Site Preparation Guide

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Preface

Purpose and audience

This guide provides system and facility managers with technical information needed to prepare their sites for V-Class servers.

Scope

Specifications and information contained in this manual apply to V-Class servers.

The site preparation guide is divided into four chapters:

- Chapter 1, “System definitions and specifications”— Contains information on the specifications for V-Class servers.
- Chapter 2, “Electrical and environmental guidelines”— Provides detailed information about electrical factors and environmental elements.
- Chapter 3, “Facility guidelines”—Describes facility considerations such as space requirements, floor loading, window locations, altitude effects, and operational considerations.
- Chapter 4, “Preinstallation survey”—Contains procedures for installing the processor and expansion cabinets as a new system at a site.
- Appendix A, “Requirements summary”—Provides examples and worksheets to determine power consumed, air conditioning requirements and weight for a specific system.
- Appendix B, “General information”—Provides some of the formulas most often needed when doing site preparation.
- Appendix C, “Templates”—Provides the templates required to lay out a computer site for the V-Class servers.

Notes

This document presents notes in the following format.

NOTE A Note highlights supplemental information.

Associated documents

The following is a list of other documents that provide more details on the topics presented in this manual:

- Standard for the Protection of Electronic Computer Data Processing Equipment, (NFPA75) National Fire Protection Association
- EIA Standard RS-232-C, Electronic Industries Association
- Electrostatic Discharge Failures of Semiconductor Devices, Unger, B.A. 1981, Bell Laboratories

1 System specifications

This chapter contains information on the specifications for V-Class servers. Tables list equipment dimensions and weights and power and cooling specifications. Basic V-Class server configurations are also discussed.

Topics discussed are:

- V-Class servers—Describes basic system building blocks.
- Dimensions and weights—Discusses V-Class server systems and individual cabinets.
- Electrical specifications —Discusses the power required for computers, upgrading and expansion, and the test station.
- Power connectors and receptacles—Discusses connectors and receptacles required for the V-Class server and the test station.
- Environmental specifications—Discusses operating ranges for temperature and humidity.

V-Class servers

Power, cooling, and space requirements for V-Class servers vary, depending on the configuration to be installed. These differences, as well as the maximum circuit board configurations, are described in this section.

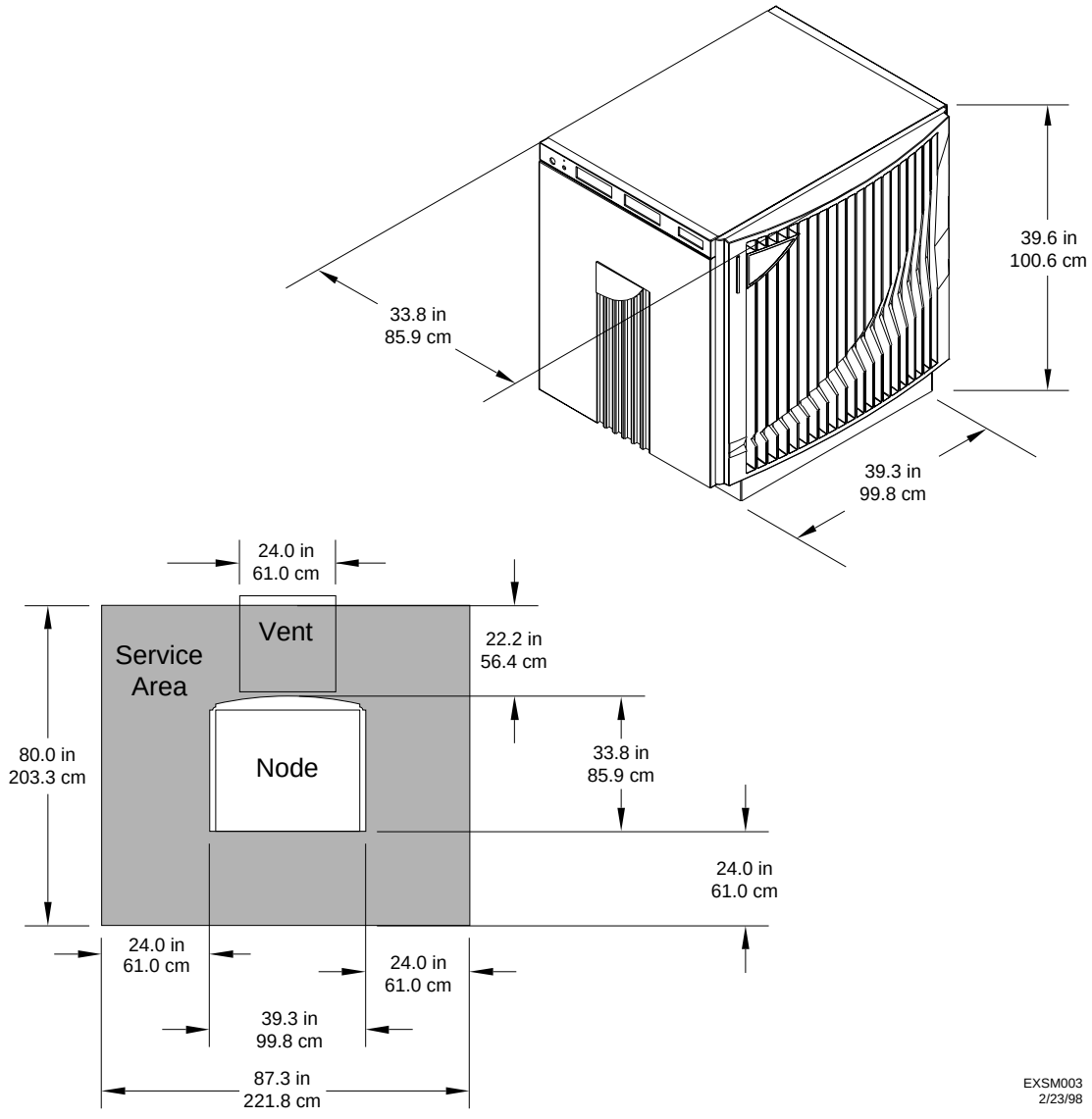
Basic system building blocks

The basic system building blocks used to configure a V-Class server are as follows:

- Server cabinet
- Test station

Figure 1 illustrates a typical V-Class server.

Figure 1 Typical V-Class server

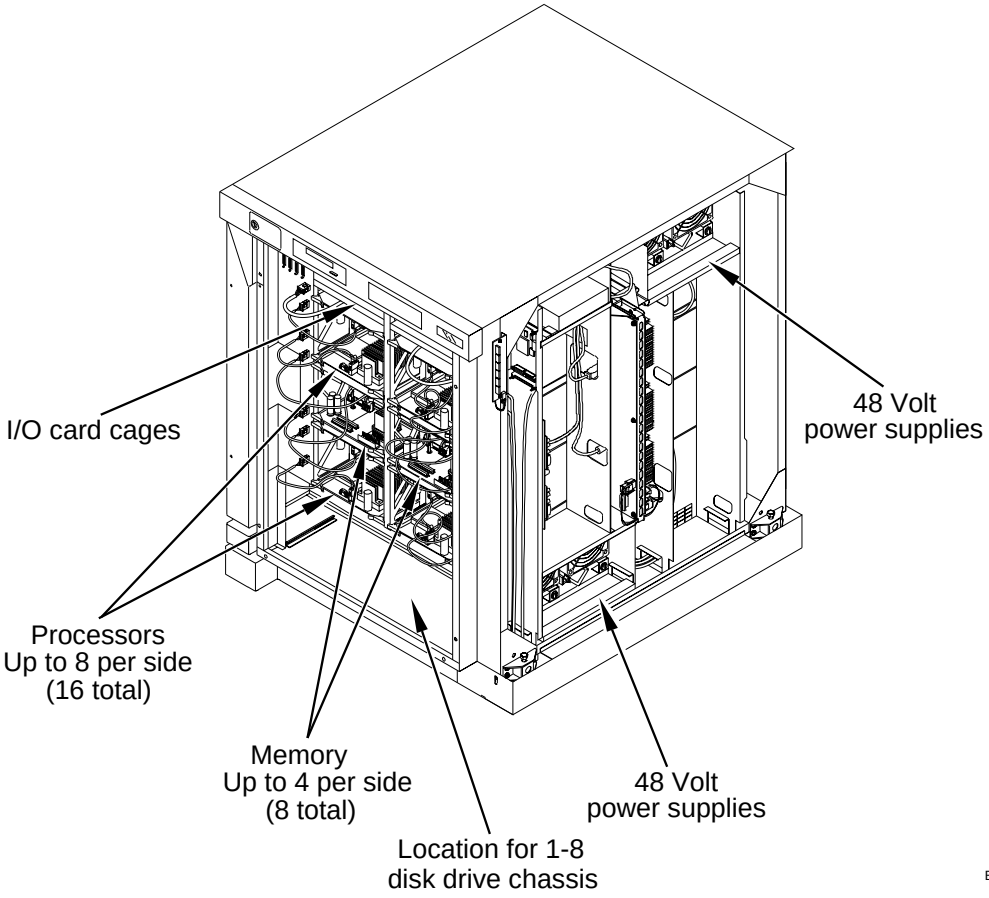


Server cabinet

This cabinet is the main building block of the V-Class server.

The cabinet may contain up to 16 processors, 8 memory boards, 4 I/O card cages, cooling fans, and power supplies. Figure 2 illustrates the location of these components.

Figure 2 Server cabinet components



Upgrading V-Class servers

When upgrading within a cabinet (adding additional memory, processors, etc.), space requirements remain the same, but power and cooling need to be increased.

When upgrading to a larger model (adding cabinets), additional floor space, as well as cooling and power, is required.

NOTE Identify and plan for future upgrades and expansions. It is cost effective to provide the extra space, cooling, and power capability you may require later, even though you do not use it immediately.

Dimensions and weights

Dimensions and weights of the system components are listed in the following tables. Table 1 lists specific component weights. To determine the weight of your specific system, refer to Table 18 on page 78 and Table 19 on page 79.

Table 1 **System component weights**

Component	Weight (kg)
Configured server (No internal disks, one CD ROM drive, no DAT drive, maximum boards and NPS)	518.1 lbs (235.5)
Fully configured server (16 internal disks, one CD ROM drive, one DAT drive, maximum boards and NPS)	558 lbs (253.1)
Processor board (EPB)	5.3 lbs (2.4)
Memory board[1] (EMB)	5.5 lbs (2.75)
PCI chassis	8.5 lbs (4.0)
Power supply[2] (NPS)	4.3 lbs (2.0)
Chassis including skins[3]	335.0 lbs (152.3)
CD ROM drive (internal)	3.1 lbs (1.4)
DAT drive[4] (internal)	3.1 lbs (1.4)
9 Gbyte disk[4] (internal)	2.3 lbs (1.0)

1. A minimum of two EMBs are required for each system.
2. A minimum of two NPSs are required for each system.
3. The listed weight for the chassis includes all items common to all systems not listed seperately in this table.
4. These items are optional and may not be included in your system.

Circuit board dimensions and weights

The server and component dimensions that comprise a V-Class server are listed in Table 2.

Table 2 Server and component dimensions

Board type	Width (cm)	Depth/ length (cm)	Height (cm)	Maximum quantity per server
Server (V-Class server)	39.3 in. (99.8)	33.8 in. (85.9)	39.6 in (100.6)	1
Power supplies (NPS)	5.0 in. (12.7)	6.0 in. (15.2)	6.7 in. (17.0)	4
Memory board (EMB)	7.8 in. (19.8)	15.5 in. (39.4))	3.6 in. (9.1)	8
Processor board (EPB)	7.8 in. (19.8)	15.5 in. (38.4)	2.9 in. (7.4)	16
PCI chassis[1]	7.8 in. (19.8)	16.0 in. (40.6)	5.75 in. (14.6)	4
Disk tray[2]	20.6 in. (52.3)	6.7 in. (17.0)	6.7 in. (17.0)	2

1. The PCI chassis can contain up to 6 controller cards.
2. This component is optional and may not be included in your system

Miscellaneous dimensions and weights

The dimensions and weights of the test station and the V-Class server system cabinet with shipping pallet are listed in Table 3.

Table 3 Miscellaneous dimensions and weights

Equipment	Width (cm)	Depth/length (cm)	Height (cm)	Weight (kg)
Test station[1]	60.0 in. (152.40)	30.0 in. (76.20)	45.0 in. (114.30)	103.0 lbs (46.9)
V-Class server on shipping pallet[2,3]	47.5 in. (120.7)	36.0 in (91.4)	44.5 in. (113.0)	727.0 lbs (330.5)
Stacked V-Class servers on shipping pallet[2,3]	47.5 in. (120.7)	36.0 in (91.4)	84.0 in. (215.5)	1254.0 lbs (597.2)
DLT 4700[4]	8.875 in. (22.2)	27.0 in. (67.5)	10.73 in. (26.83)	65.0 lbs (29.5)

1. Includes table and test station.
2. Shipping box, pallet, ramp and container adds approximately 209 lbs to the total system weight.
3. Does not include any optional equipment. Add 36.8 lbs (16.7 kg) for 16 internal disk drives or 73.6 lbs (33.4 kg) for 32 internal disk drives.
4. This component is optional and may not be included in your system·

Electrical specifications

This section provides electrical specifications for V-Class servers.

Branch circuit breaker sizing

A circuit breaker (40A minimum, 50A maximum) is required for each V-Class server cabinet. If a Hewlett-Packard UPS is used a 50A circuit breaker is required.

NOTE Always choose circuit breakers with the maximum allowed trip delay to avoid nuisance tripping.

Computer specifications

The ac power requirements for a V-Class server are described in detail in Table 4 and in Table 5. These tables provide information to help you determine the amount of ac power needed for your computer room. To determine the power requirements of your specific system, refer to Table 20 on page 80 and Table 21 on page 81.

Table 4 **System VA input (without test station)**

Power required (50 - 60 Hz)	VA
Fully configured V2200 Server (with internal disks)	5455
Fully configured V2250 Server (with internal disks)	5887
Processor boards (EPB)	187 (V2200) 214 (V2250)
Memory boards[1](EMB)	112
PCI chassis	165
CD ROM drive	16
Chassis (internal)	500
DAT drive[2](internal)	16
9 Gbyte disks[2] (internal)	23

1. A minimum of two EMBs are required for each system.
2. This component is an option and may not be included in your system.

ac power source specification

The low pass filter characteristics and balanced impedance built into the V-Class server power system provide superior noise immunity and performance. This helps to ensure that your equipment operates at optimum. Table 4 lists system power consumption and required kVa input for maximum configuration of the V-Class server.

To determine the power requirements of your specific system, refer to Table 20 on page 80 and Table 21 on page 81.

Test station ac power requirements

The ac power requirements for the V-Class server test station are listed in Table 5.

Table 5 Test station ac power requirements

Test station component	Type	Voltage (10%) vac	Frequency (1Hz)	Phase number	kVa input
Workstation and monitor	All	100 - 240	50 - 60	1	0.5
CD Rom	All	100 - 240	50 - 60	1	0.016
DAT drive	All	100 - 240	50 - 60	1	0.016

Power connectors and receptacles

This section describes the power connectors and receptacles used in a V-Class server.

Power connector and receptacle part numbers

In addition to the vendor part numbers, some power connectors and receptacles also have part numbers from national or international electrical power organizations. These organizations are:

- National Electrical Manufacturers Association (NEMA)
- International Electrotechnical Commission (IEC)

Cabinet cable connector and receptacle

Each V-Class server cabinet includes a 3-conductor, ac power cable and connector that extend 4.5 meters beyond the rear of the cabinet.

The connector on the end of the power cable plugs into the receptacle on the end of a corresponding customer supplied ac power drop. See Table 6 for details about these connectors and receptacles.

The receptacle should be easily accessible so that unplugging the power cable can be used as a means of shutting down the server.

NOTE When the system is to be installled on a raised floor, ensure that the ac receptacle is installed horizontally. A vertically installed receptacle will not allow clearance between the sub floor and the raised floor to allow connection of the power cord plug into the receptacle.

Table 6 System ac power connector and receptacle

Part type Reference specification	Circuit location	ac voltage rating	ac current rating (A)
IEC309-360P6 (North American, Japanese, and Asian)	Server plug	250	60
IEC309-363P6 (European)	Server plug	250	63
IEC309-360R6 or IEC309-360C6 (North American, Japanese, and Asian)	Customer receptacle	250	60
IEC309-363R6 or IEC309-363C6 (European)	Customer receptacle	250	63

Test station power cords

Power cords for the components that make up the V-Class server test station are listed in Table 7.

