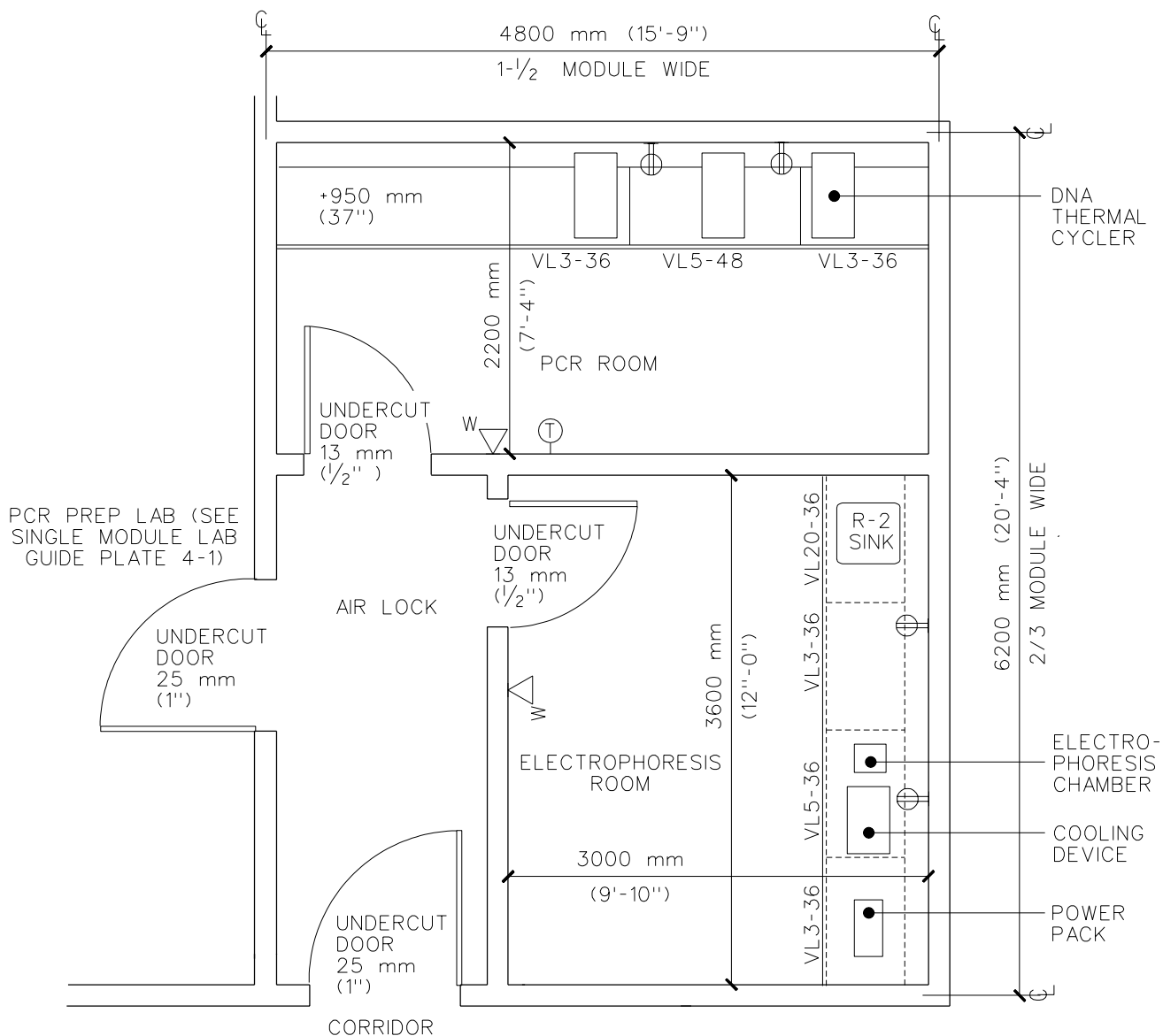
Nuclear Magnetic Resonance Room (NMR)

qty	symbol	ai	description
1		VC	MACHINE, NUCLEAR MAGNETIC RESONANCE (NMR)
1		VC	CONSOLE, CONTROL
1	VL20/ 20A	CF	CABINET, UNDERCOUNTER, SINK UNIT, 2 HINGED PANEL DOORS, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHT 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOW BASE (PG-08-1 & PG-08-6, MCS 12345)
1	S-3	CF	SINK, MOLDED, RESIN WITH END OR CORNER DRAIN OUTLET, 635 MM X 457 MM X 406 MM (25" X 18" X 16") (PG-08-1 & PG-08-6, MCS 11602)
1	TOP 13/ 13A	CF	COUNTER TOP, EPOXY, RESIN, WITH DRIP GROOVE, 25 MM (1") THICK (PG-08-1 & PG-08-6, MCS 11602)
1		CC	OUTLETS, ONE EACH, LAB AIR, FUEL GAS AND LAB VACUUM GROUPED OVER COUNTER (PG-08-1 & PG-08-6, MCS 11602)
1		CC	RECEPTACLE, ELECTRICAL, 208 VOLT, 20 AMP, 1 PHASE, DEDICATED CIRCUIT (PG-08-1, MCS 16140)
NOTE: PROVIDE COOLING FOR MAGNET, COMPRESSED AIR OR NITROGEN AS REQUIRED.			

Additional Notes (continued):

- Superconducting magnets use liquid cryogenics (helium and nitrogen). Due to quenching and to prevent explosion due to overpressure in the magnet, excess pressure is relieved through rupture discs. Discharge from these discs must be relieved to the outside through vents. Also, a separate emergency exhaust system is required with a minimum of 12 air changes per hour to exhaust above the roof any accidental gas spillage inside the room. The emergency exhaust system shall be activated by an oxygen sensor. Also, provide emergency make-up supply air from the normal supply system whenever the emergency exhaust air is activated.
- Some manufacturers do not recommend blowing air directly at magnets.

Equipment & Utility Plan Polymerase Chain Reaction Suite (PCR)



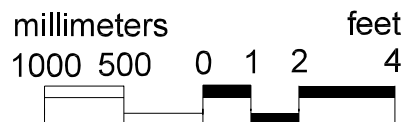
NOTE:
THIS SUITE CAN BE PLANNED IN VARIOUS WAYS.
THIS KEY SUGGESTS TWO ARRANGEMENTS.
SEE DIAGRAM 3-4 FOR MODULE SIZE.

NOTE:
LOCATE PHOSPHOR IMAGER AND
IMAGE ERASER IN DRY LAB.

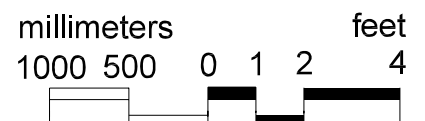
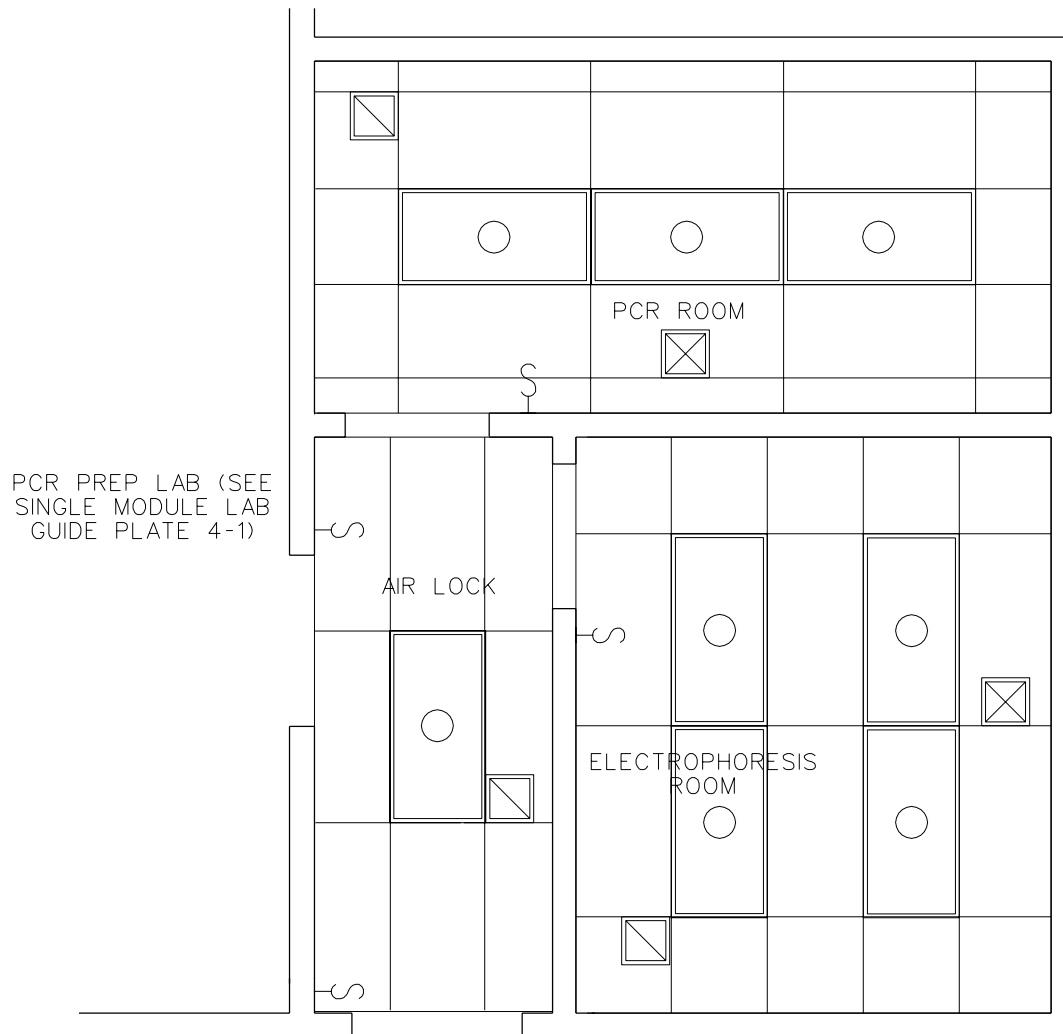
NOTE:
PREP LAB UTILIZES A LAMINAR
FLOW HOOD PROVIDING A
STERILE ENVIRONMENT.