Table 7 Test station ac power cords

Where used	Standard	Part number
North America	NEMA 6- 15P (US and Canada - 250V)	8120-0698
North America	Nema 5-15P Plug US and Canada - 125 V))	8120-1378
Australia	Australian STD 3112 Plug	8120-1369
United Kingdom	British STD 1363/A Plug	8120-1351
European	Continental Europe CEE 7/7 Plug	8120-1689
Swiss	Swiss SEV Type 12 Plug	8120-2104
Denmark	Danish AFSNIT 107 Plug	8120-2956
South Africa	IEC 83-B1 Plug (S. Africa, India)	8120-4211
Japan	Japan NEMA 5-15 Plug	8120-4753

Environmental requirements

This section contains the environmental specifications and cooling requirements for the V-Class server.

Temperature and humidity specifications

Ambient intake air temperature is often different from ambient room temperature; you should measure the operating temperature and humidity directly in front of the cabinet cooling air intakes rather than check only ambient room conditions. Table 8 lists the computer room temperature and humidity specifications for V-Class servers.

Table 8 **V-Class server computer room environment**

Temperature and humidity specifications[1]		
Parameter	**Recommended operating range**	**Recommended maximum rate of change (per hour)**
Temperature[2]	68° to 86° F (20° to 30° C)	41° F repetitive, 68° F nonrepetitive (5° C repetitive, 20° C nonrepetitive)
Humidity	40% - 60% with no condensation	6%

1. These are recommended values. For operation outside these ranges, contact your Hewlett-Packard sales representative.
2. At altitudes up to 3,000 meters.

NOTE Operating ranges refer to the ambient air temperature and humidity measured at the cabinet cooling air intake vents.

Cooling requirements

Air conditioning equipment requirements and recommendations are described in the following sections.

Cabinet power dissipation specifications

Table 9 and Table 10 list the power dissipations of the equipment that make up the V-Class server computers. The table for each cabinet type lists the individual power dissipation totals for all equipment types that can be installed in that cabinet.

The air conditioning data is derived from the following equations:

- Watts x (0.860)=kcal/hour
- Watts x (3.414)=Btu/hour
- Btu/hour divided by 12,000=tons of refrigeration required

Cabinet power dissipation

Table 9 lists the power dissipation of the V-Class server system components. To determine the power dissipation of your specific system, refer to Table 20 on page 80 and Table 21 on page 81.

Table 9 **V-Class server system component power dissipation**

Component	Watts dissipated
Fully configured V2200 Server (with internal disks)[1]	5291
Fully configured V2250 Server (with internal disks)	5710
Processor boards (EPB)	181.0 (V2200) 208 (V2250)
Memory boards[2] (EMB)	109.0
PCI chassis	160.0
CD ROM drive (internal)	15.5

Component	Watts dissipated
Chassis	485.0
9 Gbyte disks[3](internal)	21.6
Dat drive3 (internal)	14.7

1. Does not include the test station.
2. A minimum of two EMBs are required for each system.
3. These components are optional and may not be included in your system.

Test station power dissipation

Table 10 lists the power dissipation of the V-Class server test station equipment.

Table 10 V-Class server test station power dissipation

Equipment	Type	Watts dissipated	kcal/ hour	Btu/ hour	Tons of refrigeration
Test station (includes monitor)	Domestic and international	365	306	1246	0.1
DAT (external)	Domestic and international	16	13.76	54.6	.005
CD Rom (external)	Domestic and international	16	13.76	54.6	.005
DLT 4700[1]	Optional	82	71	279.9	.02

1. This component is optional and may not be included in your system.

Air flow

V-Class servers require that the cabinet air intake temperature be between 20^{o} C and 30^{o} C.

The V-Class server cabinet moves approximately 1600 cfm (1cfm = 1.699 m^3/hr).

Any of the cooling system layouts described in Chapter 2 can be adapted to cool the V-Class server.

Figure 3 illustrates the location of the inlet and outlet airducts on a cabinet.

Figure 4 illustrates a cooling system layout adapted from typical cooling system described in Chapter 2.

Figure 3 **Air duct locations**

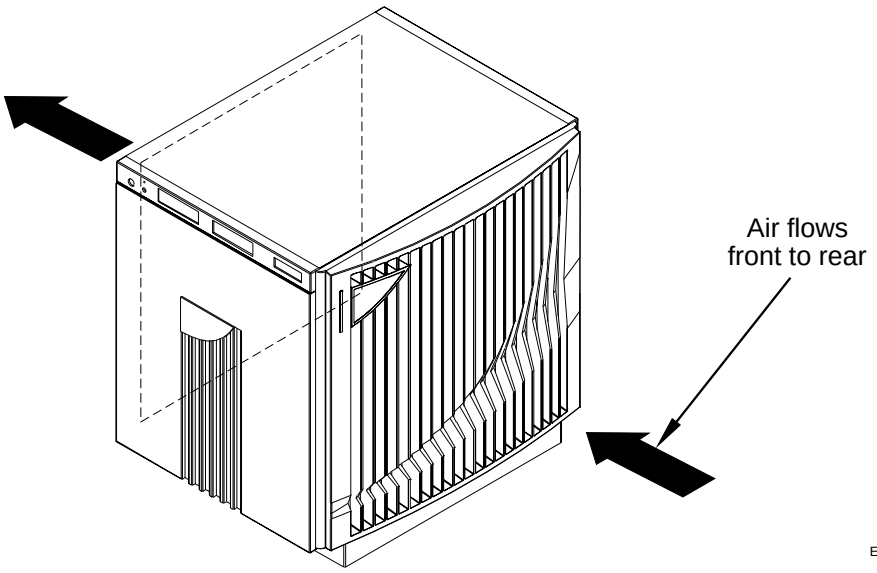
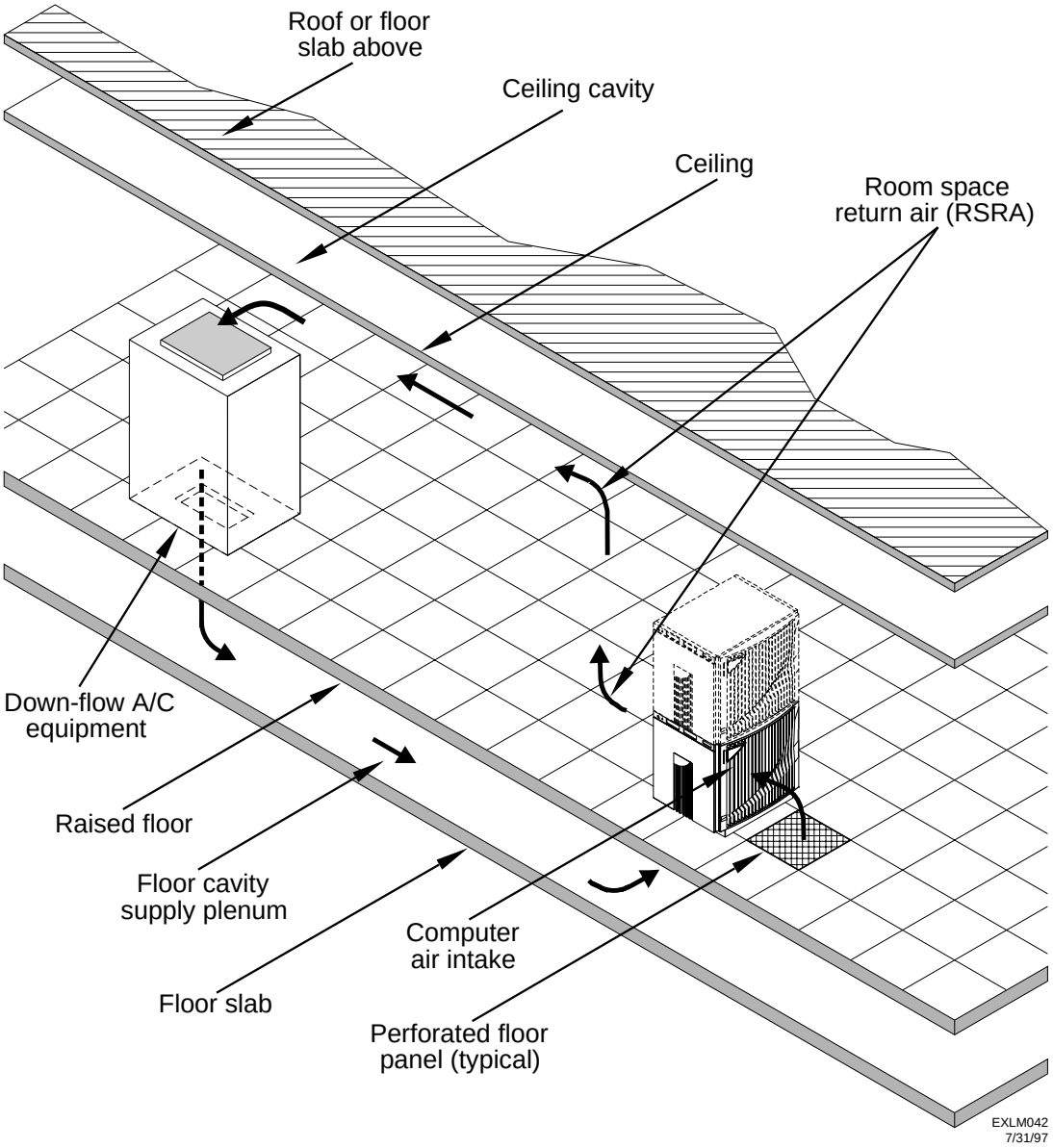


Figure 4 Typical V-Class server cooling system



2 Electrical and environmental guidelines

This chapter provides guidelines for planning and preparing the site. Careful site planning and preparation ensures trouble-free installation and reliable operation of V-Class servers. Factors that may contribute to less than optimal equipment operation are also highlighted.

Information relating to a V-Class server is summarized in Appendix A of this guide. Information on special installations, such as on board a ship, truck, or plane is not provided. For these types of installations, consult professionals in the appropriate field and follow their recommendations.

The major topics presented in this chapter are:

- Electrical factors
- Environmental elements
- Operational considerations

Electrical factors

Proper design and installation of a power distribution system for a V-Class server requires specialized skills. Those responsible for this task must have a thorough knowledge and understanding of appropriate electrical codes and the limitations of the power systems for computer and data processing equipment.

In general, a well-designed power distribution system exceeds the requirements of most electrical codes. A good design, when coupled with proper installation practices, produces the most trouble-free operation.

A detailed discussion of power distribution system design and installation is beyond the scope of this document. However, electrical factors relating to power distribution system design and installation must be considered during the site preparation process.

The electrical factors discussed in this section are:

- Computer room safety
- Electrical load requirements (circuit breaker sizing)
- Power quality
- Distribution hardware
- System installation guidelines
- Environmental elements

Computer room safety

Fire protection and adequate lighting (for equipment servicing) are important safety considerations. Federal and local safety codes govern computer installations.

Fire protection

The National Fire Protection Association's Standard for the Protection of Electronic Computer Data Processing Equipment, NFPA 75, contains information on safety monitoring equipment for computer rooms.

Most computer room installations are equipped with the following fire protection devices:

- Smoke detectors
- Fire and temperature alarms
- Fire extinguishing system

Additional safety devices are:

- Circuit breakers
- An emergency power cutoff switch

Lighting requirements for equipment servicing

Adequate lighting and utility outlets in a computer room reduce the possibility of accidents during equipment servicing. Safer servicing is also more efficient and, therefore, less costly.

For example, it is difficult to see cable connection points on the hardware if there is not enough light. Adequate lighting reduces the chances of connector damage when cables are installed or removed.

The minimum recommended illumination level is 70 foot-candles (756 lumens per square meter) when the light level is measured at 30 inches (76.2 cm) above the floor.

Electrical load requirements (circuit breaker sizing)

Electrical power load (kVa input) requirements for V-Class servers are summarized in Appendix A of this manual.

These tables provide load requirements for computers and peripherals, but additional capacity should be added for equipment upgrading or expansion.

It is always a good idea to derate power distribution systems for one or more of the following reasons:

- To avoid nuisance tripping from load shifts or power transients, circuit protection devices should never be run above 80% of their root-mean-square (RMS) current ratings.
- Safety agencies derate most power connectors to 80% of their RMS current ratings.

Power quality

This equipment is designed to operate over a wide range of voltages and frequencies. It has been tested and shown to comply with EMC Specification EN50082. However, damage can occur if these ranges are exceeded. Severe electrical disturbances can exceed the design specifications of the equipment.

Sources of electrical disturbances

Electrical disturbances, sometimes called glitches, affect the quality of electrical power. Common sources of these disturbances are:

- Fluctuations occurring within the facility's distribution system
- Utility service low-voltage conditions (such as sags or brownouts)
- Wide and rapid variations in input voltage levels
- Wide and rapid variations in input power frequency
- Electrical storms
- Large inductive sources (such as motors)
- Faults in the distribution system wiring (such as loose connections)
- Microwave, radar, or radio transmissions

Power system protection

Computer systems can be protected from the sources of many of these electrical disturbances by using:

- A dedicated power distribution system
- Power conditioning equipment
- Over- and under-voltage detection and protection circuits
- Screening to cancel out the effects of undesirable transmissions
- Lightning arresters on power cables to protect equipment against electrical storms

Power quality

Every precaution has been taken, during power distribution system design, to provide immunity to power outages of less than one cycle. However, testing cannot conclusively rule out loss of service. Therefore, adherence to the following guidelines provides the best possible performance of power distribution systems for V-Class server equipment:

- Dedicated power source—Isolates CPU power distribution system from other circuits in the facility.
- Missing phase and low-voltage detectors—Shuts equipment down automatically when a severe power disruption occurs. For peripheral equipment, these devices are recommended but optional.
- Uninterruptible power supply (UPS)—Keeps input voltage constant and should be considered if outages of one-half cycle or more are common. Refer to qualified contractors or consultants for each situation.

Distribution hardware

This section describes wire selection and the types of raceways used in the distribution system.

Wire selection

Use copper conductors instead of aluminum, as aluminum's coefficient of expansion differs significantly from that of other metals used in power hardware. Because of this difference, aluminum conductors can cause connector hardware to work loose, overheat, and fail.

Raceway systems

Raceways (electrical conduits) form part of the protective ground path for personnel and equipment. Raceways protect the wiring from accidental damage and also provide a heat sink for the wires.

Any of the following types may be used:

- Electrical metallic tubing (EMT) thin-wall tubing
- Rigid (metal) conduit
- Sealtight (for humid environments)

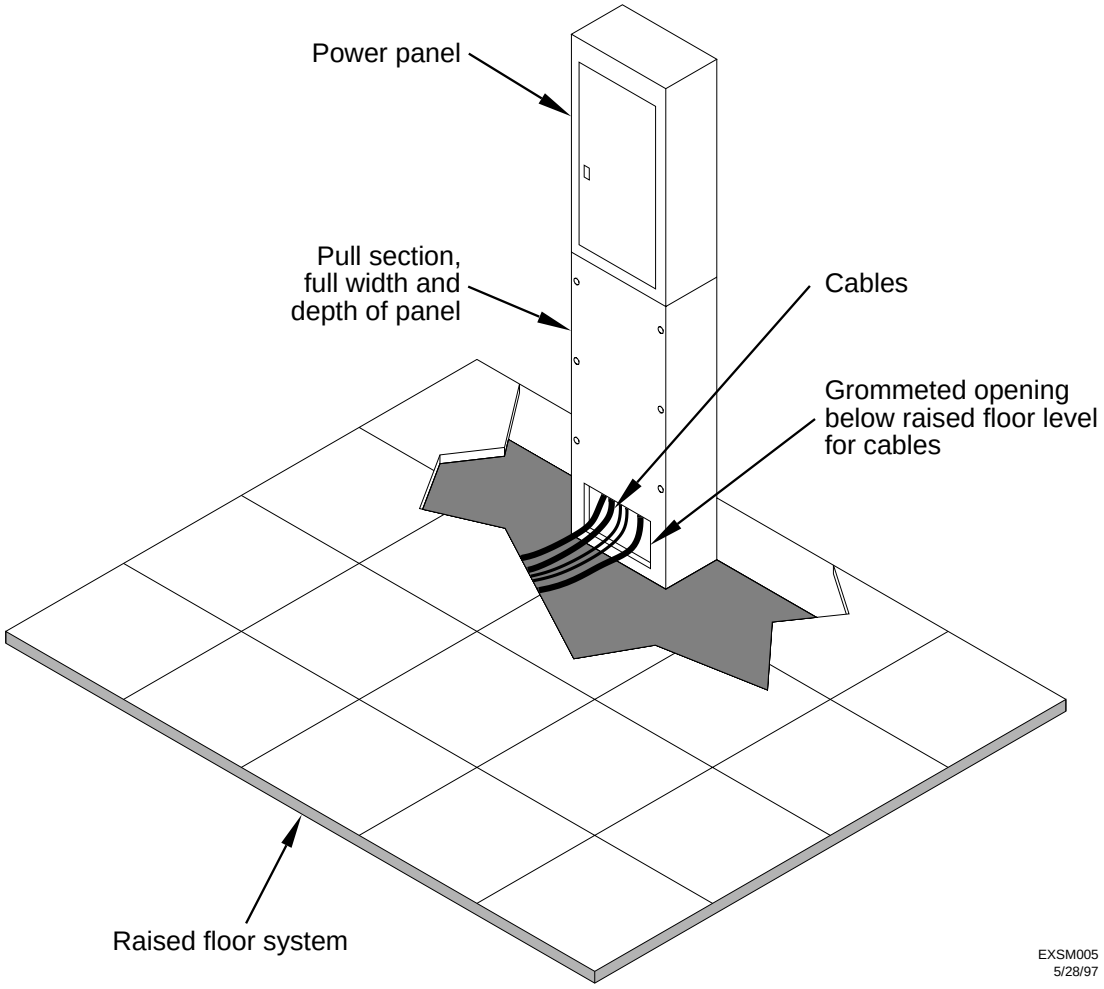
Raceway systems for building distribution

All building feeders and branch circuitry should be in rigid metallic conduit with proper connectors (to provide ground continuity). Conduit that is exposed and subject to damage should be constructed of rigid galvanized steel.

Raceway systems for raised floor application

A cable trough is not required for a V-Class server installed in a computer room that has a raised floor: the power drops and interface cables from the equipment are routed down through the panel pull section, through a grommet-protected opening (beneath the floor level), and under the floor panels. Figure 5 shows the power panel detail.

Figure 5 Power panel detail (raised floor)



Raceway systems for nonraised floor application

A cable trough may be required when an V-Class server system is installed in a computer room that does not have a raised floor. The power drops and interface cables from the CPU panel and peripheral panel are routed down through the panel pull section, out through a grommet-protected opening, and into the cable trough.

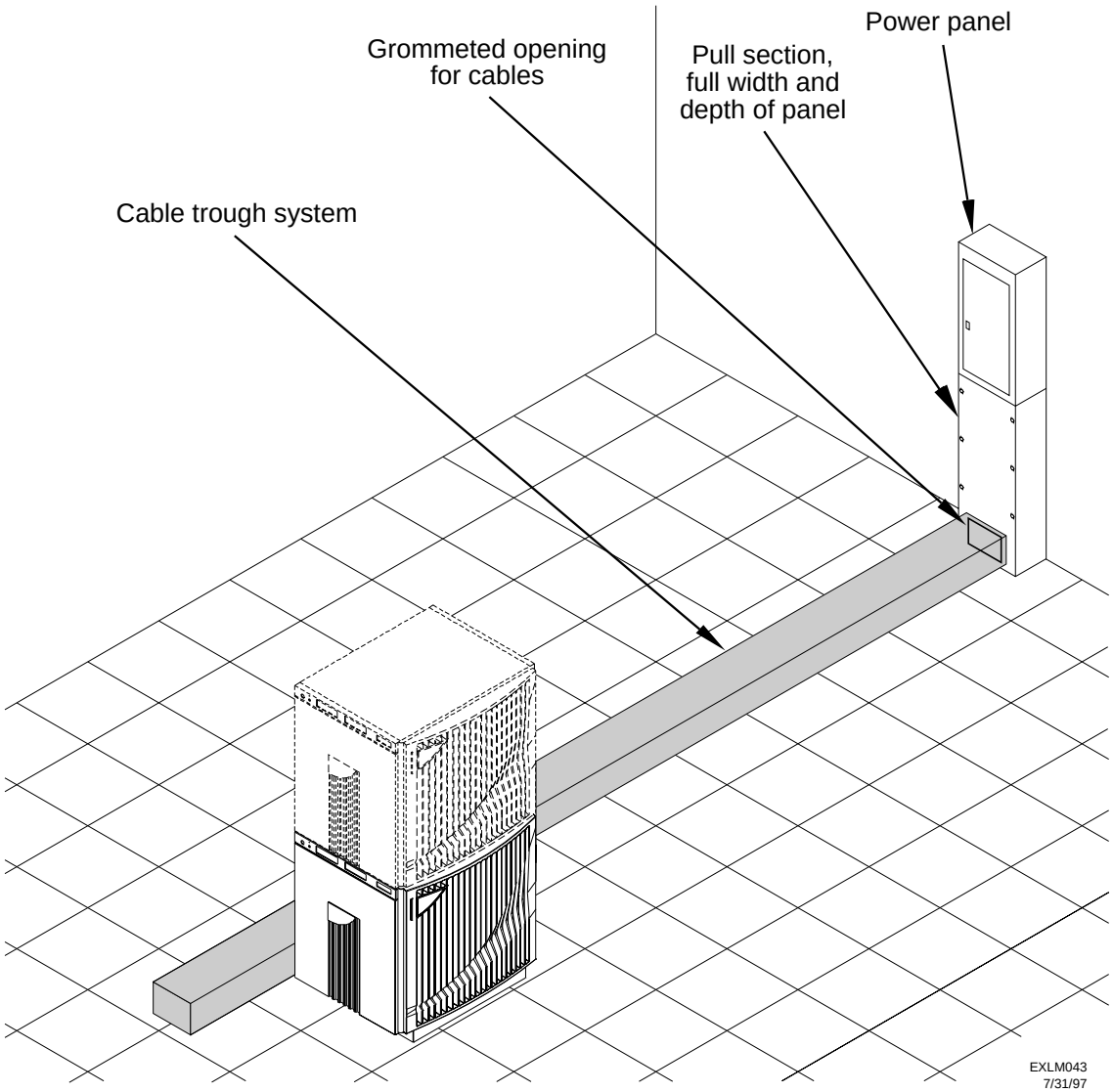
The cable trough connects to the bottom of the power panel. It should be sized to hold all cables and receptacles for the power drops that come from the CPU and peripheral power panels and for the power cables and plugs that come from the peripheral cabinet(s) and the CPU cabinets.

While the length of the cable trough may vary from one site to the next, the width and height must be compatible with the computer system cable trough. Refer to Figure 6 for details of the customer supplied cable trough.

NOTE The cable trough should be recognized by safety agencies as a ground conductor.

The cable trough cover should be sturdy enough to walk on.

Figure 6 Power panel detail (nonraised floor)



Grounding systems

V-Class servers require two methods of grounding:

- Power distribution safety grounding
- High frequency intercabinet grounding

These ground systems are described in the next sections.

Power distribution safety grounding

The power distribution safety grounding system consists of connecting various points in the power distribution system to earth ground using green (green/yellow) wire ground conductors. Having these ground connections tied to metal chassis parts that may be touched by computer room personnel protects them against shock hazard from current leakage and fault conditions.

Power distribution systems consist of several parts. Hewlett-Packard recommends that these parts be solidly interconnected to provide an equipotential ground to all points.

Main building electrical ground

The main electrical service entrance equipment should have an earth ground connection, as required by applicable codes. Connections such as a grounding rod, building steel, or a conductive type cold water service pipe provide an earth ground.

Electrical conduit ground

All electrical conduits should be made of rigid metallic conduit that is securely connected together or bonded to panels and electrical boxes, so as to provide a continuous grounding system.

Power panels ground

Each power panel should be grounded to the electrical service entrance with green (green/yellow) wire ground conductors. The green (green/yellow) wire ground conductors should be sized per applicable codes (based on circuit over current device ratings).

Computer equipment ground

Ground all computer equipment with the green (green/yellow) wire included in the branch circuitry. The green (green/yellow) wire ground conductors should be connected to the appropriate power panel and should be sized per applicable codes (based on circuit over current device ratings).

Cabinet interconnect grounding

Signal interconnect between system cabinets requires high frequency ground return paths. Connect all cabinets to site ground.

NOTE

In some cases power distribution system green (green/yellow) wire ground conductors are too long and inductive to provide adequate high frequency ground return paths. Therefore, the V-class server is shipped with a ground strap for connecting the system cabinet to the site grounding grid (customer-supplied). Installation of this ground strap is optional and there is a chance that it may cause ground loops.

When power panels are located in close proximity to the computer equipment, connect them to site grounding grid. Methods of providing a sufficiently high frequency ground grid are described in the next sections.

Raised floor installations

If a raised floor system is used, install a complete signal grounding grid for maintaining equal potential over a broad band of frequencies. The grounding grid should be connected to the equipment cabinet and electrical service entrance ground at multiple connection points via minimum #6 AWG (16mm^2) wire ground conductor.

Hewlett-Packard recommends the following three approaches:

- Excellent—Add a grounding grid to the subfloor. The grounding grid should be made of aluminum strips mounted to the subfloor. The strips should be 0.032 in. (0.08 cm) thick and a minimum of 3.0 in. (8.0 cm) wide.

  Connect each pedestal to four strips (Figure 9) using 1/4 in. (6.0 mm) bolts tightened to the manufacturer's torque recommendation.

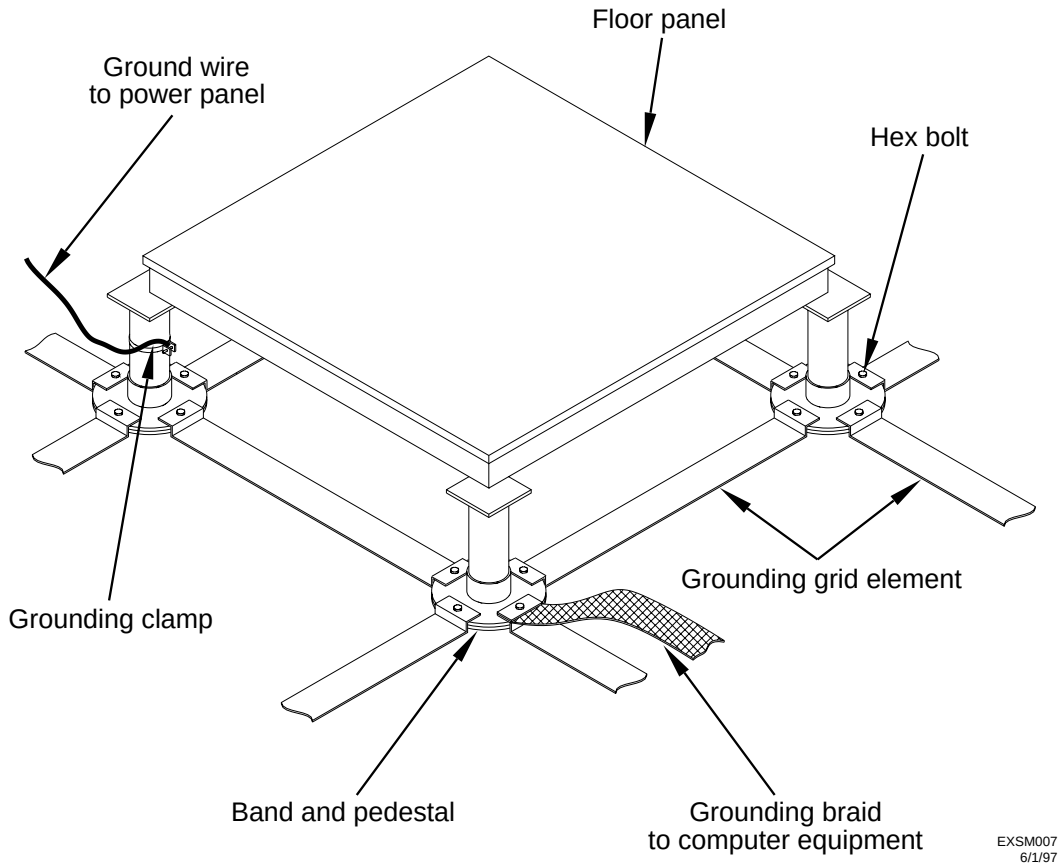
- Good—Use the raised floor structure as a ground grid. In this case, the floor must be designed as a ground grid with bolted down stringers and tin-lead, or zinc plating (to provide low resistance, and attachment points for connection to service entrance ground and V-Class server equipment. The use of conductive floor tiles with this style of grid further enhances ground performance.

- Adequate—If the excellent or good ground grid systems are impossible to implement, contact a local Hewlett-Packard representative. Arrangements can be made to provide custom lengths

of ground braid to interconnect system cabinets. However, connecting system cabinets with custom lengths of braided ground straps causes higher ground impedance than the techniques used in the excellent and good ground grid systems, and the resulting ground system will not perform as well.

Figure 7 illustrates a raised floor ground system.

Figure 7 Raised floor ground system



Nonraised floor installations

If the computer room does not have a raised floor, use a cable trough assembly to route equipment power cables.

NOTE Depending on the specific system, the cable trough may be HP- supplied or customer-supplied.

This cable trough assembly may be used as the conduit for high frequency ground. In addition to possible ground connections to Hewlett-Packard cabinets, the cable trough should be connected to the electrical service ground at multiple connection points via a minimum #6 AWG ($16mm^2$) wire ground conductor. Refer to Figure 8 on page 34 for details..

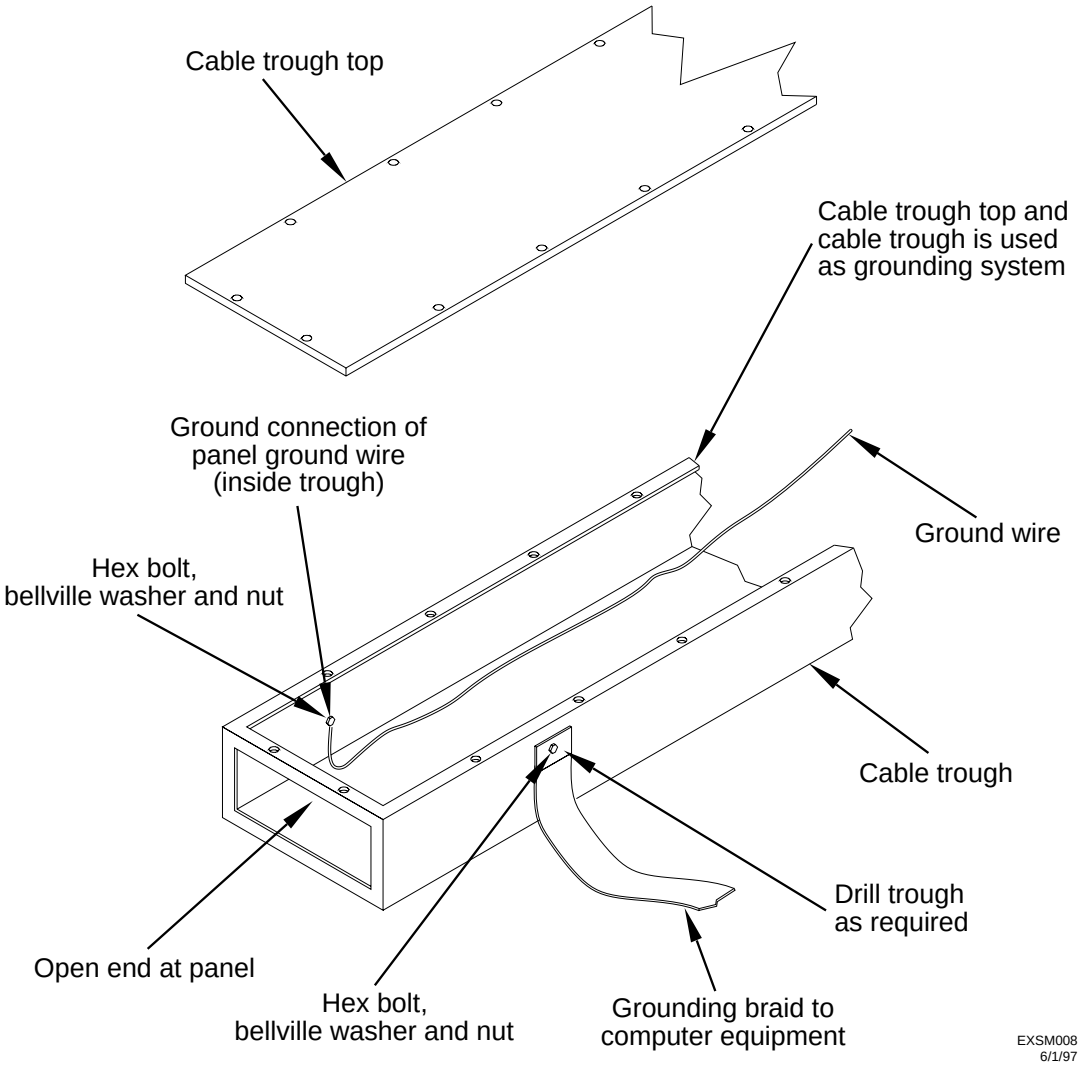
Equipment grounding implementation details

If it has been determined to be necessary, connect all Hewlett-Packard equipment cabinets to the site ground grid as follows:

- Attach one end of each ground strap to the applicable cabinet ground lug.
- Attach the other end to the nearest pedestal base (raised floor), or cable trough ground point (nonraised floor).
- Check that the braid contact on each end of the ground strap consists of a terminal and connection hardware (a 1/4-in. (6.0-mm) bolt, nuts, and washers).
- Check that the braid contact connection points are free of paint or other insulating material and treated with a contact enhancement compound (similar to Burndy Penetrox).