Suite 54 m²
(589 ft²)

INCLUDES SINGLE
MODULE LAB



Reflected Ceiling Plan Polymerase Chain Reaction Suite (PCR)



Design Standards

Polymerase Chain Reactor Room (PCR)

ARCHITECTURAL

Floor Area	10 m ² (112 ft ²)*	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

*Floor area may change depending on suite layout.

Lighting

ELECTRICAL

Power

General	750 lx (70 fc)	General	-
Special	1100 lx (100 fc) task	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	-
-----------	-----	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	315 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	32 W/m ² (3.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	1	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	positive**	Minimum % Outside Air	100
Min Air Changes per Hour	4	100% Exhaust Air	yes
Steam	-	Special Exhaust	-

**Maintain positive pressure with respect to air lock by exhausting 15% less than supply air.

Maintain positive pressure in air lock with respect to corridor and PCR Prep Lab.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	-
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Design Standards

Electrophoresis Room

ARCHITECTURAL

Floor Area	11 m ² (118 ft ²)*	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

*Floor area may change depending on suite layout.

Lighting

ELECTRICAL

Power

General	750 lx (70 fc)	General	-
Special	1100 lx (100 fc) task	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	-
-----------	-----	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	420 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	32 W/m ² (3.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	1	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	positive**	Minimum % Outside Air	100
Min Air Changes per Hour	4	100% Exhaust Air	yes
Steam	-	Special Exhaust	-

**Maintain positive pressure with respect to air lock to air lock by exhausting 15% less than supply air.

Maintain positive pressure in air lock with respect to corridor and PCR Prep Lab.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

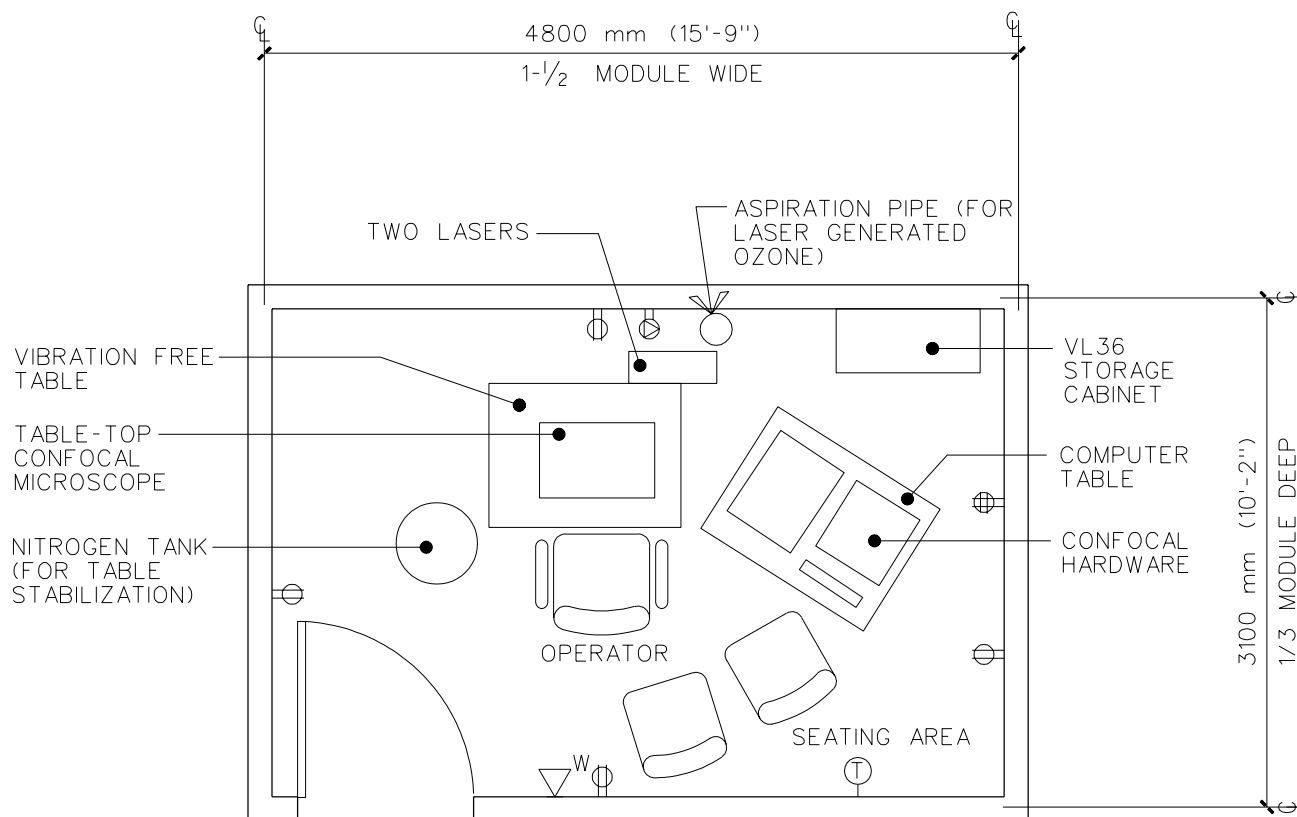
September 30, 1995

Equipment Guide List

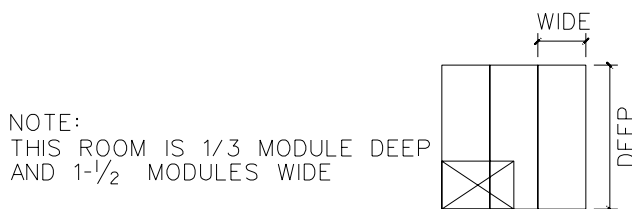
Polymerase Chain Reaction Suite (PCR)

qty	symbol	ai	description
AR		VV	CYCLERS, DNA THERMAL, 305 MM X 610 MM (12" X 24")"
			NOTE: FOR EQUIPMENT REQUIREMENTS SEE (LABORATORIES, GENERAL) LISTED IN GUIDE PLATE 4-1
1		VV	POWER PACK
1		VV	COOLING DEVICE
1		VV	ELECTROPHORESIS CHAMBER

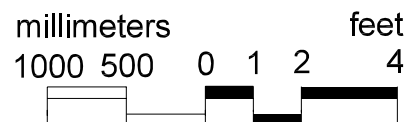
Equipment & Utility Plan Confocal Microscope Room



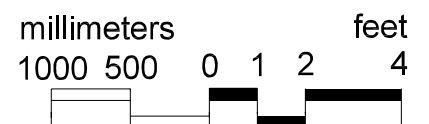
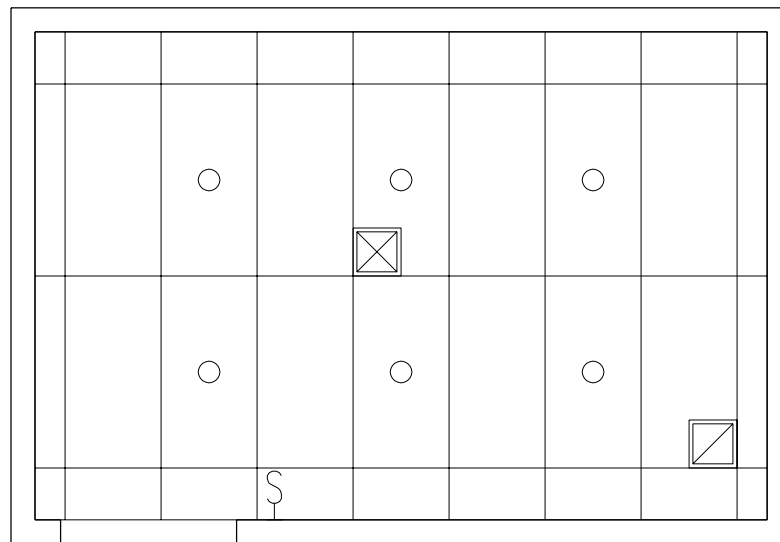
NOTE:
LOCATE THIS SPACE AWAY FROM
MAGNETIC FIELD GENERATORS, AND
SOURCES OF VIBRATION (MECH RMS,
ELEVATORS, BUSY ROADWAYS, ETC).