Figure 8 illustrates a customer supplied cable trough ground system.

Figure 8 Cable trough ground system



System installation guidelines

This section contains information about installation practices. Some common pitfalls are highlighted. Both power cable and data communications cable installations are discussed.

NOTE In domestic installations, the proper receptacles should be installed prior to the arrival of Hewlett-Packard equipment. Refer to the appropriate installation guide for installation procedures.

Wiring connections

Expansion and contraction rates vary among different metals. Therefore, the integrity of an electrical connection depends on the restraining force applied. Connections that are too tight compress or deform the hardware and cause it to weaken. This usually leads to a short circuit that trips circuit breakers.

CAUTION Connections that are too loose will have a high resistance that will cause serious problems, such as erratic equipment operation. A high resistance connection overheats and sometimes causes fire or high temperatures that can destroy hard-to-replace components such as distribution panels or system bus bars.

Wiring connections must be properly torqued. Many equipment manufacturers specify the proper connection torque values for their hardware.

Ground connections must only be made on a conductive, nonpainted surface. When equipment vibration is present, lockwashers must be used on all connections to prevent connection hardware from working loose.

Wiring for power conditioning equipment

Power conditioning equipment sense wires must be routed well away from main power conductors and electrical devices that might produce stray coupling between circuits. Stray coupling could interfere with power conditioning sense circuits, thus nullifying their benefits.

Data communications cables

Route data communications cables away from areas of high energy electric fields created by power transformers and heavy foot traffic. Use shielded data communications cables that meet approved industrial standards to reduce the effects of external fields.

NOTE

Hewlett-Packard supplies shielded data communications cables that comply with FCC standards for Electromagnetic Interference (EMI). Approved cables reduce the risk of high-speed data loss in serial data communications installations.

Environmental elements

The following environmental elements can affect a V-Class server installation:

- Computer room considerations
- Cooling requirements
- Humidity level
- Air conditioning ducts
- Dust and pollution control
- Electrostatic discharge (ESD) prevention
- Acoustics (noise reduction)
- Seismic activity

Computer room considerations

The following criteria are recommended when preparing a computer room for a V-Class server system:

- Locate the computer room away from the exterior walls of the building to avoid the heat gain from windows and exterior wall surfaces.
- Use windows that are double or triple glazed and shaded to prevent direct sunlight from entering the computer room when exterior windows are unavoidable.
- Maintain the computer room at a positive pressure relative to surrounding spaces.
- Use a vapor barrier installed around the entire computer room envelope to restrain moisture migration.
- Caulk and vapor seal all pipes and cables that penetrate the envelope.
- Use a 10-inch to 12-inch raised floor system for the most favorable room air distribution system (underfloor distribution).

Cooling requirements

Air conditioning equipment requirements and recommendations are described in the following sections.

NOTE

If a power source such as a UPS is located in the computer room, include its cooling requirements with the main system complex total. If placed in a different room, its cooling requirements are separate and must be added to the appropriate room totals.

Peripheral equipment power dissipation

The power dissipations and required amount of air conditioning for peripherals are summarized in Appendix A of this guide.

Basic air conditioning equipment requirements

The cooling capacity of the installed air conditioning equipment for the computer room should be sufficient to offset the computer equipment dissipation loads, as well as any space envelope heat gain.

The air conditioning equipment should include:

- Air filtration
- Cooling or dehumidification
- Humidification
- Reheating
- Air distribution
- System controls adequate to maintain the computer room within the operating ranges listed in Table 8 on page 14

Lighting and personnel must also be included. For example, a person dissipates about 450 Btu per hour while performing a typical computer room task.

At altitudes above 10,000 feet (3048 m), the lower air density reduces the cooling capability of air conditioning systems. If your facility is located above this altitude, the recommended temperature ranges may need to

be modified. For each 1000 feet (305 m) increase in altitude above 10,000 feet (up to a maximum of 15,000 feet), subtract 1.5° F (0.83° C) from the upper limit of the temperature range listed in Table 8 on page 14.

Air conditioning system recommendations

The following should be considered when designing an air conditioning system and selecting the necessary equipment:

- The air conditioning system that serves the computer room should be capable of operating 24 hours a day, 365 days a year. It should also be independent of other systems in the building.
- The value of computer system availability, redundant air conditioning equipment or capacity.
- Future computer system expansion.
- Air conditioning equipment air filters should have a minimum rating of 45% (based on “AShAE Standard 52-76, Dust Spot Efficiency Test”).
- Introducing only enough outside air into the system to meet building code requirements (for human occupancy) and to maintain a positive air pressure in the computer room.

Air conditioning equipment

The following three air conditioning system types are listed in order of recommendation:

- Complete self-contained package unit(s) with remote condenser(s). These systems are available with up or down discharge and are usually located in the computer room.
- Chilled water package unit with remote chilled water plant. These systems are available with up or down discharge and are usually located in the computer room.
- Central station air handling units with remote refrigeration equipment. These systems are usually located outside the computer room.

Basic air distribution systems

A basic air distribution system includes supply air and return air. In some cases, the type of air conditioning system that is used determines what type of air distribution system is appropriate.

An air distribution system should be zoned to deliver an adequate amount of supply air to the cooling air intake vents of the computer system equipment cabinets. Supply air temperature should be maintained within the following parameters:

- Ceiling supply system—From 55° F (12.8° C) to 60° F (15.6° C)
- Floor supply system—At least 60° F (15.6° C)

If a ceiling plenum return air system or a ducted ceiling return air system is used, the return air grille(s) in the ceiling should be located directly above the computer equipment cabinets.

Air distribution system

The following three types of air distribution system are listed in order of recommendation:

- Underfloor air distribution system—Downflow air conditioning equipment located on the raised floor of the computer room uses the cavity beneath the raised floor as plenum for the supply air.

  Return air from an underfloor air distribution system can be room space return air (RSRA), as shown in Figure 9 or ducted return air (DRA) above the ceiling, as shown in Figure 10.

  Perforated floor panels (available from the raised floor manufacturer) should be located around the perimeter of the system cabinets. Supply air emitted though the perforated floor panels is then available near the cooling air intake vents of the computer system cabinets.
- Ceiling plenum air distribution system—Supply air is ducted into the ceiling plenum from upflow air conditioning equipment located in the computer room or from an air handling unit (remote).

The ceiling construction should resist air leakage. Place perforated ceiling panels (with down discharge air flow characteristics) around the perimeter of the system cabinets. The supply air emitted downward from the perforated ceiling panels is then available near the cooling air intake vents of the computer system cabinets.

Return air should be ducted back to the air conditioning equipment though the return air duct above the ceiling.

- Above ceiling ducted air distribution system—Supply air is ducted into a ceiling diffuser system from upflow air conditioning equipment located in the computer room or from an air handling unit (remote).

  Return air from an above ceiling ducted air distribution system may be ducted return air (DRA) above the ceiling, as shown in Figure 9 or ceiling plenum return air (CPRA), as shown in Figure 10.

  Adjust the supply air diffuser system grilles to direct the cooling air downward around the perimeter of the computer system cabinets. The supply air is then available near the cooling air intake vents of the computer system cabinets (Figure 9 and Figure 10).

Air conditioning systems installation

All air conditioning equipment, materials, and installation must comply with any applicable construction codes. Installation of the various components of the air conditioning system must also conform to the air conditioning equipment manufacturer's recommendations.

Figure 9 illustrates a typical computer room underfloor air distribution system (RSRA).

Figure 10 illustrates a typical computer room underfloor air distribution system. (DRA)

Figure 11 illustrates a typical computer room raised floor layout showing the general location of supply air panels.

Figure 12 illustrates a typical computer room ceiling plenum air distribution system.

Figure 13 illustrates a typical computer room above ceiling ducted air with DRA.

Figure 14 illustrates a typical computer room above ceiling ducted air with CPRA.

Figure 9 Underfloor air distribution system (RSRA)

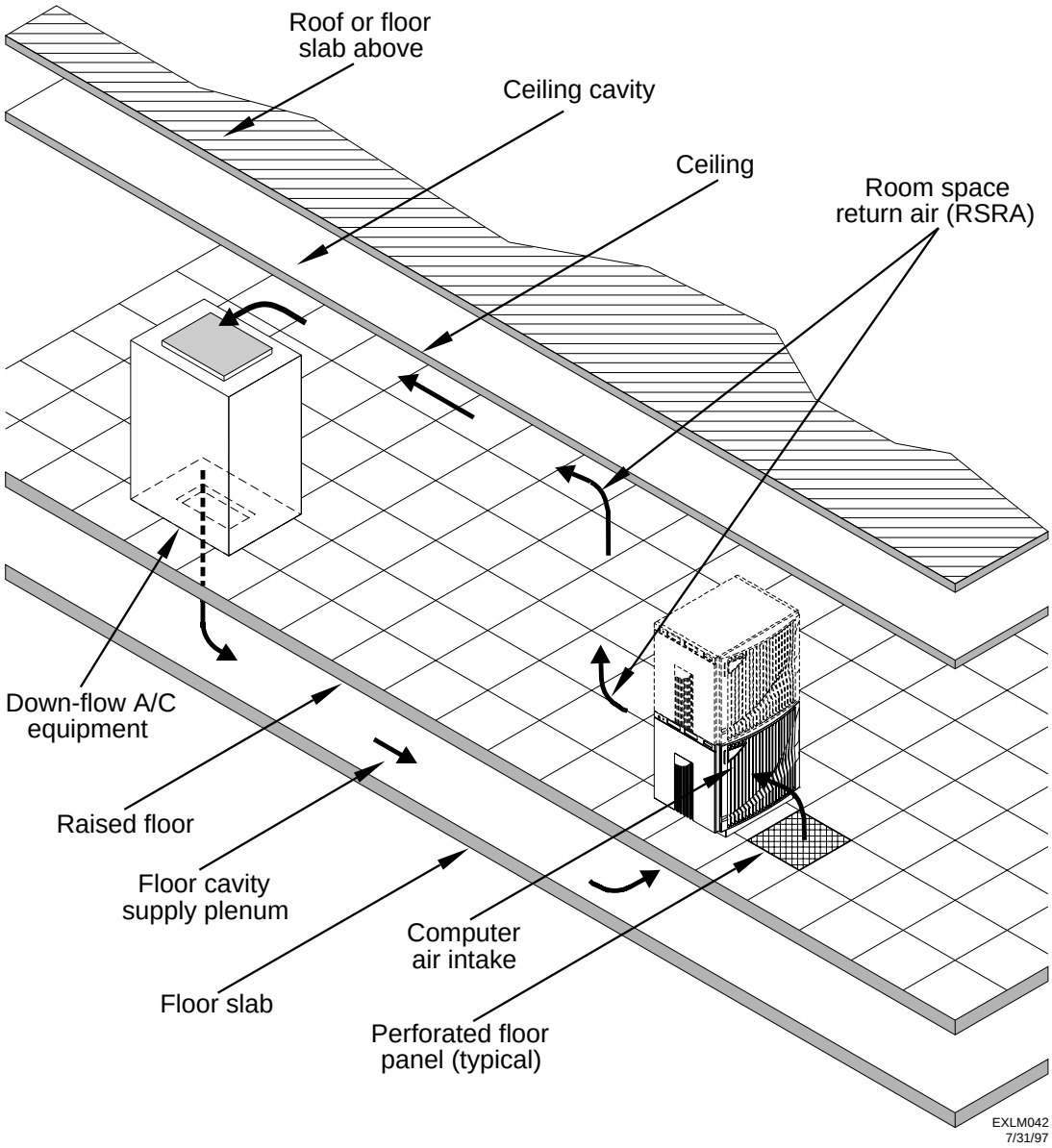


Figure 10 Underfloor air distribution system (DRA)

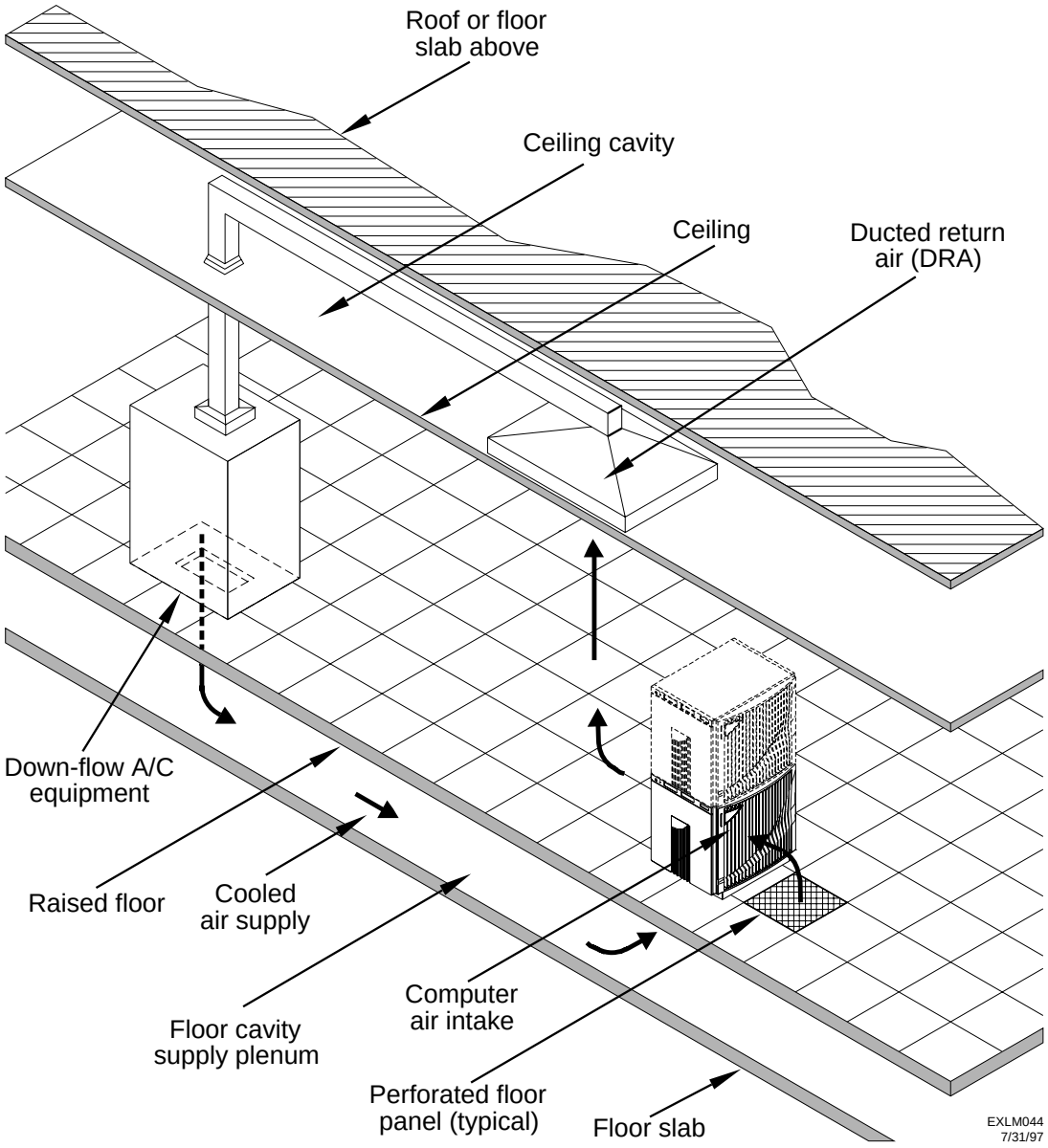


Figure 11 Computer room typical raised floor layout

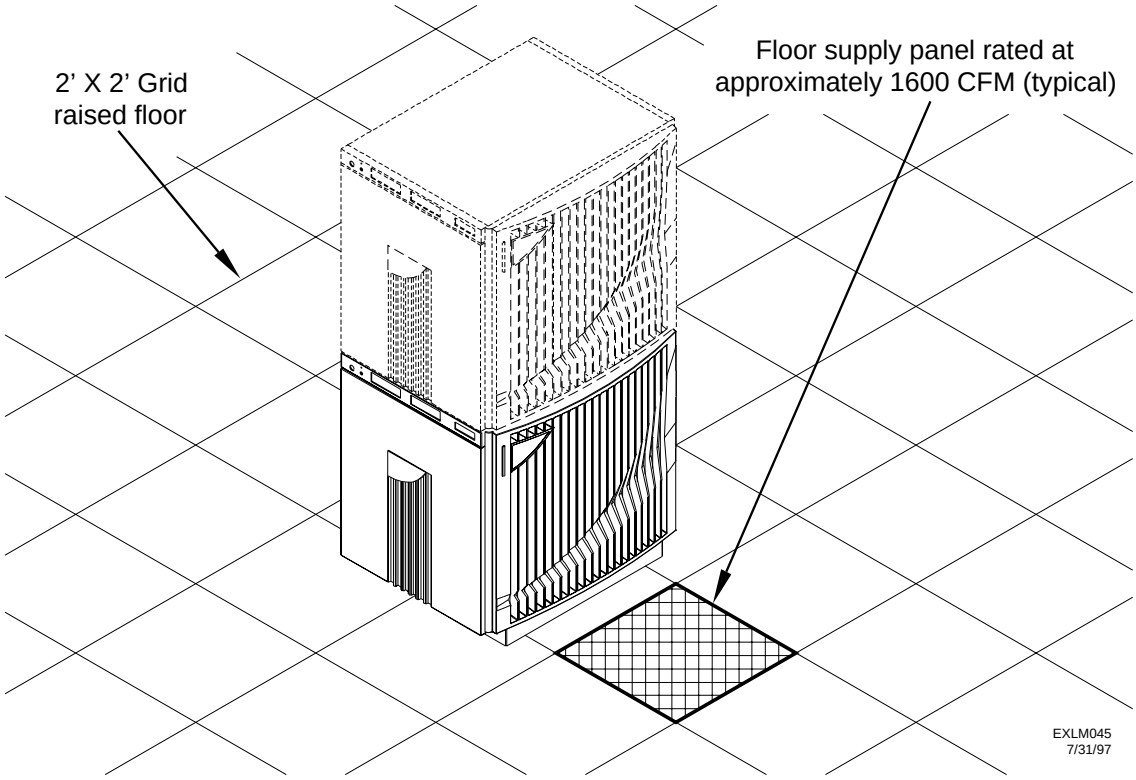


Figure 12 Ceiling plenum air distribution system

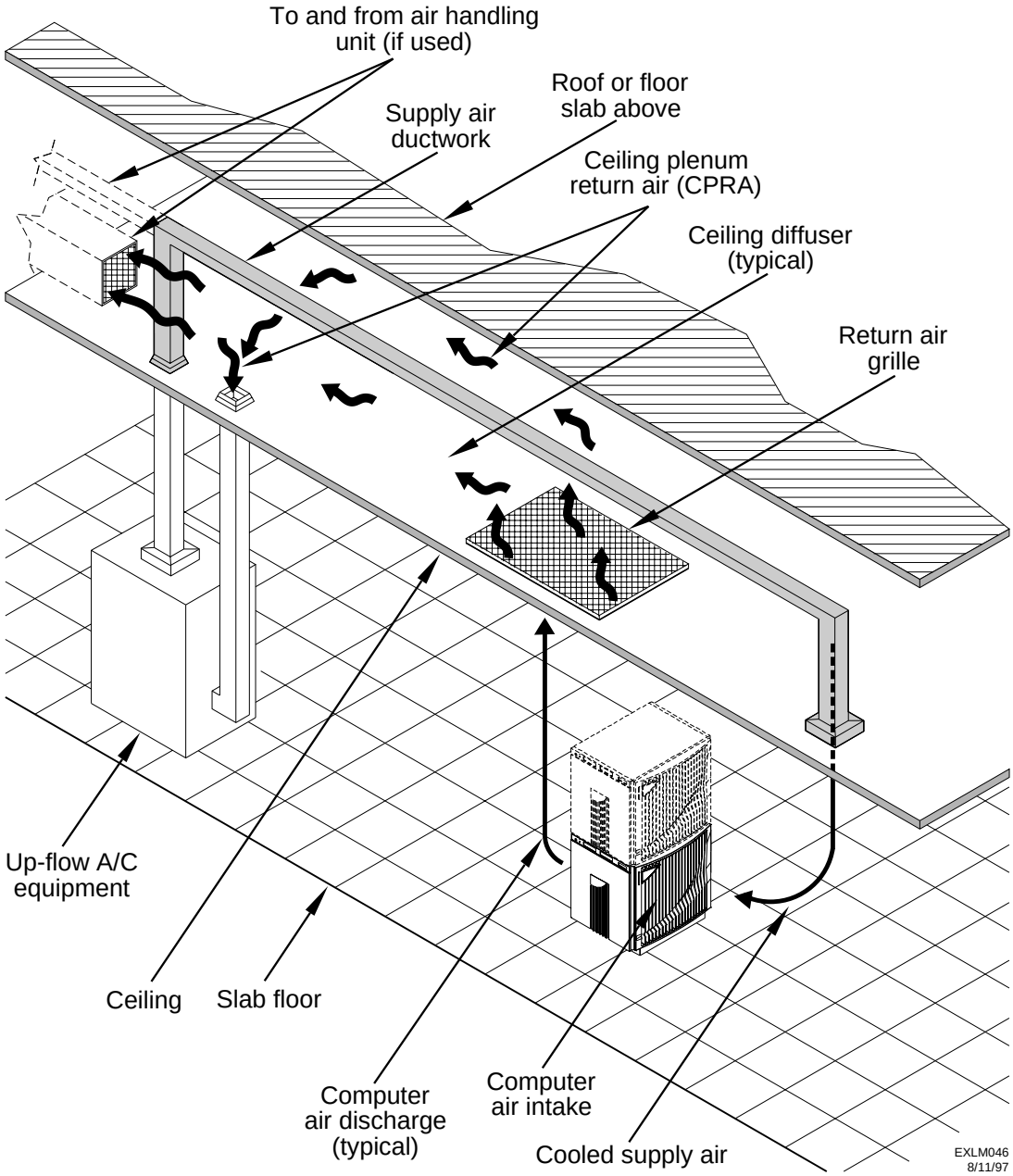


Figure 13 Above ceiling ducted air with DRA

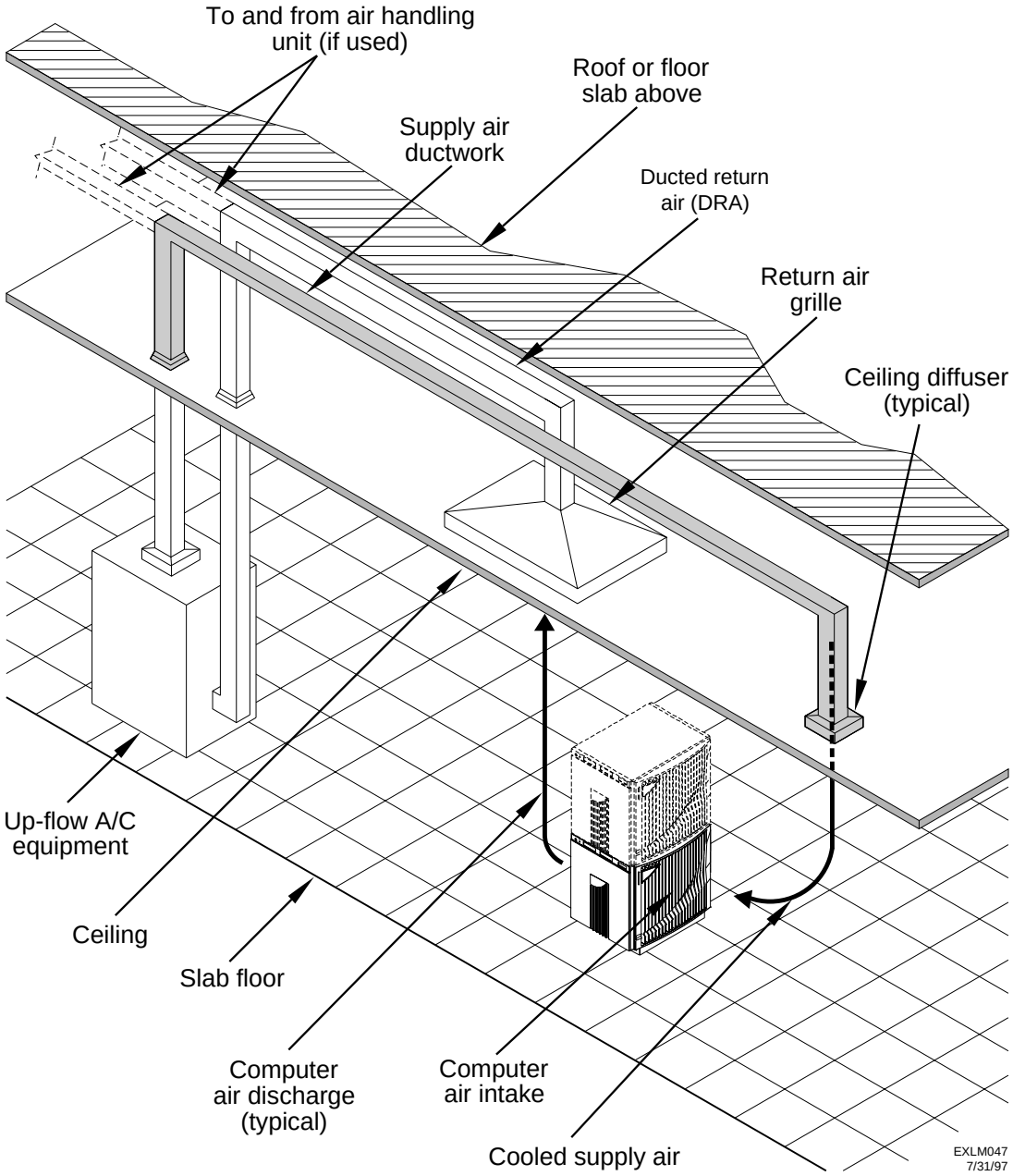
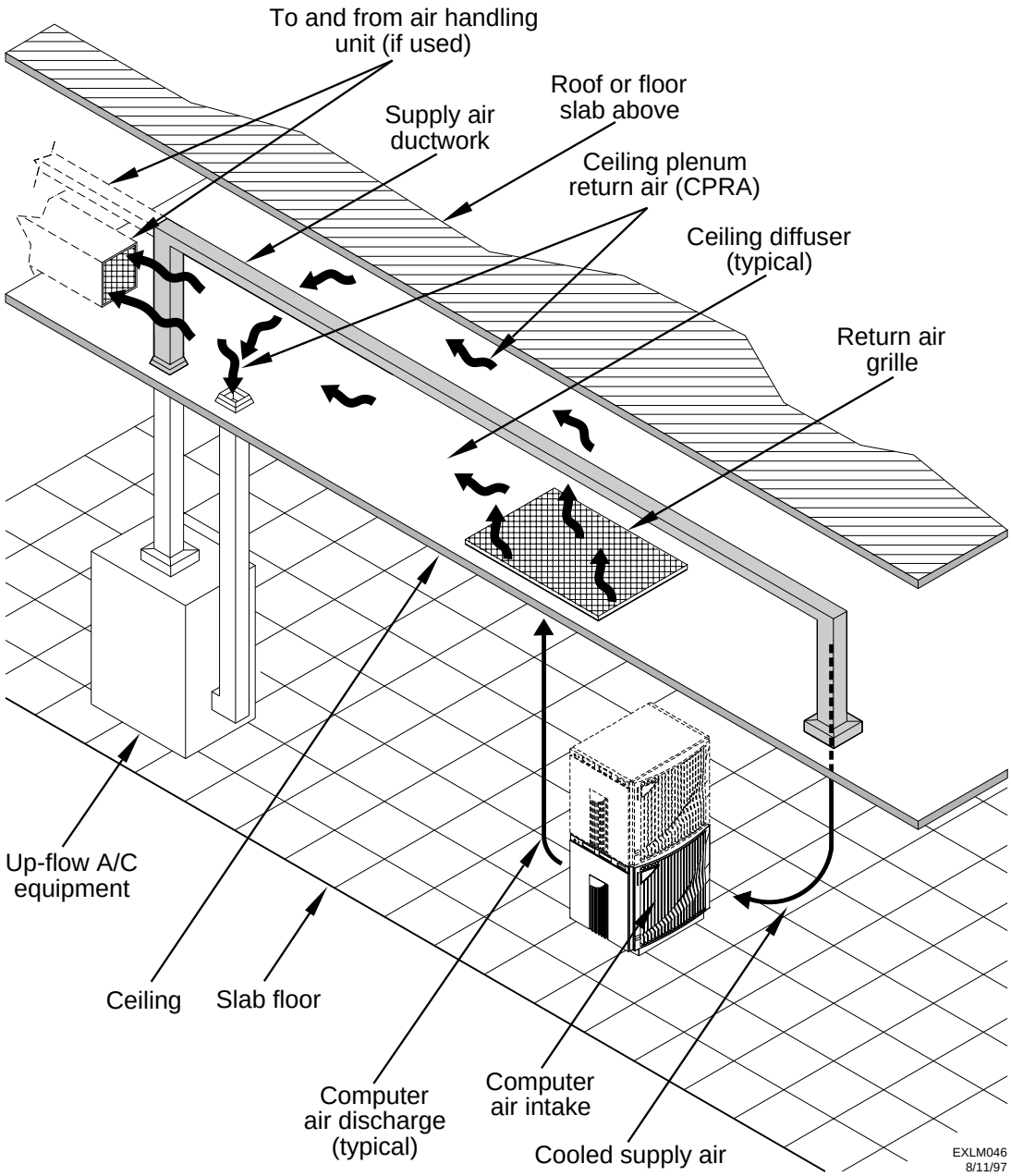


Figure 14 Above ceiling ducted air with CPRA



Humidity level

Maintain proper humidity levels. High humidity causes galvanic actions to occur between some dissimilar metals. This eventually causes a high resistance between connections, leading to equipment failures. High humidity can also have an adverse affect on some magnetic tapes and paper media.

CAUTION

Low humidity contributes to undesirably high levels of electrostatic charges. This increases the electrostatic discharge (ESD) voltage potential. ESD can cause component damage during servicing operations. Allways follow proper procedures unless. Paper feed problems on high-speed printers are usually encountered in low-humidity environments.

Low humidity levels are often the result of the facility heating system and occur during the cold season. Most heating systems provide air with a low humidity level, unless the system has a built-in humidifier.

Air conditioning ducts

Use separate computer room air conditioning duct work. If it is not separate from the rest of the building, it might be difficult to control cooling and air pressure levels. Duct work seals are important for maintaining a balanced air conditioning system and high static air pressure. Adequate cooling capacity means little if the direction and rate of air flow cannot be controlled because of poor duct sealing. Also, the ducts should not be exposed to warm air, or humidity levels may increase.

Dust and pollution control

Disk drives, tape drives, and some other mechanical devices require a dust-free environment for trouble-free operation. Hewlett-Packard disk and tape drives are protected from dust particles by mechanical air filters designed to trap large dust particles.

Smaller particles can pass though some filters and, over a period of time, cause problems in mechanical parts. Small dust particles can be prevented from entering the computer room by maintaining its air conditioning system at a high static air pressure level.

The computer room should be kept clean. The following process helps this effort:

- Smoking—Establish a no-smoking policy. Cigarette smoke particles are eight times larger than the clearance between disk drive read/write heads and the disk surface.
- Printer—Locate printers (especially high-speed line printers) in a separate room to eliminate paper problems.
- Eating or drinking—Establish a no-eating or drinking policy. Spilled liquids can cause short circuits in equipment such as keyboards.
- Rugs—Use a tightly sealed vacuum cleaner to clean rugs.
- Tile floors—Use a dust-absorbent cloth mop rather than a dry mop to clean tile floors.