14 m²
(147 ft²)



Reflected Ceiling Plan Confocal Microscope Room



Design Standards

Confocal Microscope Room

ARCHITECTURAL

Floor Area	14 m ² (147 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	325 lx (30 fc)	General	-
Special	-	Special	-
Incandescent fixtures with PAR38 halogen flood lamps on dimmer switch		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	600 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	48 W/m ² (4.5 W/ft ²)*	Dry Bulb Temp Heating	22°C (72°F)
Number of People	3	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	positive	Minimum % Outside Air	100
Min Air Changes per Hour	6	100% Exhaust Air	yes
Steam	-	Special Exhaust	-

*Based on water cooled laser generator. See note 1 below.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	see below
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Additional Notes:

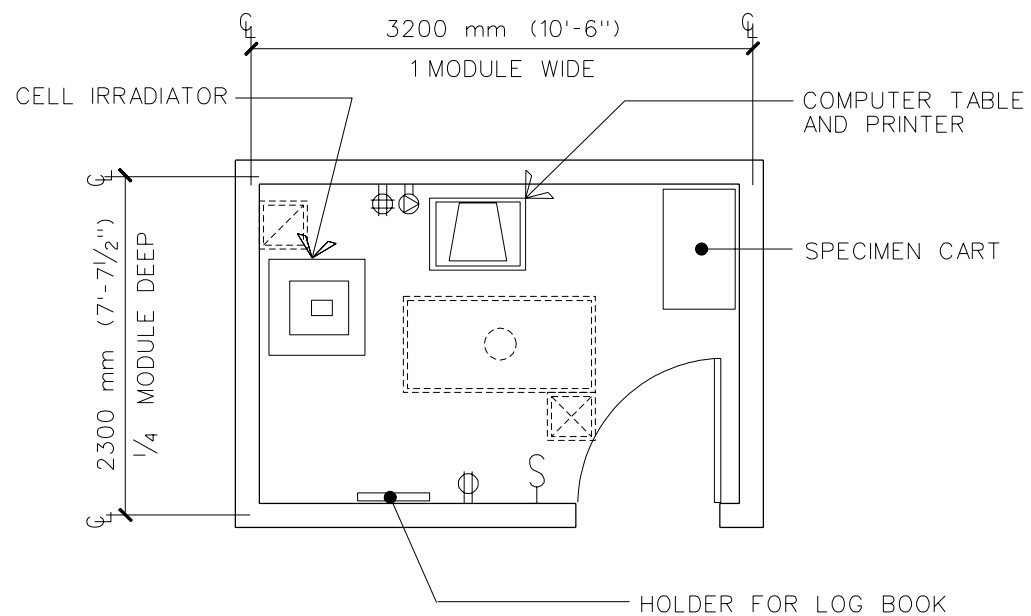
1. Use of water-cooled laser generators is preferred as air-cooled generators dissipate excessive heat into the room. Tie into a common closed circuit cooler for all water-cooled equipment in the Research Facility. Provide domestic water backup for cooling water in case of emergency.

Equipment Guide List

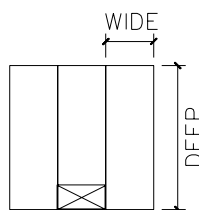
Confocal Microscope Room

qty	symbol	ai	description
1		VV	MICROSCOPE, CONFOCAL AND ANCILLARY EQUIPMENT
1		VV	TABLE, VIBRATION FREE, 1219 MM X 914 MM (48" X 36")
1		VV	TANK, NITROGEN STORAGE
1		VV	TABLE, COMPUTER, 1219 MM X 914 MM (48" X 36")
1	VL36	CF	CABINET, FULL HEIGHT, WITH SLOPING TOP, 2 GLAZED SLIDING DOORS AND 5 ADJUSTABLE SHELVES, WIDTH - 914 MM (36"); DEPTH - 406 MM (16"); HEIGHT - 2134 MM (84") (PG-08-1 & PG-08-6, MCS 12345)
1		VV	CHAIR, ROTARY, WITH ARMS
AR		VV	CHAIR, ROTARY, WITHOUT ARMS
1		VV	CLOCK, BATTERY OPERATED
1		CC	RECEPTACLE, ELECTRICAL, 208 VOLT, 20 AMP 1 PHASE (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

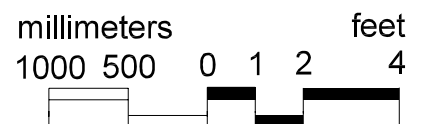
Equipment & Utility Plan Cell Irradiator Room



NOTE:
THIS ROOM IS 1/4 MODULE
DEEP AND 1 MODULE WIDE.



6.6 m²
(71 ft²)



Design Standards

Cell Irradiator Room

ARCHITECTURAL

Floor Area	6.6 m ² (71 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	550 lx (50 fc)	General	-
Special	-	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	-	ADP	yes
-----------	---	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	105 W	Dry Bulb Temp Cooling	24°C (76°F)
AC Load Equipment	97 W/m ² (9.0 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	1*	Relative Humidity - Cooling	50%
Noise Criteria	NC-40	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	6	100% Exhaust Air	yes
Steam	-	Special Exhaust	-

*This room intended for short occupancy.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	-
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

Cell Irradiator Room

qty	symbol	ai	description
1		VV	IRRADIATOR, GAMMA CELL, 610 MM X 610 MM (24" X 24")
1		VV	CART, SPECIMEN
1		VV	HOLDER, FOR LOG BOOK, WALL MOUNTED
1		VV	CRT, COMPUTER SYSTEM, WITH KEYBOARD
1		VV	PRINTER, COMPUTER SYSTEM
1		VV	TABLE, COMPUTER AND PRINTER
AR		CC	OUTLET, ADP (EMPTY CONDUIT SYSTEM) (SEE ELECTRICAL ENGINEERING SERVICE GUIDE LINES)
1		CC	RECEPTACLE, ELECTRICAL, QUADRUPLX, FOR COMPUTER EQUIPMENT ITEMS (PG-08-1, MCS 16140; H-08-3, CS 866-1)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

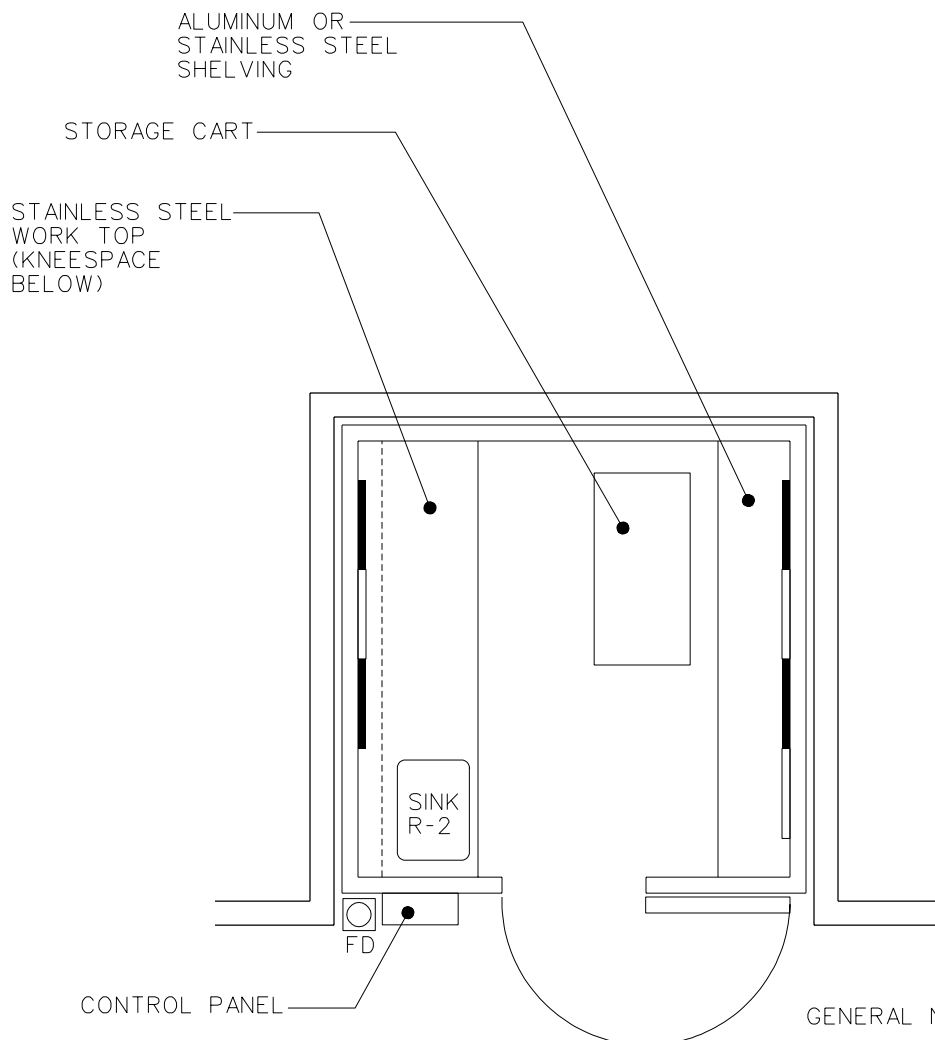
Section 6

Design Guide Plates: Laboratory Support

Guide
Plate
Series

- 6 - 1 Cold Procedure Room
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List
- 6 - 2 Glassware Washing and Sterilization Room
 - Equipment & Utility Plan
 - Reflected Ceiling Plan
 - Design Standards
 - Equipment Guide List
- 6 - 3 Tissue Culture Laboratory
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List
- 6 - 4 Gas Cylinder Storage Room
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List
- 6 - 5 Acid Storage Room
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List
- 6 - 6 Flammable Storage Room
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List
- 6 - 7 Ultralow Freezer Room
 - Equipment & Utility Plan
 - Design Standards
 - Equipment Guide List

Equipment & Utility Plan Cold Procedure Room



GENERAL NOTES:

PREFABRICATED COLD ROOM IS PIT MOUNTED.