Special precautions are necessary if the computer room is near a source of air pollution. Some air pollutants, especially hydrogen sulfide (H^2S), are not only unpleasant but corrosive as well. Hydrogen sulfide damages wiring and delicate sound equipment. The use of activated charcoal filters reduces this form of air pollution.

Electrostatic discharge (ESD) prevention

Static charges (voltage levels) occur when objects are separated or rubbed together. The voltage level of a static charge is determined by the following factors:

- Types of materials
- Relative humidity
- Rate of change or separation

Effect of humidity on ESD charge levels

Table 11 lists charge levels based on personnel activities and humidity levels.

Table 11 Static charge levels and relative humidity

Personnel activity[1]	Humidity[2] and charge levels (voltages)[3]			
	26%	32%	40%	50%
Person walking across a linoleum floor	6,150 V	5,750 V	4,625 V	3,700 V
Person walking across a carpeted floor	18,450 V	17,250 V	13,875 V	11,100 V
Person getting up from a plastic chair	24,600 V	23,000 V	18,500 V	14,800 V

1. Source: B.A. Unger, Electrostatic Discharge Failures of Semiconductor Devices (Bell Laboratories, 1981)
2. For the same relative humidity level, a high rate of airflow produces higher static charges thana low airflow rate.
3. Some data in this table has been extrapolated.

Static protection measures

Follow these precautions to minimize possible ESD-induced failures in the computer room:

- Install conductive flooring (conductive adhesive must be used when laying tiles).
- Use conductive wax if waxed floors are necessary.
- Ensure that all equipment and flooring are properly grounded and are at the same ground potential.
- Use conductive tables and chairs.
- Use a grounded wrist strap (or other grounding method) when handling circuit boards.
- Store spare electronic modules in antistatic containers.
- Maintain recommended humidity level and airflow rates in the computer room.

Acoustics

Computer equipment and air conditioning blowers cause computer rooms to be noisy. Ambient noise level in a computer room can be reduced as follows:

- Dropped ceiling—Cover with a commercial grade of fire-resistant, acoustic rated, fiberglass ceiling tile.
- Sound deadening—Cover the walls with curtains or other sound deadening material.
- Removable partitions—Use foam rubber models for most effectiveness.

3 Facility guidelines

This chapter describes facility characteristics and provides guidelines for preparing the computer room.

- Facility characteristics
- Space requirements

Facility characteristics

This section contains information about facility characteristics that must be considered for the installation or operation of a V-Class server. Facility characteristics are:

- Floor loading
- Typical raised floor site
- Rolling loads
- Important raised floor considerations
- Windows
- Altitude effects

Floor loading

The computer room floor must be able to support the total weight of the installed computer system as well as the weight of the individual cabinets as they are moved into position.

Floor loading is usually not an issue in nonraised floor installations. The information presented in this section is directed toward raised floor installations.

NOTE Any floor system under consideration for a V-Class server installation should be verified by an appropriate floor system consultant.

Raised floor loading

Raised floor loading is a function of the manufacturer's load specification and the positioning of the equipment relative to the raised floor grid. While Hewlett-Packard cannot assume responsibility for determining the suitability of a particular raised floor system, it does provide information and illustrations for the customer or local agencies to determine installation requirements.

Floor loading terms

Floor loading terms used to describe floor loading issues are defined in Table 12.

Table 12 Floor loading term definitions

Term	Definition
Dead load	The weight of the raised panel floor system, including the understructure. Expressed in lb/ft^2 (kg/m^2).
Live load	The load that the floor system can safely support. Expressed in lb/ft^2 (kg/m^2).
Concentrated load	The load that a floor panel can support on a 1-in^2 (6.45 cm^2) area at the panel's weakest point (typically the center of the panel), without the surface of the panel deflecting more than a predetermined amount.
Ultimate load	The maximum load (per floor panel) that the floor system can support without failure. Failure expressed by floor panel(s) breaking or bending. Ultimate load is usually stated as load per floor panel.
Rolling load	The load a floor panel can support (without failure) when a wheel of specified diameter and width is rolled across the panel.
Average floor load	Computed by dividing total equipment weight by the area of its footprint. This value is expressed in lb/ft^2 (kg/m^2).

Average floor loading

The average floor load value, defined in Table 12, is not appropriate for addressing raised floor ratings at the floor grid spacing level. However, it is useful for determining floor loading at the building level, such as the area of solid floor, or span of raised floor tiles covered by the V-Class server footprint.

Typical raised floor site

This section contains an example of a computer room raised floor system that is satisfactory for the installation of a V-Class server.

Based on specific information provided by Hewlett-Packard, Tate Access Floors has recommended its Series 800 all-steel access floor with bolt-together stringers and 24-in. (61.0-cm) by 24-in. (61.0-cm) floor panels.

Specifications for the Tate Access Floors Series 800 raised floor system are listed in

Table 13 Typical raised floor specifications

Item[1]	Rating
Dead load	7 lb/ft ^{2} (34.2 kg/m^2)
Live load	313 lb/ft ^{2} (1528.3 kg/m^2)
Concentrated load[2]	1250 lb (567 kg)
Ultimate load	4000 lb (1814 kg) per panel
Rolling load[3]	400 lb (181 kg)
Rolling load[4]	500 lb (227 kg)

1. From Table 12
2. With 0.08 in. (0.2 cm) of span maximum deflection
3. With 3 in. (7.6 cm) diameter by 1.8 in. (4.6 cm) wise wheels (and 10 computer simulated passes over the floor). It is recommended that 0.75 in. (1.9 cm) thick plywood paneling be put on the second floor before rolling cabinets into place.
4. With 6 in. (15.2 cm) diameter by 1.5 in. (3.0 cm) wide wheels (and 10,000 computer simulated passes over the floor). It is recommended that 0.75 in. (1.9 cm) thick plywood paneling be put on the raised floor before rolling cabinets into place.

Rolling loads

A rolling load is defined in Table 12.

Important raised floor considerations

Raised floor system considerations follow:

- Because many raised floor systems do not have grid stringers between floor stands, the lateral support for the floor stands depends on adjacent panels being in place. To avoid compromising this type of floor system while gaining under floor access, remove only one floor panel at a time.
- Larger floor grids (bigger panels) are generally rated for lighter loads.

CAUTION Do not install any raised floor system until you have carefully examined it to verify that it is adequate to support the appropriate installation.

Windows

Avoid housing computers in a room with windows. Sunlight entering a computer room may cause problems. Magnetic tape storage media is damaged if exposed to direct sunlight. Also, the heat generated by sunlight places an additional load on the cooling system.

Altitude effects

Many tape drives, including those supplied by Hewlett-Packard, have vacuum column transport mechanisms that are affected by atmospheric pressure. Adjustments to these mechanisms may be required to compensate for the lower atmospheric pressure at higher altitudes. Hewlett-Packard field engineers make these adjustments on tape drives supplied by Hewlett-Packard. Tape drives supplied by other vendors should be adjusted by the appropriate vendor.

Space requirements

This section contains information about space requirements for a V-Class server. This data should be used as the basic guideline for space plan developments. Other factors, such as airflow, lighting, and equipment space requirements must be considered.

Delivery space requirements

There should be enough clearance to move equipment safely from the receiving area to the computer room. Permanent obstructions, such as pillars or narrow doorways, can cause equipment damage.

Delivery plans should include the possible removal of walls or doors. The physical dimensions for applicable computers and peripheral equipment are summarized in Appendix A.

Operational space requirements

Other factors must be considered along with the basic equipment dimensions. Reduced airflow around equipment causes overheating, which can lead to equipment failure. Therefore, the location and orientation of air conditioning ducts, as well as airflow direction, are important. Obstructions to equipment intake or exhaust airflow must be eliminated.

The locations of lighting fixtures and utility outlets affect servicing operations. Plan equipment layout to take advantage of lighting and utility outlets. Do not forget to include clearance for opening and closing equipment doors.

Clearance around the cabinets must be provided for proper cooling airflow through the equipment.

The service area space requirements, outlined in Appendix C, are minimum dimensions. If other equipment is located so that it exhausts heated air near the cooling air intakes of the computer system cabinets, larger space requirements are needed to keep ambient air intake to the computer system cabinets within the specified temperature and humidity ranges.

Space planning should also include the possible addition of equipment, or other changes in space requirements. Equipment layout plans should also include provisions for the following:

- Channels or fixtures used for routing data cables and power cables
- Access to air conditioning ducts, filters, lighting, and electrical power hardware
- Power conditioning equipment
- Storage racks for tape reels, disk packs, and printer paper
- Cabinets for cleaning materials
- Maintenance area and spare parts

Technical documentation space requirements

Provide enough bookshelves for V-Class server technical documentation. About 8 to 10 feet of book shelving is required.

Floor plan grid

Copies of the floor plan grid are located in Appendix C. Each square in the grid represents 12 square inches (the equipment footprint templates are drawn to the same scale).

In addition to its use for planning the location of equipment in the computer room, the floor plan grid should also be used when planning the locations of the following items:

- Air conditioning vents
- Lighting fixtures
- Utility outlets
- Doors
- Access areas for power wiring and air conditioning filters
- Equipment cable routing

Equipment footprint templates

Equipment footprint templates are drawn to the same scale as the floor plan grid (1/4 inch = 1 foot). These templates are provided to show basic equipment dimensions and space requirements for servicing. Refer to Appendix C for templates.

The service areas shown on the template drawings are lightly shaded.

Removable copies of the equipment footprint templates are located in Appendix C. They should be used with the floor-plan grid to define the location of the equipment that will be installed in your computer room.

NOTE Photocopying typically changes the scale of drawings copied. If any templates are copied, then all templates and floor-plan grids must also be copied.

Computer room layout plan

Use the following procedure to create a computer room layout plan:

Step 1. Remove several copies of the floor-plan grid from Appendix C.

Step 2. Cut and join them together (as necessary) to create a scale model floor-plan of your computer room.

Step 3. Remove a copy of each applicable equipment footprint template from Appendix C.

Step 4. Cut out each template selected in Step 3; then place it on the floor-plan grid created in Step 2.

Step 5. Position pieces until the desired layout is obtained; then fasten the pieces to the grid.

Step 6. Mark locations of computer room doors, air conditioning floor vents, utility outlets, and so on.

NOTE Attach a reduced copy of the completed floor-plan to the site survey (Table 15 and Table 16) located in Chapter 4, “Preinstallation survey.” This floor plan is used by a Hewlett-Packard field engineer during equipment installation process.

Operational considerations

This section describes the test station and auto-answer modem and customer-supplied phone lines.

Workstation and auto-answer modem

The workstation and auto-answer modem are features on servers installed in North America. They provide a communications link between the server and a remote facility.

Customer-supplied phone lines

NOTE The communication line must be a dedicated line.

A communication line is required for the remote console facility and UUCP. In addition, a modem is required for the UUCP feature. Although a single phone line, with the appropriate switching controls can be used for both devices, a dedicated line is recommended for each device.

The system internal modem is equipped with an RJ11 telephone connector. For North American installations, the customers telephone jack must comply with RJ11 specifications. Otherwise, the modem cannot be connected.

NOTE The RJ11 connectors are the small, quick-disconnect type, not the large 4-pin type.

4 Preinstallation survey

This chapter provides a site survey information packet consisting of an information form, checklists, and a survey used to evaluate a computer facility. The checklists should be completed and the information sheets and information forms filled out by the customer and a Hewlett-Packard representative.

- Typical installation schedule
- Site inspection and predelivery meeting
- Site survey
- Site inspection
- Delivery survey
- Mailing address

Packet Content

The site survey information packet is designed to identify problems that might occur before, during, or after the installation of the system.

Checklists

Preinstallation checklists are used to verify that the customer site is ready for the equipment installation.

Information sheets

Preinstallation survey information sheet lists customer name, address, and corresponding Hewlett-Packard sales personnel.

Information forms

Preinstallation survey information forms list delivery information and special instructions.

Typical installation schedule

The following schedule lists the sequence of events for a typical system installation.

- 60 days before installation
  - Floor plan design completed and mailed to Hewlett-Packard
- 30 days before installation
  - Primary power and air conditioning installation completed
  - Telephone and data cables installed
  - Fire protection equipment installed
  - Major facility changes completed
  - Special delivery requirements defined
  - Site inspection survey completed
  - Delivery survey completed
  - Signed copy of the site inspection and delivery survey mailed to Hewlett-Packard.
- 7 days before installation
  - Final check made with an Hewlett-Packard field engineer to resolve any last minute problems

Site inspection and predelivery meeting

All major site preparation should be completed at least 30 days before the equipment is scheduled for delivery. At this time, a site inspection and predelivery coordination meeting should be arranged with a Hewlett-Packard representative.

The purpose of this meeting is to go through the inspection checklist and to arrange an installation schedule.

Site survey

The tables and figures on the following pages form a 6-sheet site survey information packet.

Fill in the information on the 6 sheets of this survey, and return a signed copy to the following address:

Hewlett-Packard Company
3000 Waterview Parkway
P.O. Box 833851
Richardson, TX 75083-3851
United States of America

The following site survey sheets contain the basic customer and Hewlett-Packard information.

Table 14 Customer and Hewlett-Packard information

Customer information	
Name:	Phone No:
Street:	City or Town:
State or Province:	Country
Zip or postal code:	
Primary customer contact:	Phone No.:
Secondary customer contact:	Phone No.:
Traffic coordinator:	Phone No.:
Hewlett-Packard information	
Sales representative	Order No:
Representative making survey	Date:
Scheduled delivery date	

Site inspection

Table 15 contains the on-site inspection checklist.

Table 15 Site inspection checklist

Please check either Yes or No			
Computer room			
No.	**Area or condition**	**Yes**	**No**
1.	Is there a copy of the completed floor plan?		
2.	Is there adequate space for maintenance needs?		
3.	Is access to the site or computer room restricted?		
4.	Is the computer room structurally complete?		
5.	Is a raised floor installed?		
6.	Is the raised floor adequate for equipment loading?		
7.	Are there channels or cutouts for cable routing?		
8.	Is there a remote console telephone line available with an RJ11 jack?		
9.	Is a UUCP telephone line available?		
10.	Are customer supplied peripheral cables available?		
Power and lighting			
No.	**Area or condition**	**Yes**	**No**
11.	Are lighting levels adequate for maintenance?		
12.	Are there ac outlets available for servicing needs?		
13.	Does the input voltage correspond to equipment specifications?		
14.	Does the input frequency correspond to equipment specifications?		
15.	Are lightning arrestors installed?		
16.	Is power conditioning equipment installed?		

Please check either Yes or No			
Power and lighting (continued)			
No.	**Area or condition**	**Yes**	**No**
17.	Is there a dedicated branch circuit for equipment?		
18.	Is the dedicated branch circuit less than 250 feet (72.5 meters)?		
19.	Are the input circuit breakers adequate for equipment loads?		
Safety			
No.	**Area or condition**	**Yes**	**No**
20.	Is there an emergency power shut-off switch?		
21.	Is there a telephone available for emergency purposes?		
22.	Is there a fire protection system in the computer room?		
23.	Is antistatic flooring installed?		
24.	Are there any equipment servicing hazards?		
Cooling			
No.	**Area or condition**	**Yes**	**No**
25.	Can cooling be maintained between 68° and 86° F (20° and 30° C)?		
26.	Can temperature changes be held to less than 41° F (5 ° C) per hour?		
27.	Can humidity level be maintained between 40% and 60%?		
28.	Are air conditioning filters installed?		
Storage			
No.	**Area or condition**	**Yes**	**No**
29.	Are cabinets available for tape and disc media?		
30.	Is shelving available for documentation?		

Please check either Yes or No			
Training			
No.	**Area or condition**	**Yes**	**No**
31.	Are personnel enrolled in the System Administrator's Course?		
32.	Is on-site training needed?		

Delivery survey

The delivery survey form shown in Figure 15 and Figure 16 lists delivery or installation requirements. If any of the items on the list apply, enter the appropriate information in the areas provided on the form.

Special instructions or recommendations, such as those described below, should be entered on the special instructions or recommendations form as shown in Figure 15 and Figure 16.

- Packaging restrictions at the facility, such as size and weight limitations
- Special delivery procedures
- Special equipment required for installation, such as tracking or hoists
- What time the facility is available for installation (after the equipment is unloaded)
- Special security requirements applicable to the facility, such as security clearance

Figure 15 Delivery survey (Part 1)

DELIVERY CHECKLIST

DOCK DELIVERY

Is dock large enough for a semitrailer? Yes _____ No _____

Circle the location of the dock and give street name if different than address.

North

West East

South

STREET DELIVERY

Circle the location of access door and list street name if different than address.

North

West East

South

List height _____ and width _____ of access door.

List special permits (if required) for street delivery.

Permit type: Agency obtained from:

_____ _____

_____ _____

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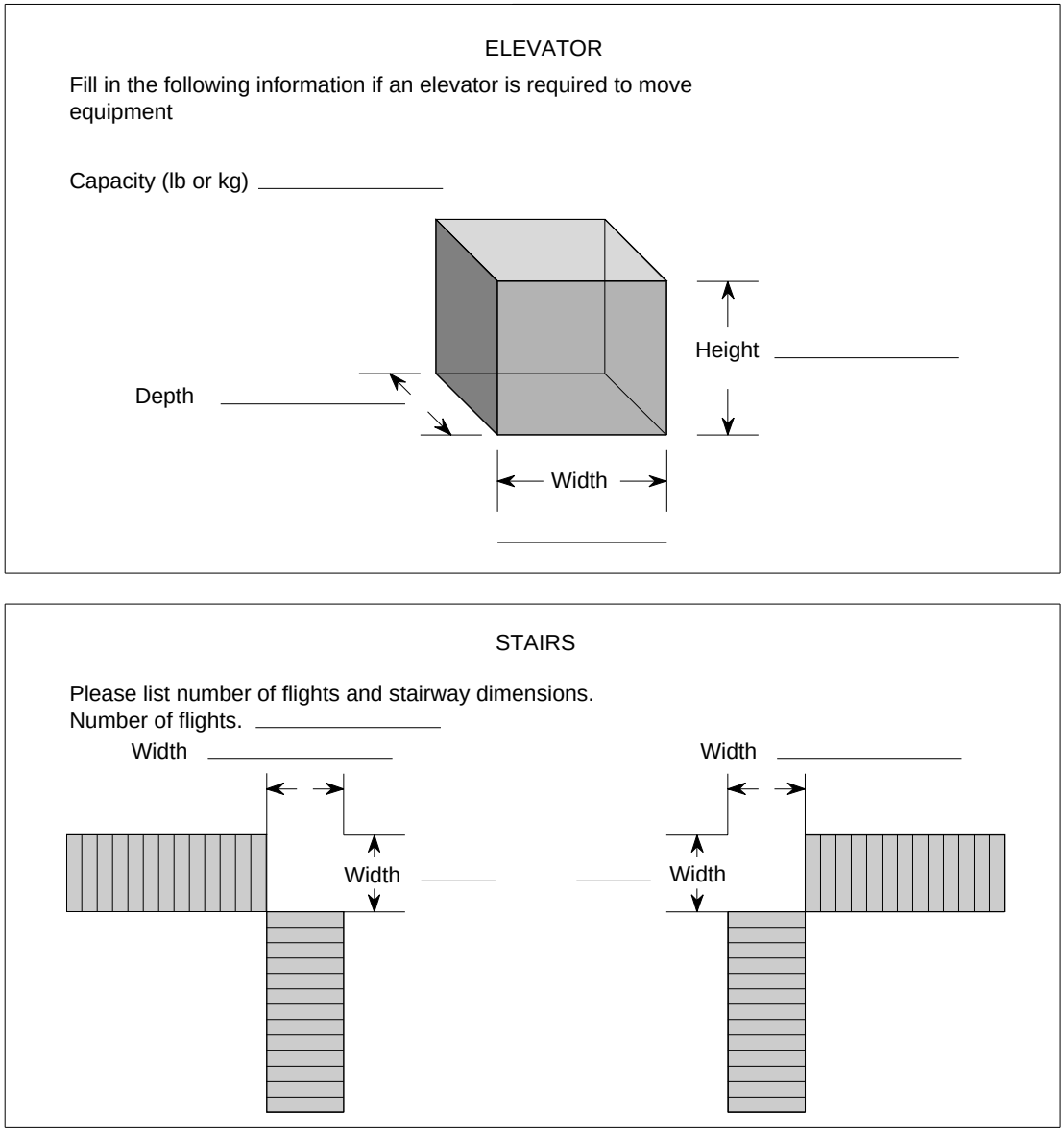
12/15/96

Figure 16 Delivery survey (Part 2)



EXSM013
12/15/96

Mailing address

Mail correspondence to:

Hewlett-Packard Company

3000 Waterview Parkway

P.O. Box 833851

Richardson, TX 75083-3851

A System requirements summary

This appendix summarizes the requirements that must be considered in preparing the site for a V-Class server.

To determine the power consumed and the air conditioning required, follow the examples located in Table 16, then complete the entries in Table 17.

NOTE When determining power and air condition requirements you must consider any peripheral equipment that will be installed during initial installation or as a later update. Refer to the applicable documentation for such devices to determine the power and air-conditioning that is required to support these devices.

Table 16 Example power consumption and air conditioning requirement summary

Component	Quantity	Multiply quantity by:	Power dissipated (kilo watts)	Air conditioning required (tons) (kilo watts/ 3.517 =tons)
Processor boards[1](EPB)	4	181.4 (V2200)/ 207.6 (V2250)	725.6(.7)/ 830.4 (.8)	.20/ .24
Memory boards[1] (EMB)	2	108.6	217.2 (.217)	.06
PCI chassis	1	160.0	160 (.016)	.05
Chassis	1	485	485 (.485)	.14
Second DAT drive or CD Rom	1	15.5	15.5 (.016)	.005
9 Gigabyte disks[2]	0	21.6		
Test station (with monitor)	1	365	365 (.365)	.1
DLT 4700	0	82		
		Total	1968.3 (1.97)/ 2073.1 (2.07)	.56/ .60

1. A minimum of two EMBs are required for each system.
2. This component is optional and may not be included in your system.

Table 17 Power consumption and air conditioning requirement

Component	Quantity	Multiply quantity by:	Power dissipated (kilo watts)	Air conditioning required (tons) (kilo watts/ 3.517 = tons)
Processor boards (EPB)		181.4 (V2200)/ 207.6 (V2250)		
Memory boards[1] (EMB)		108.6		
PCI chassis		160.0		
Chassis	1	485.0	485.0 (.485)	.14
Second DAT drive or CD Rom		15.5		
9 Gigabyte disks		21.6		
DLT 4700		82		
Test station (with monitor)	1	365	365 (.365)	.1
		Total		

1. A minimum of two EMBs are required for each system.

To determine overall weight, follow the examples located in Table 18, then complete the entries in Table 19.

Table 18 Example weight summary

Component	Quantity	Multiply by	Weight (kg)
Processor boards (EPB)	4	5.3	21.2 lbs (9.6)
Memory boards[1] (EMB)	2	5.5	11.0 lbs (5.0)
PCI chassis	1	8.5	8.50 lbs (3.7)
Chassis[2]	1	335.0	335.0 lbs (152.3)
Power supplies[3] (NPS)	2	4.3	8.6 lbs (3.9)
Second DAT drive or CD Rom	1	3.1	3.1 lbs (1.4)
9 Gigabyte disks	0	2.3	
DLT 4700	0	65.0	
Test station[4]	1	100.0	100.0 lbs (45.5)
		Total weight	487.4 lbs (221.5)

1. A minimum of two EMBs are required for each system.
2. The listed weight for the chassis includes all items common to all systems not listed separately in this table.
3. A minimum of two NPSs are required for each system.
4. Includes table, test station, DAT drive, console printer, and modem.

Table 19 Weight summary

Component	Quantity	Multiply by	Weight (kg)
Processor boards (EPB)		5.3	
Memory boards[1] (EMB)		5.5	
PCI chassis		8.5	
Chassis[2]	1	335.0	335.0 lbs (152.3)
Power supplies[3](NPS)		4.3	
Second DAT drive or CD Rom	1	3.1	3.1 lbs (1.4)
9 Gigabyte disks		2.3	
DLT 4700		65.0	
Test station[4]	1	100.0	100.0 lbs (45.5)
		Total weight	

1. A minimum of two EMBs are required for each system.
2. The listed weight for the chassis includes all items common to all systems not listed separately in this table.
3. A minimum of two NPSs are required for each system.
4. Includes table and test station.

To determine overall power required, follow the examples located in Table 20, then complete the entries in Table 21.

NOTE

When determining power and air condition requirements you must consider any peripheral equipment that will be installed during initial installation or as a later update. Refer to the applicable documentation for such devices to determine the power and air-conditioning that is required to support these devices.

Table 20 Example power requirements

Component	Quantity	Multiply quantity by:	Power required (kVa)
Processor boards (EPB)		187 (V2200) 214 (V2250)	
Memory boards[1] (EMB)		112	
PCI chassis		165	
Chassis	1	500	500 (.50)
Second DAT drive or CD Rom		16	
9 Gigabyte disks		23	
DLT 4700		240	
Test station (with monitor)	1	440	440 (.44)
		Total	

1. A minimum of two EMBs are required for each system.

Table 21 Power requirement summary

Component	Quantity	Multiply quantity by:	Power required (kVa)
Processor boards (EPB)		187 (V2200) 214 (V2250)	
Memory boards[1] (EMB)		112	
PCI chassis		165	
Chassis	1	500	500 (.50)
Second DAT drive or CD Rom		16	
9 Gigabyte disks		23	
Test station (with monitor)	1	440	440 (.44)
DLT 4700		240	
		Total	

1. A minimum of two EMBs are required for each system.

B Conversion factors

The conversion factors provided in this appendix are intended to ease data calculation for systems that do not conform specifically to the configurations listed in previous chapters of this Site Preparation Guide.

Listed below are the conversion factors used in this document, as well as additional conversion factors which maybe helpful in determining those factors required for site planning.

- Refrigeration
  - 1 watt = .86 Kcal/h
  - 1 watt = 3.413 Btu/h
  - 1 watt = 2.843^{-4} tons
  - 1 ton = 200 Btu/min
  - 1 ton = 12,000 Btu/h
  - 1 ton = 3,517.2 W
- Metric equivalents
  - 1 centimeter = 0.3937 in.
  - 1 meter = 3.28 ft
  - 1 meter = 1.09 yds
  - 1 in. = 2.54 cm
  - 1 ft = 0.305 m
  - 1 CFM = $1.7 m^3/h$
- kVa conversions, three ø

  $kVa = V \times A \times \sqrt{3} / 1000$
- kVa conversion, single ø

  $kVa = V \times A / 1000$

C Templates

This appendix contains blank floor plan grids and equipment templates. Combine the necessary number of floor plan grid sheets to create a scaled version of the computer room floor plan.

Equipment footprint templates

Equipment footprint templates are drawn to the same scale as the floor plan grid (1/4 inch = 1 foot). These templates are provided to show basic equipment dimensions and space requirements for servicing.

The service areas shown on the template drawings are lightly shaded.

The equipment templates should be used with the floor-plan grid to define the location of the equipment that will be installed in your computer room.

NOTE Photocopying typically changes the scale of drawings copied. If any templates are copied, then all templates and floor-plan grids must also be copied.

Computer room layout plan

Use the following procedure to create a computer room layout plan:

Step 1. Remove several copies of the floor-plan grid.

Step 2. Cut and join them together (as necessary) to create a scale model floor-plan of your computer room.

Step 3. Remove a copy of each applicable equipment footprint template.

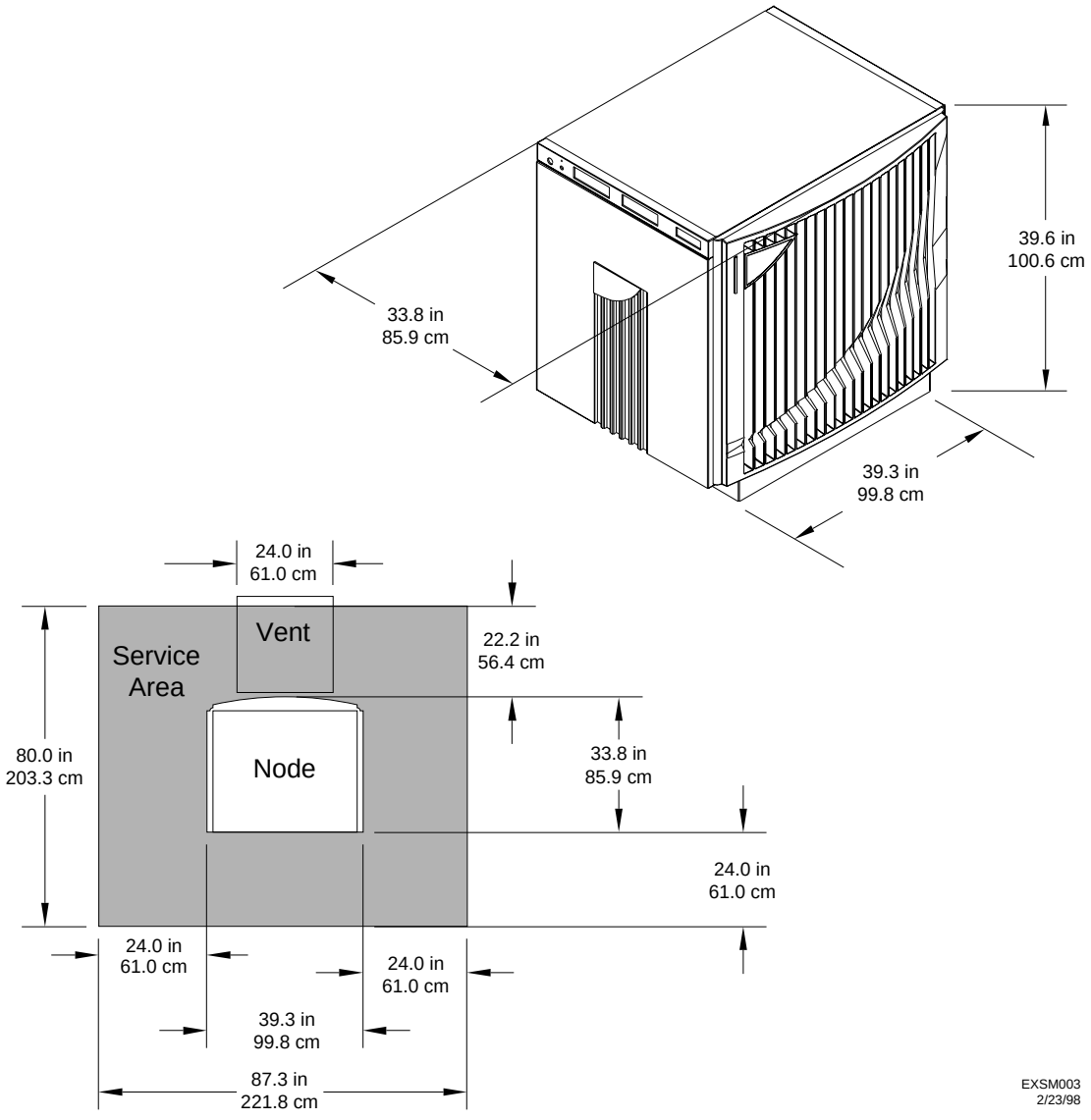
Step 4. Cut out each template selected in Step 3; then place it on the floor-plan grid created in Step 2.

Step 5. Position pieces until the desired layout is obtained; then fasten the pieces to the grid. Mark locations of computer room doors, air conditioning floor vents, utility outlets, and so on.

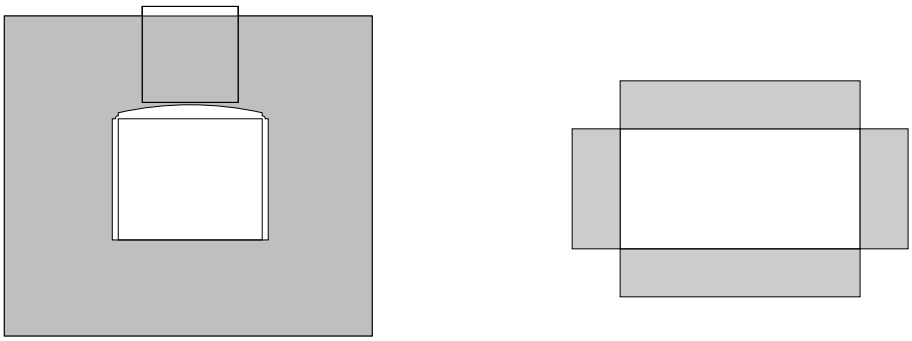
NOTE Attach a reduced copy of the completed floor-plan to the site survey (Table 15 and Table 16) located in Chapter 4, “Preinstallation survey.” This floor plan is used by a Hewlett-Packard field engineer during equipment installation process.