SEAL ELECTRICAL CONDUIT WITH THERMAL BREAK AT COLD ROOM PENETRATION TO AVOID CONDENSATION.

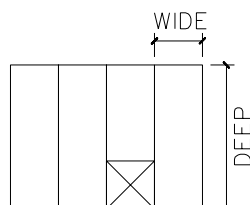
COLD ROOM WORKING TEMPERATURE IS APPROXIMATELY 4° C.

LOCATE A FLOOR DRAIN OUTSIDE COLD ROOM TO CAPTURE CONDENSATE.

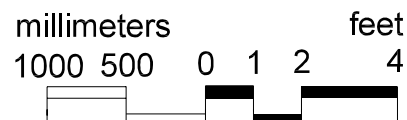
PROVIDE HEAT TRACING UNDER FLOOR SLAB TO PREVENT FROST ACCUMULATION IF COLD ROOM IS LOCATED ON SLAB ON GRADE.

NOTE:

THIS ROOM IS 1/3 MODULE DEEP AND 1 MODULE WIDE.



7.5 m²
(81 ft²)



Design Standards

Cold Procedure Room

ARCHITECTURAL

Floor Area	7.5 m ² (81 ft ²)*	Wall Finish	prefab
Ceiling	prefab	Base	-
Ceiling Height	-	Floor Finish	prefab
RFI Shielding	-	Slab Depression	yes
Soundproofing	-	Floor Load	-

*Prefabricated, see PG-08-1 MCS 13062, H-08-3 CS 643-1

Lighting

ELECTRICAL

Power

General	750 lx (70 fc)	General	GFI
Special	-	Special	-
Incandescent fixtures		Emergency	-

COMMUNICATIONS

Telephone	-	ADP	-
-----------	---	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	-	Dry Bulb Temp Cooling	4°C (40°F)
AC Load Equipment	-	Dry Bulb Temp Heating	-
Number of People	-	Relative Humidity - Cooling	- %
Noise Criteria	-	Relative Humidity - Heating	- %
Room Pressure	-	Minimum % Outside Air	-
Min Air Changes per Hour	-	100% Exhaust Air	-
Steam	-	Special Exhaust	-

Provide minimum 42 m³/s (25 cfm) supply and exhaust air.

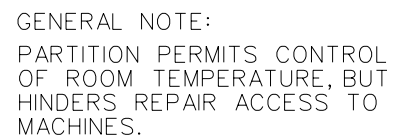
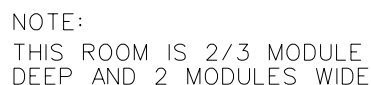
PLUMBING AND LABORATORY GASES

Sanitary Drain	yes	Cold Water	yes
Acid Waste	-	Hot Water	yes
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

Cold Procedure Room

qty	symbol	ai	description
AR		CC	COLD PROCEDURE ROOM, PREFABRICATED WALK-IN, SIZE AS SPECIFIED BY RESEARCH SERVICE, TEMP. RANGE, 0 DEGREES C TO 4 DEGREES C (PG-08-1, MCS 11615)
AR		CC	SHELVING, ADJUSTABLE, ALUMINUM OR STAINLESS STEEL, PERFORATED, 457 MM (18") DEEP (PG-08-1, MCS 11615)
1		CC	DRAIN, FLOOR (PG-08-1, MCS 15400)
1	TOP 5	CF	COUNTER TOP, CORROSION RESISTING (STAINLESS) STEEL, RAISED RIM, WITH INTEGRAL SINK AND SPLASHBACKS (PG-08-1 & PG-08-6, MCS 11602)
1	R-2	CF	SINK, CORROSION RESISTING STEEL, WITH END OR CORNER DRAIN OUTLET, 457 MM X 457 MM X 406 MM (18" X 18" X 16") (PG-08-1 & PG-08-6, MCS 11602)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP, WITH GROUND FAULT INTERRUPTER (PG-08-1, MCS, 16140; H-08-3, CS 801-3)

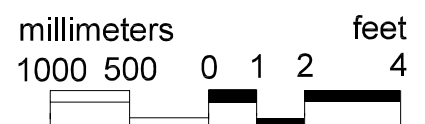
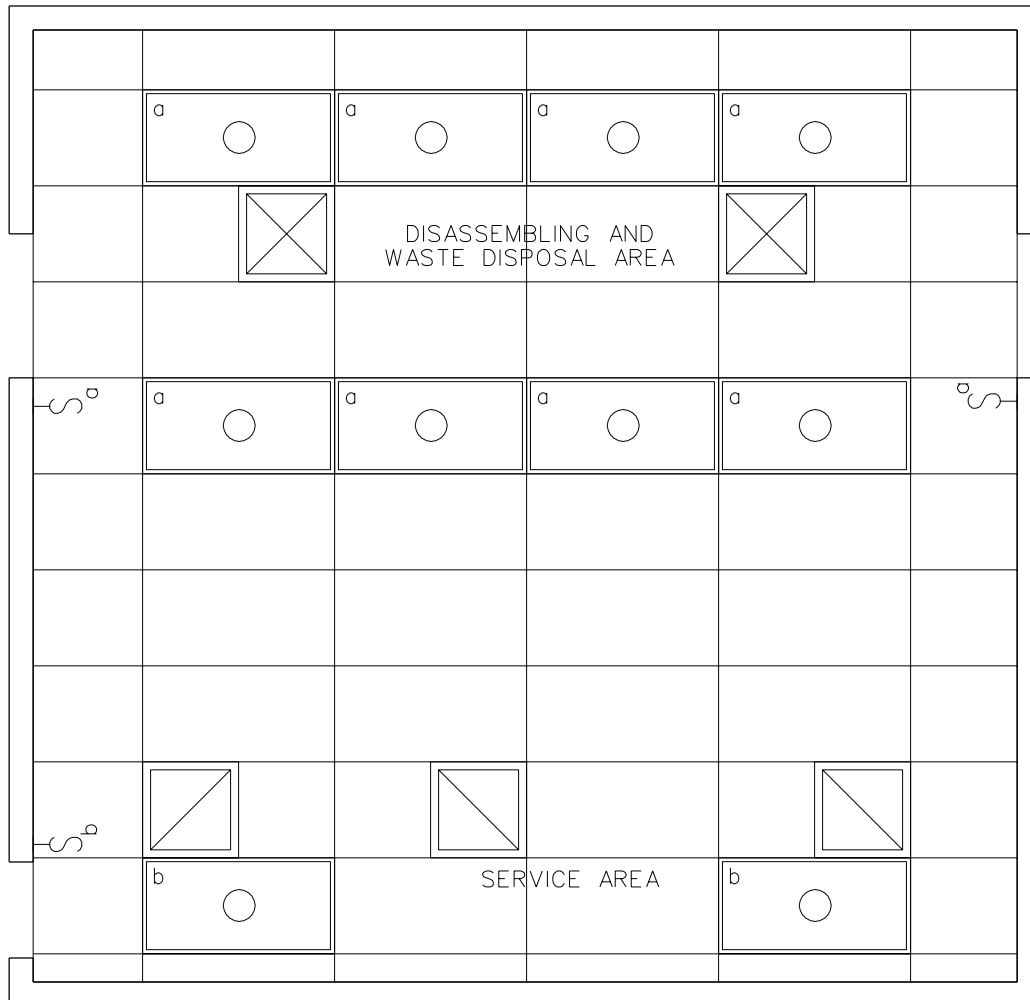


millimeters feet

1000 500 0 1 2 4

1 meter 2 feet

Reflected Ceiling Plan Glassware Washing and Sterilization Room



Design Standards

Glassware Washing and Sterilization Room

ARCHITECTURAL

Floor Area	38 m ² (406 ft ²)	Wall Finish	cmu/sc
Ceiling	at (sp)	Base	erf
Ceiling Height	2700 mm (9 ft)	Floor Finish	erf
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

SPECIAL EQUIPMENT

HW517 Glassware washing machine	VS260 Sterilizer
DW 911 Still	K3010 Ice Machine

Lighting

ELECTRICAL

Power

General	750 lx (70 fc)	General	-
Special	1100 lx (100 fc) task	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	1120 W	Dry Bulb Temp Cooling	27 C (80°F)
AC Load Equipment	65 W/m ² (6.0 W/ft ²)	Dry Bulb Temp Heating	21 C (70°F)
Number of People	2 to 3	Relative Humidity - Cooling	60%
Noise Criteria	NC-40	Relative Humidity - Heating	- %
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	15	100% Exhaust Air	yes
Steam	275 kPa (40-60 psig)	Special Exhaust	yes

See PG-08-6 for steam, heat gain, & exhaust capacities. See PG-08-4 Volume 3 Section II for Type 'B' hood details.

Provide a dedicated exhaust system with liquid-tight stainless steel ductwork.

Limit temp rise in service area to 8.3°C (15°F) above disassembling area.

PLUMBING AND LABORATORY GASES

Sanitary Drain	yes	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	-	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

Glassware Washing and Sterilization Room

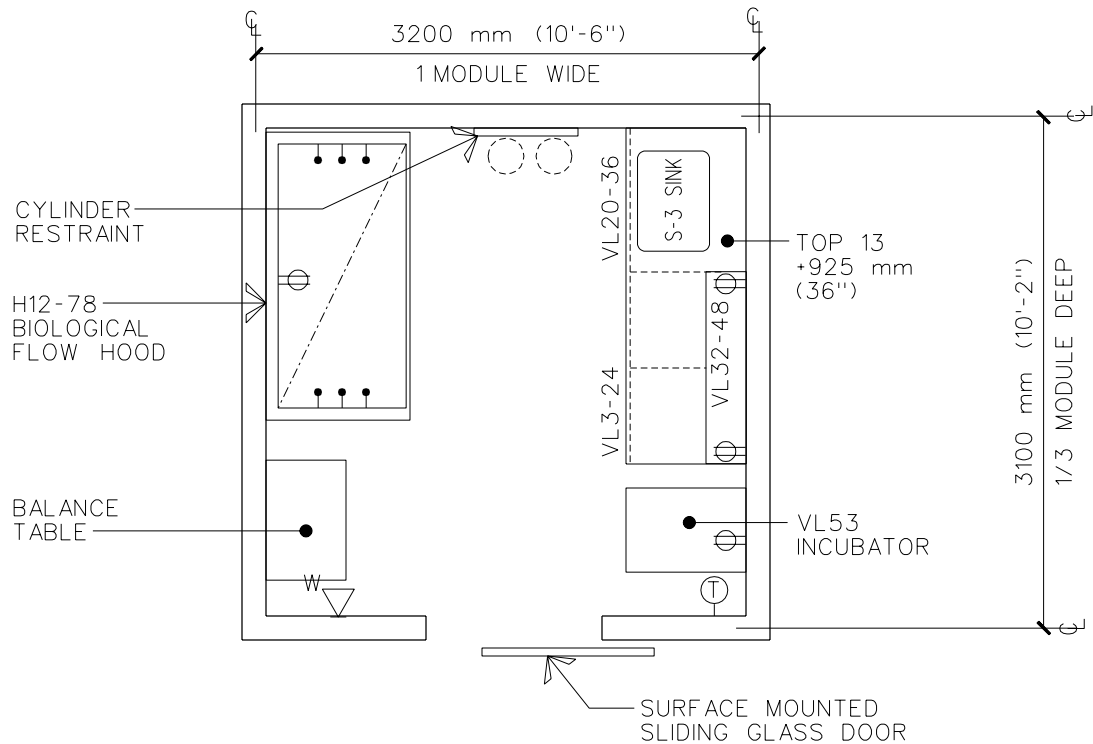
qty	symbol	ai	description
1	HW517	CC	WASHING MACHINE, LABORATORY GLASSWARE AND UTENSILS, RECESSED, 660 MM X 483 MM (26" X 19"), BASKET OR SPINDLE HEADER OR PIPETTE HEADER, WITH HEADER TRANSFER DOLLY, 1143 MM X 1067 MM X 2286 MM (45" X 42" X 90") (PG-08-1 & PG-08-6, MCS 11714)
1	DW911	VV	STILL, WATER, HIGH PURITY, 19 L (5 GAL.) PER HOUR, COUNTER MOUNTED, 635 MM X 406 MM X 1143 MM (25" X 16" X 45"), 208 VOLT, 40 AMP, SINGLE PHASE (PG-08-1, MCS 11612)
1		CC	UTILITIES FOR ELECTRIC STILL, ELECTRIC OUTLET, 208 VOLT, 50 AMP, 1 PHASE, WATER AND WASTE FROM ADJACENT SINK
1	VS260	CC	STERILIZER, LABORATORY, RECESSED, CHAMBER SIZE: 610 MM X 914 MM X 1219 MM/.68 M3 (24" X 36" X 48"/24 CU. FT.), (PG-08-1 & PG-08-6, MCS 11710)
AR		CC	HOOD, EXHAUST, OVER STERILIZER DOOR (PG-08-1, MCS 15840)
AR		VV	OVEN, DRYING, FLOOR MOUNTED, 208 VOLT, 3000 WATT
1		CC	SINK, CORROSION RESISTING STEEL, 2 COMPARTMENT, EACH SINK 559 MM X 406 MM X 279 MM (22" X 16" X 11"), WITH FAUCET AND RINSE HOSE ASSEMBLY (PG-08-1, MCS 11602)
1	VL20/ 20A	CF	CABINET, UNDERCOUNTER, SINK UNIT, 2 HINGED PANEL DOORS, WIDTH - 1219 MM (48"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR		CF	COUNTER TOP, CORROSION RESISTING STEEL, 32 MM (1-1/4") THICK
AR	VL1/1A	CF	CABINET, UNDERCOUNTER, WITH 4/3 DRAWERS, WIDTH - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHTS - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
			-OR-
AR	VL4/4A	CF	CABINET, UNDERCOUNTER, WITH 2 DRAWERS, 2 HINGED DOORS AND 1 ADJUSTABLE SHELF, WIDTH - 1219 MM (48"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL7/7A	CF	CABINET, UNDERCOUNTER, WITH 2 HINGED DOORS AND 2/1 ADJUSTABLE SHELVES, WIDTHS - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHTS - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
AR	VL14	CF	TABLE FRAME, WITH DRAWER(S), KNEE SPACE UNIT, WIDTH - 1067 MM (42"); DEPTH - 559 MM (22"); HEIGHT - 787 MM (31") (PG-08-1 & PG-08-6, MCS 12345)
AR	VL29	CF	CABINET, WALL, WITH SLOPING TOP, 2 GLAZED SLIDING DOORS AND 2 ADJUSTABLE SHELVES, WIDTH - 914 MM (36"); DEPTH - 406 MM (16"); HEIGHT - 762 MM (30") (PG-08-1 & PG-08-6, MCS 12345)

Equipment Guide List

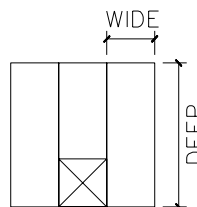
Glassware Washing and Sterilization Room

qty	symbol	ai	description
AR		VV	TABLE, WORK, 864 MM X 1524 MM X 762 MM (34" X 60" X 30")
1		VV	DISPENSER, PAPER TOWEL, SURFACE MOUNTED
1	K3010	CC	MACHINE, ICE MAKING (CRUSHED) AND DISPENSING, AUTOMATIC, FLOOR MOUNTED, 45 KG (100 LB.), BIN, 120 VOLT, 20 AMP, 710 MM X 658 MM X 2108 MM (28" X 25" X 82") (PG-08-1 & PG-08-6, MCS 11415)
1		CC	DRAIN, FLOOR (PG-08-1, MCS 15400)
1		VV	CLOCK, BATTERY OPERATED
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 15 AMP, STRIP MOLD WITH OUTLETS, WIRED ALTERNATELY ON SEPARATE CIRCUITS ON 610 MM (24") CENTERS ABOVE COUNTER (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, 208 VOLT, 20 AMP, 1 PHASE, ON WALL, WEATHERPROOF (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

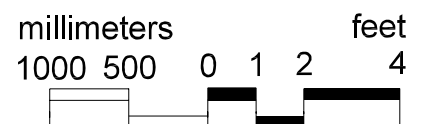
Equipment & Utility Plan Tissue Culture Laboratory



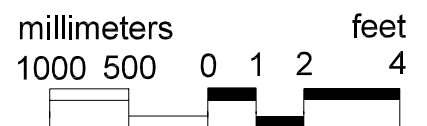
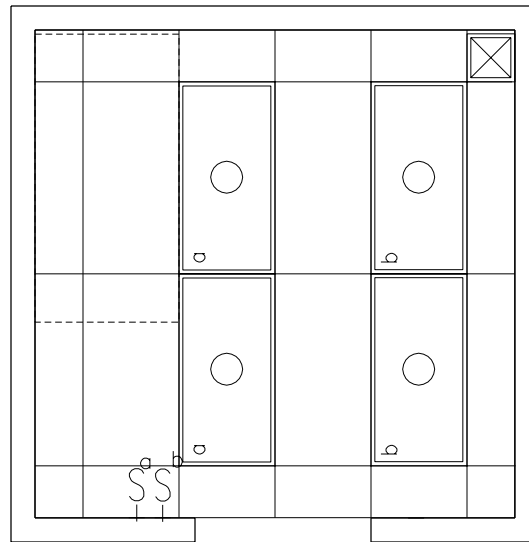
NOTE:
THIS ROOM IS 1/3 MODULE
DEEP AND 1 MODULE WIDE.



9 m²
(97 ft²)



Reflected Ceiling Plan Tissue Culture Laboratory



Design Standards

Tissue Culture Laboratory

ARCHITECTURAL

Floor Area	9 m ² (97 ft ²)	Wall Finish	gwb
Ceiling	at	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

SPECIAL EQUIPMENT

H12-78 Laminar Flow Hood			
Lighting		ELECTRICAL	Power
General	550 lx (50 fc)	General	-
Special	1100 lx (100 fc) task	Special	-
Louvered deep cell parabolic fixtures, T-8 lamps		Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	yes
-----------	-----	-----	-----

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	420 W	Dry Bulb Temp Cooling	25°C (78°F)
AC Load Equipment	36 W/m ² (3.6 W/ft ²)	Dry Bulb Temp Heating	22°C (72°F)
Number of People	1	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	positive	Minimum % Outside Air	100
Min Air Changes per Hour	12	100% Exhaust Air	yes
Steam	-	Special Exhaust	-
See PG-08-10 HVAC for exhaust requirements for specific laminar flow hood type.			

PLUMBING AND LABORATORY GASES

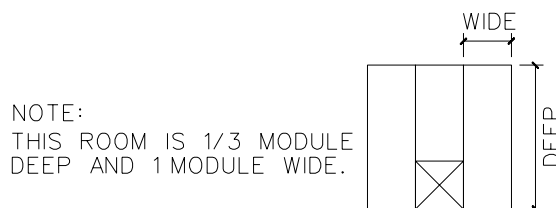
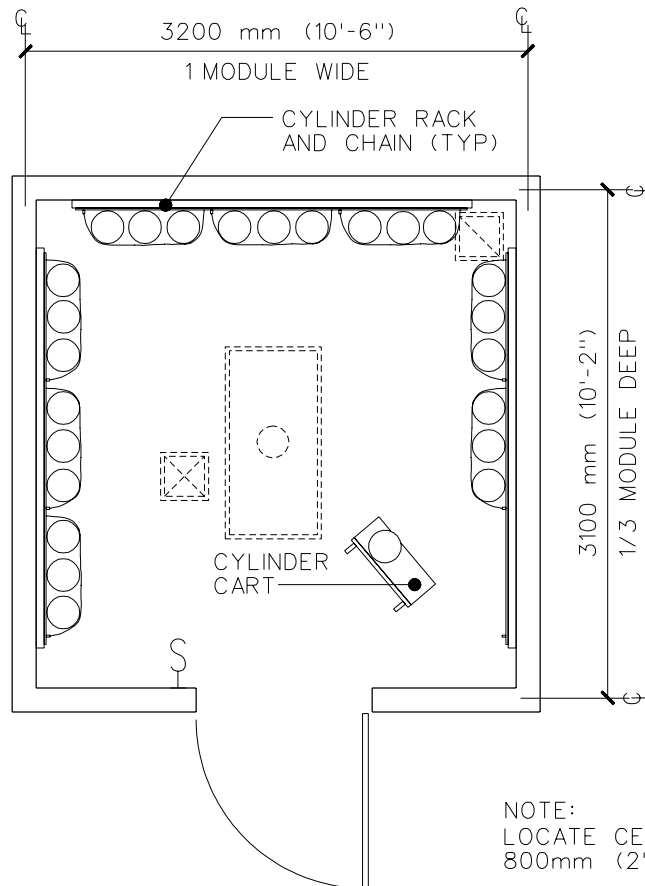
Sanitary Drain	-	Cold Water	yes
Acid Waste	yes	Hot Water	yes
Other	-	Reagent Grade Water	yes
Fuel Gas	yes	Laboratory Air	yes
Nitrogen	-	Laboratory Vacuum	yes

Equipment Guide List

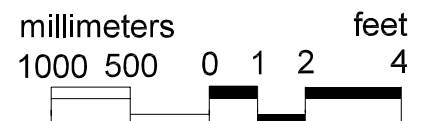
Tissue Culture Laboratory

qty	symbol	ai	description
1	H12-54/ 78	CC	CABINET, AIR FLOW, BIOLOGICAL WITH LAB AIR, FUEL GAS AND LAB VACUUM OUTLETS, 120 VOLT, 20 AMP, RECEPTACLE (PG-08-1 & PG-08-6, MCS 11604)
1	VL32	CF	CABINET, WALL, OPEN WITH SLOPING TOP AND 2 ADJUSTABLE SHELVES, WIDTHS - 1219 MM (48"); DEPTH - 330 MM (13"); HEIGHT - 762 MM (30") (PG-08-1 & PG-08-6, MCS 12345)
1	VL3/3A	CF	CABINET, UNDERCOUNTER, WITH 5/4 DUST SEAL DRAWERS, WIDTH - 610 MM (24"); DEPTH - 559 MM (22"); HEIGHTS - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
1	VL20/ 20A	CF	CABINET, UNDERCOUNTER, WITH 5/4 DUST SEAL DRAWERS, AVAILABLE WIDTHS - 914 MM (36"); DEPTH - 559 MM (22"); HEIGHTS - 787 MM (31"); FOR FLOOR MOUNTED ADD 127 MM (5") TOE BASE (PG-08-1 & PG-08-6, MCS 12345)
1	S-3	CF	SINK, MOLDED, RESIN WITH END OR CORNER DRAIN OUTLET, 635 MM X 457 MM X 406 MM (25" X 18" X 16") (PG-08-1 & PG-08-6, MCS 11602)
1	TOP 13/ 13A	CF	COUNTER TOP, EPOXY, RESIN, WITH DRIP GROOVE, 25 MM (1") THICK, 762 MM (30") DEEP ALONG WALL (PG-08-1 & PG-08-6, MCS 11602)
1		VV	TABLE, BALANCE
1	VL53	VV	INCUBATOR, BACTERIOLOGICAL, 120 VOLT, 1.5 KW
1		VV	CLOCK, BATTERY OPERATED
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)

Equipment & Utility Plan Gas Cylinder Storage Room



9 m²
(97 ft²)



Design Standards

Gas Cylinder Storage Room

ARCHITECTURAL

Floor Area	9 m ² (97 ft ²)	Wall Finish	cmu
Ceiling	gwb	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	c (treated)
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	325 lx (30 fc)	General	-
Special	-	Special	-
Emergency	-	Emergency	-

COMMUNICATIONS

Telephone	-	ADP	-
-----------	---	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	140 W	Dry Bulb Temp Cooling	26°C (78°F)
AC Load Equipment	-	Dry Bulb Temp Heating	22°C (72°F)
Number of People	-	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour *		100% Exhaust Air	yes

*Min 4 air changes per hour or 0.005 m³/s per m² (1 cfm per ft²) of floor area.

NFPA 55 requirements must be met.

Provide continuous gas detection system with ECC alarm and local alarm at continuously attended location.

PLUMBING AND LABORATORY GASES

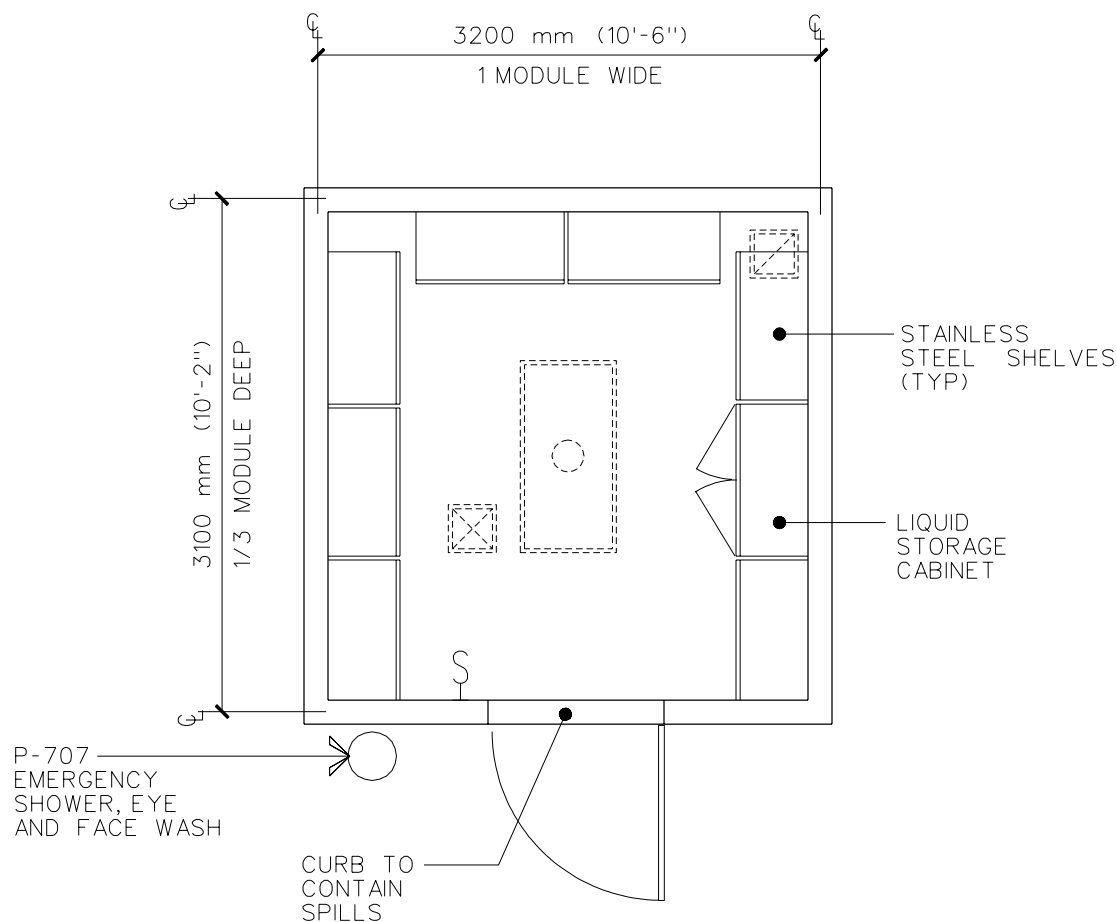
Sanitary Drain	-	Cold Water	-
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

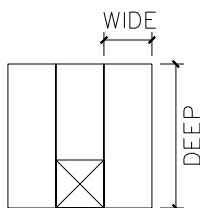
Gas Cylinder Storage Room

qty	symbol	ai	description
NOTE: CONSTRUCTION TO COMPLY WITH NFPA 68, CHAPTER 4.			
AR		CC	RACK, CYLINDER, 711 MM X 559 MM X 1930 MM (28" X 22" X 76") (PG-08-1, MCS 10360; H-08-4, SD 64C)
AR		CC	RACK, CHAIN (PG-08-1, MCS 10360; H-08-4, SD 64C)
2		VV	CART, CYLINDER, 610 MM X 762 MM (24" X 30")

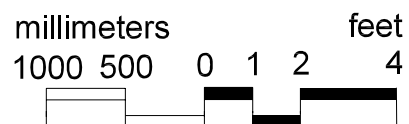
Equipment & Utility Plan Acid Storage Room



NOTE:
THIS ROOM IS 1/3 MODULE
DEEP AND 1 MODULE WIDE



9 m²
(97 ft²)



Design Standards

Acid Storage Room

ARCHITECTURAL

Floor Area	9 m ² (97 ft ²)	Wall Finish	cmu
Ceiling	gwb	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	c (treated)
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	550 lx (50 fc)	General	-
Special	-	Special	-
Emergency	-	Emergency	-

COMMUNICATIONS

Telephone	-	ADP	-
-----------	---	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	140 W	Dry Bulb Temp Cooling	26°C (78°F)
AC Load Equipment	-	Dry Bulb Temp Heating	22°C (72°F)
Number of People	-	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	4	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes

Provide dedicated exhaust system for room, with acid resistant epoxy coating on exhaust fan.

Ductwork to be fiberglass reinforced polyester resin self-extinguishing material, or galvanized plastic coated (PVC) acid-resistant material.

PLUMBING AND LABORATORY GASES

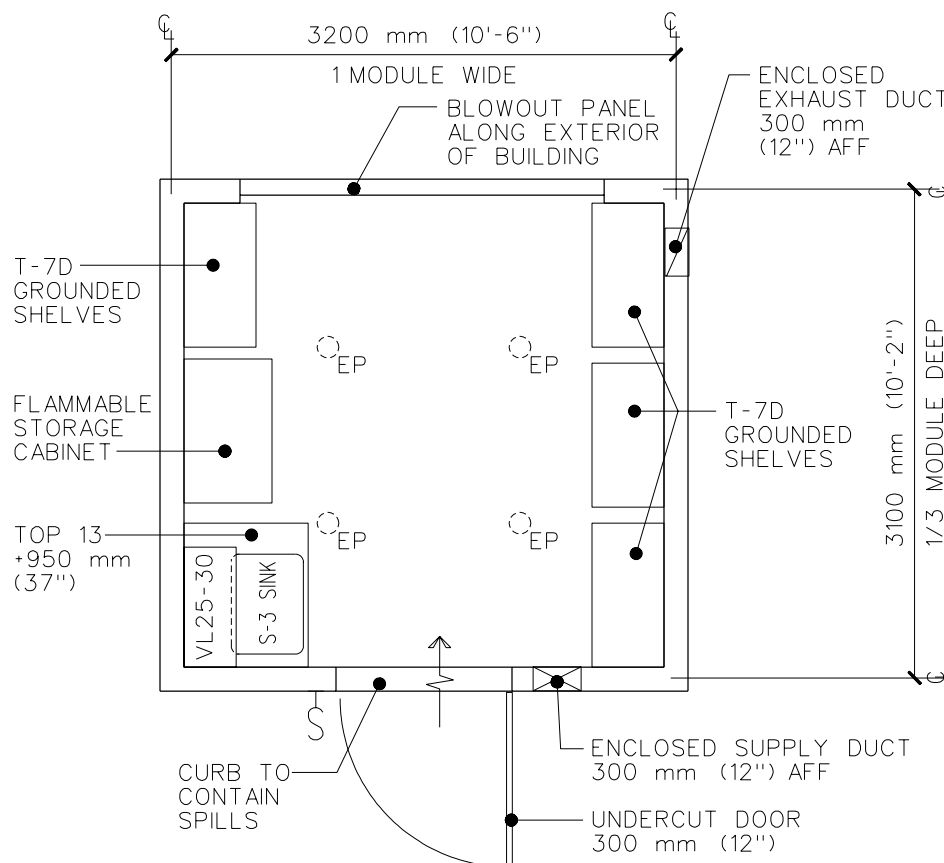
Sanitary Drain	-	Cold Water	-
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

Acid Storage Room

qty	symbol	ai	description
			NOTE: PROVIDE ADEQUATE VENTILATION AND TEMPERATURE CONTROL AS REQUIRED.
AR		VV	CABINET, STORAGE, LIQUID
AR	T-7D	CC	SHELVING, WALL HUNG, STAINLESS STEEL, STANDARD AND BRACKET TYPE, 4 ADJUSTABLE SHELVES, 914 MM X 457 MM X 1219 MM (36" X 18" X 48"), WITH LIP EDGES (PG-08-1, MCS 10671; H-08-4, SD 60D)
			NOTE: P-707, EMERGENCY SHOWER, EYE AND FACE WASH TO BE LOCATED IMMEDIATELY OUTSIDE OF ACID STORAGE ROOM.

Equipment & Utility Plan Flammable Storage Room

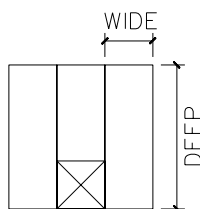


NOTE:
LOCATE THIS ROOM
ALONG EXTERIOR WALL

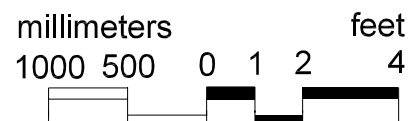
NOTE:
NEED FOR BLOWOUT PANEL
IS DEPENDENT UPON CODE
REQUIREMENTS, AND TYPE
AND QUANTITY OF
FLAMMABLE LIQUIDS.

NOTE:
TWO HOUR WALL CONSTRUCTION
PER NFPA-30. COORDINATE WITH
HVAC DUCT LOCATIONS.

NOTE:
THIS ROOM IS 1/3 MODULE
DEEP AND 1 MODULE WIDE



9 m²
(97 ft²)



Design Standards

Flammable Storage Room

ARCHITECTURAL

Floor Area	9 m ² (97 ft ²)	Wall Finish	cmu/gwb
Ceiling	gwb	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	c (treated)
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	325 lx (30 fc)	General	-
Special	-	Special	-
Explosion proof incandescent fixtures with PAR38 halogen flood lamps on dimmer switch		Seal conduit in rigid steel	

COMMUNICATIONS

Telephone	-	ADP	-
-----------	---	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	600 W	Dry Bulb Temp Cooling	26°C (78°F)
AC Load Equipment	-	Dry Bulb Temp Heating	22°C (72°F)
Number of People	-	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	30%
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour *		100% Exhaust Air	yes
Steam	-	Special Exhaust	yes

*Min 6 air changes per hour or 0.005 m³/s per m² (1 cfm per ft²) of floor area, or 0.067 m³/s (150 cfm) exhaust.

NFPA 30 requirements must be met.

Provide a dedicated exhaust system for room.

Provide explosion-proof motor & spark-proof fan.

PLUMBING AND LABORATORY GASES

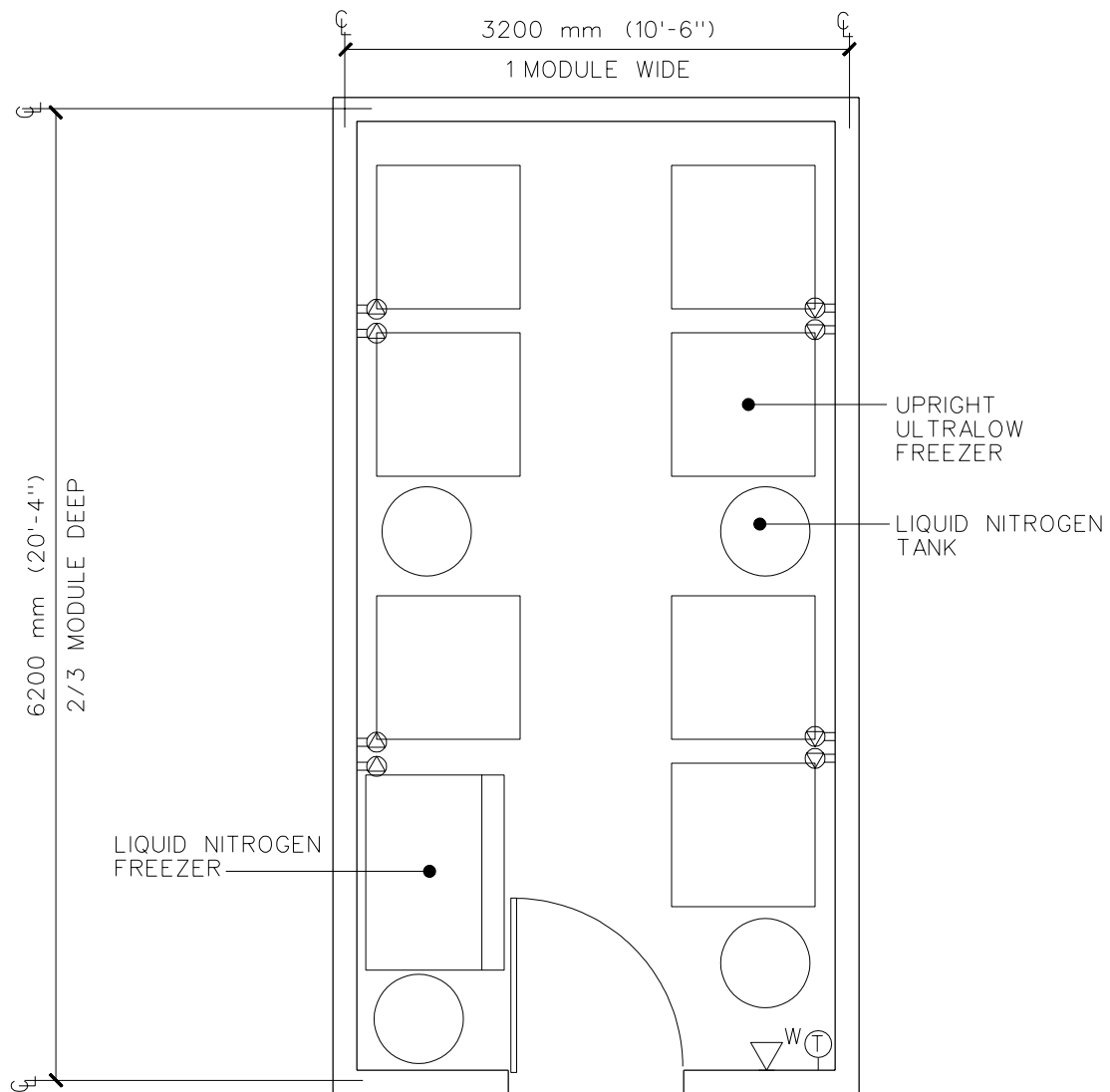
Sanitary Drain	yes	Cold Water	yes
Acid Waste	-	Hot Water	yes
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

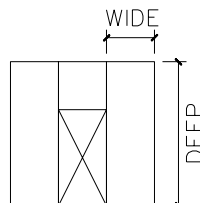
Flammable Storage Room

qty	symbol	ai	description
NOTE: PROVIDE ADEQUATE VENTILATION AND TEMPERATURE CONTROL AS REQUIRED.			
AR		VV	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 20 AMP (PG-08-1, MCS 16140; H-08-3, CS 801-3)
AR	T-7D	CC	SHELVING, WALL HUNG, STAINLESS STEEL, STANDARD AND BRACKET TYPE, 4 ADJUSTABLE SHELVES, 914 MM X 457 MM X 1219 MM (36" X 18" X 48"), WITH LIP EDGES (PG-08-1, MCS 10671; H-08-4, SD 60D)
AR	T-6A	CC	SHELVING, FLOORSTANDING, STEEL, WITH SLOPING TOP AND 4 OR 5 ADJUSTABLE SHELVES, 914 MM X 457 MM X 2134 MM (36" X 18" X 84") (PG-08-1, MCS 12301; H-08-4, SD 60B)
1	VL25	CF	CABINET, WALL, WITH SLOPING TOP, 2 GLAZED SLIDING DOORS AND 2 ADJUSTABLE SHELVES, AVAILABLE WIDTHS - 762 MM (30"); DEPTH - 330 MM (13"); HEIGHT - 762 MM (30") (PG-08-1 & PG-08-6, MCS 12345)
1	TOP 13/13A	CF	COUNTER TOP, EPOXY, RESIN, WITH DRIP GROOVE, 25 MM (1") THICK (PG-08-1 & PG-08-6, MCS 11602)
1	S-3	CF	SINK, MOLDED, RESIN WITH END OR CORNER DRAIN OUTLET, 635 MM X 457 MM X 406 MM (25" X 18" X 16") (PG-08-1 & PG-08-6, MCS 11602)
1		VV	EMERGENCY EYE AND FACE WASH, MOUNTED ON GOOSENECK FAUCET

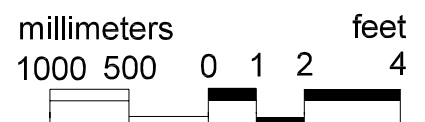
Equipment & Utility Plan Ultralow Freezer Room



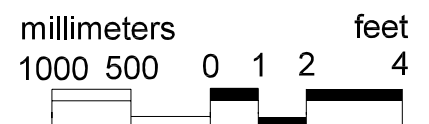
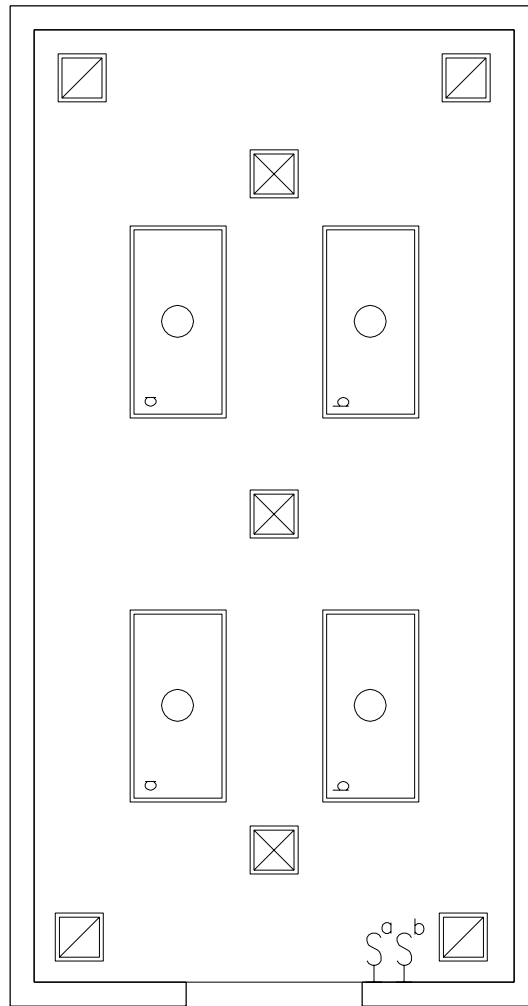
NOTE:
THIS ROOM IS 2/3 MODULE
DEEP AND 1 MODULE WIDE.



18.5 m²
(198 ft²)



Reflected Ceiling Plan Ultralow Freezer Room



Design Standards

Ultralow Freezer Room

ARCHITECTURAL

Floor Area	18.5 m ² (198 ft ²)	Wall Finish	cmu (sc)
Ceiling	gwb	Base	rb
Ceiling Height	2700 mm (9 ft)	Floor Finish	vct
RFI Shielding	-	Slab Depression	-
Soundproofing	-	Floor Load	-

Lighting

ELECTRICAL

Power

General	550 lx (50 fc)	General	-
Special	-	Special	-
Emergency	-	Emergency	-

COMMUNICATIONS

Telephone	yes	ADP	-
-----------	-----	-----	---

HEATING, VENTILATING AND AIR CONDITIONING

AC Load Lights	420 W	Dry Bulb Temp Cooling	22°C (72°F)
AC Load Equipment	161 W/m ² (15.0 W/ft ²)	Dry Bulb Temp Heating	-
Number of People	-	Relative Humidity - Cooling	50%
Noise Criteria	NC-45	Relative Humidity - Heating	- %
Room Pressure	negative	Minimum % Outside Air	100
Min Air Changes per Hour	30	100% Exhaust Air	yes
Steam	-	Special Exhaust	yes

Freezers have air-cooled compressors. Freezer temperature -62.2°C (-80°F).

Provide heat recovery system, if cost effective based on life cycle cost, to apply to an appropriate system in the building. See PG-08-10 HVAC for type of heat recovery system that may be employed.

PLUMBING AND LABORATORY GASES

Sanitary Drain	-	Cold Water	-
Acid Waste	-	Hot Water	-
Other	-	Reagent Grade Water	-
Fuel Gas	-	Laboratory Air	-
Nitrogen	-	Laboratory Vacuum	-

Equipment Guide List

Ultralow Freezer Room

qty	symbol	ai	description
AR		VV	FREEZER, ULTRALOW, UPRIGHT
AR		VV	FREEZER, LIQUID NITROGEN, 1219 MM X 914 MM (48" X 36")
AR		VV	TANK, LIQUID NITROGEN, 610 MM (24") DIAMETER
AR		CC	RECEPTACLE, ELECTRICAL, DUPLEX, 120 VOLT, 30 AMP, DEDICATED CIRCUIT (PG-08-1, MCS 16140)
AR		CC	RECEPTACLE, ELECTRICAL, 208 VOLT, 20 AMP, 1 PHASE, ON WALL, WEATHERPROOF (PG-08-1, MCS 16140; H-08-3, CS 801-3)
NOTE: PROVIDE MONITORING SYSTEM IF CARBON DIOXIDE IS USED.			