Figure 17 provides the basic dimensions of the V-Class server.

Figure 17 V-Class server dimensions



Scale: 1/4 inch = 1 foot

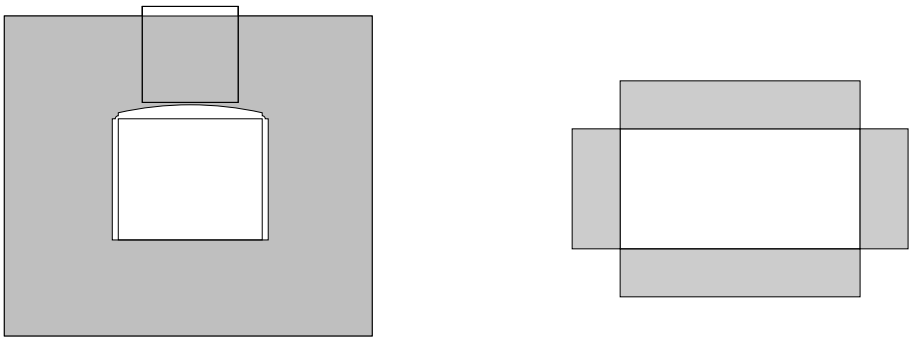


Service area

EXSM016
8/21/97

Computer room layout plan

Scale: 1/4 inch = 1 foot

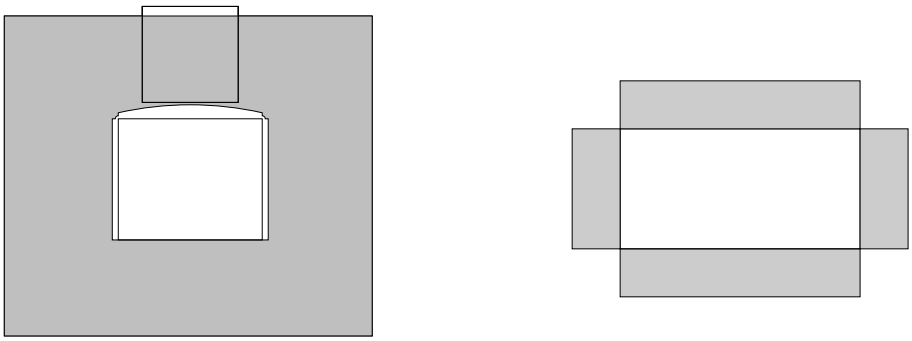


Service area

EXSM016
8/21/97

Computer room layout plan

Scale: 1/4 inch = 1 foot

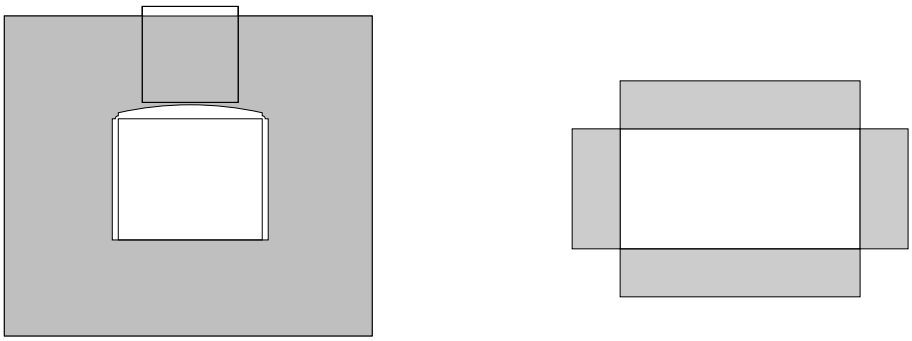


Service area

EXSM016
8/21/97

Computer room layout plan

Scale: 1/4 inch = 1 foot

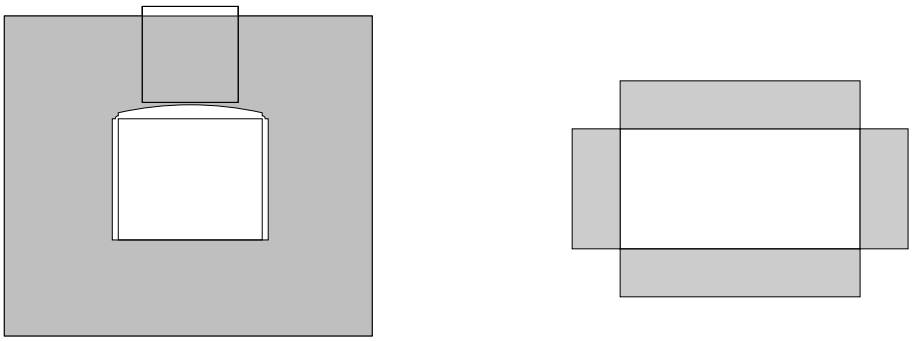


Service area

EXSM016
8/21/97

Computer room layout plan

Scale: 1/4 inch = 1 foot

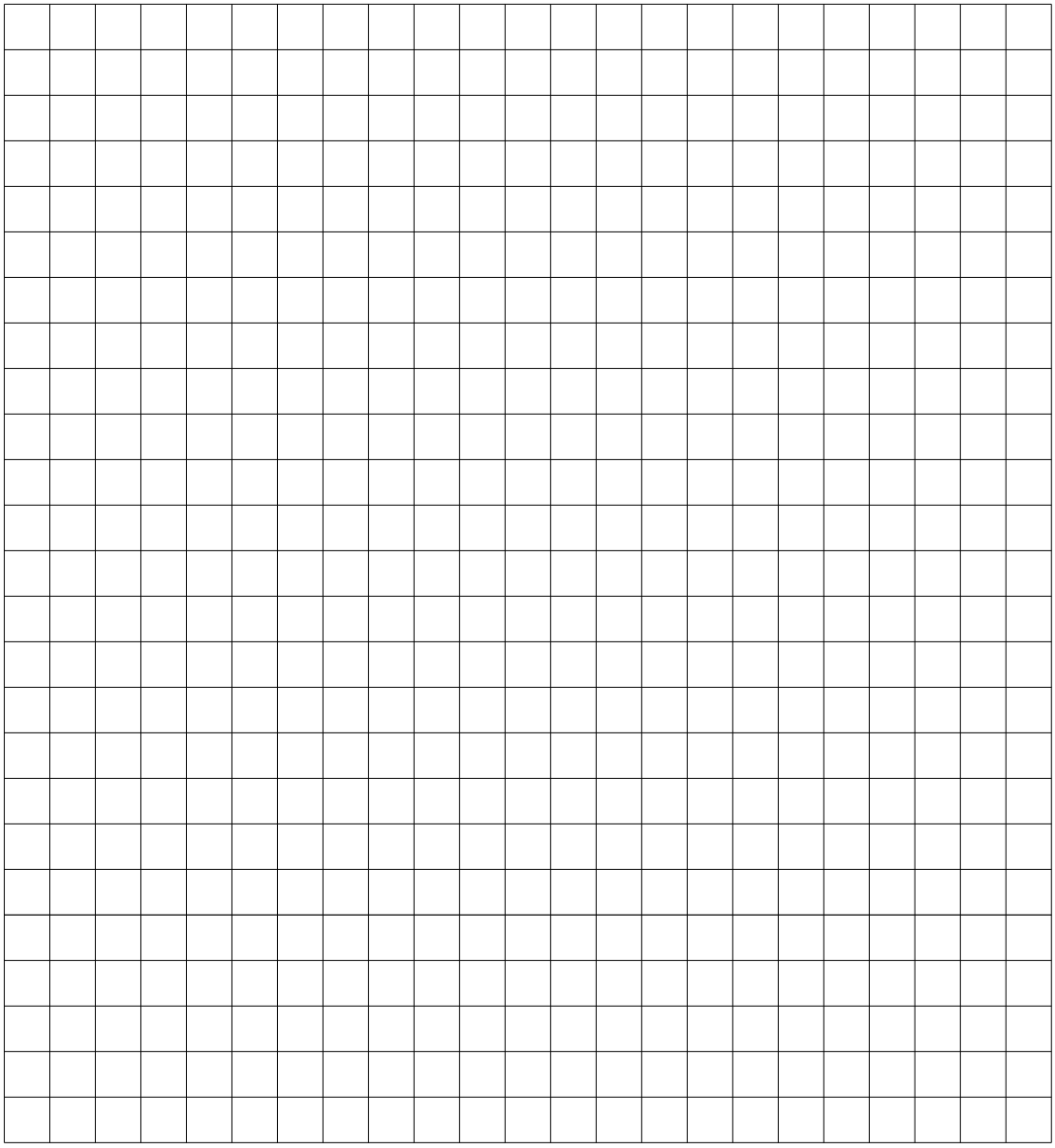


Service area

EXSM016
8/21/97

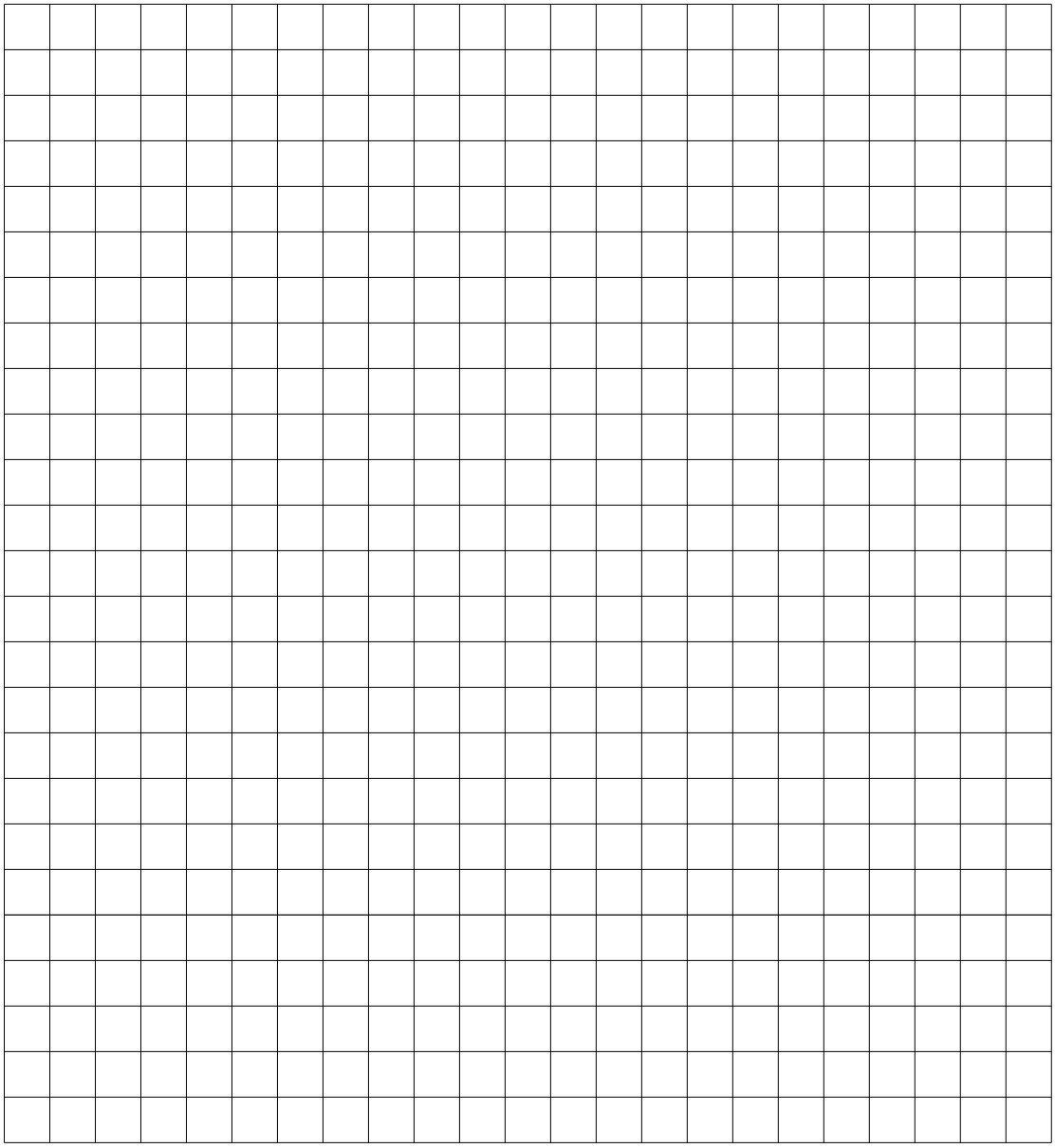
Computer room layout plan

1 square = 1 foot



EXSM015
8/21/97

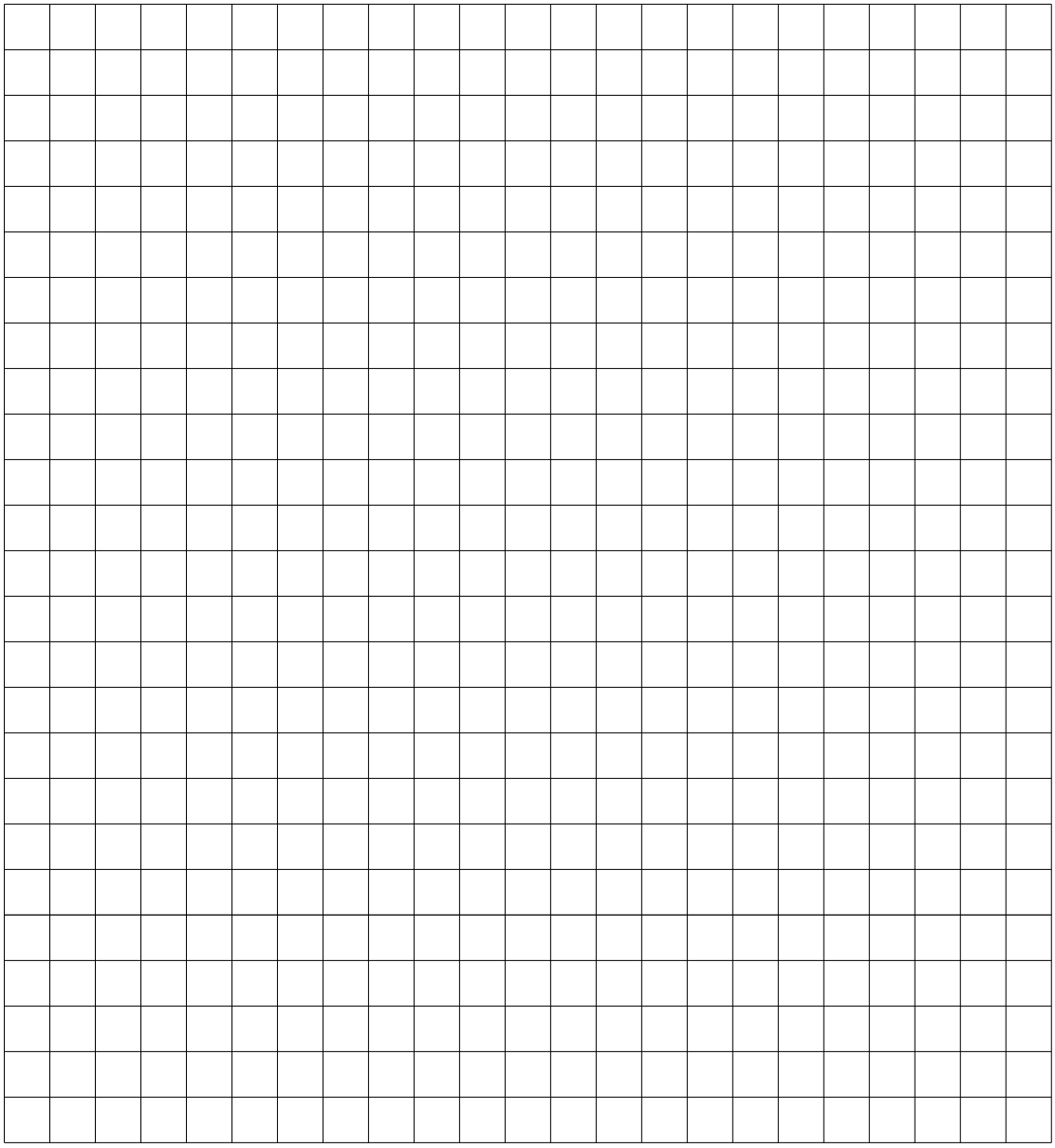
1 square = 1 foot



EXSM015
8/21/97

Computer room layout plan

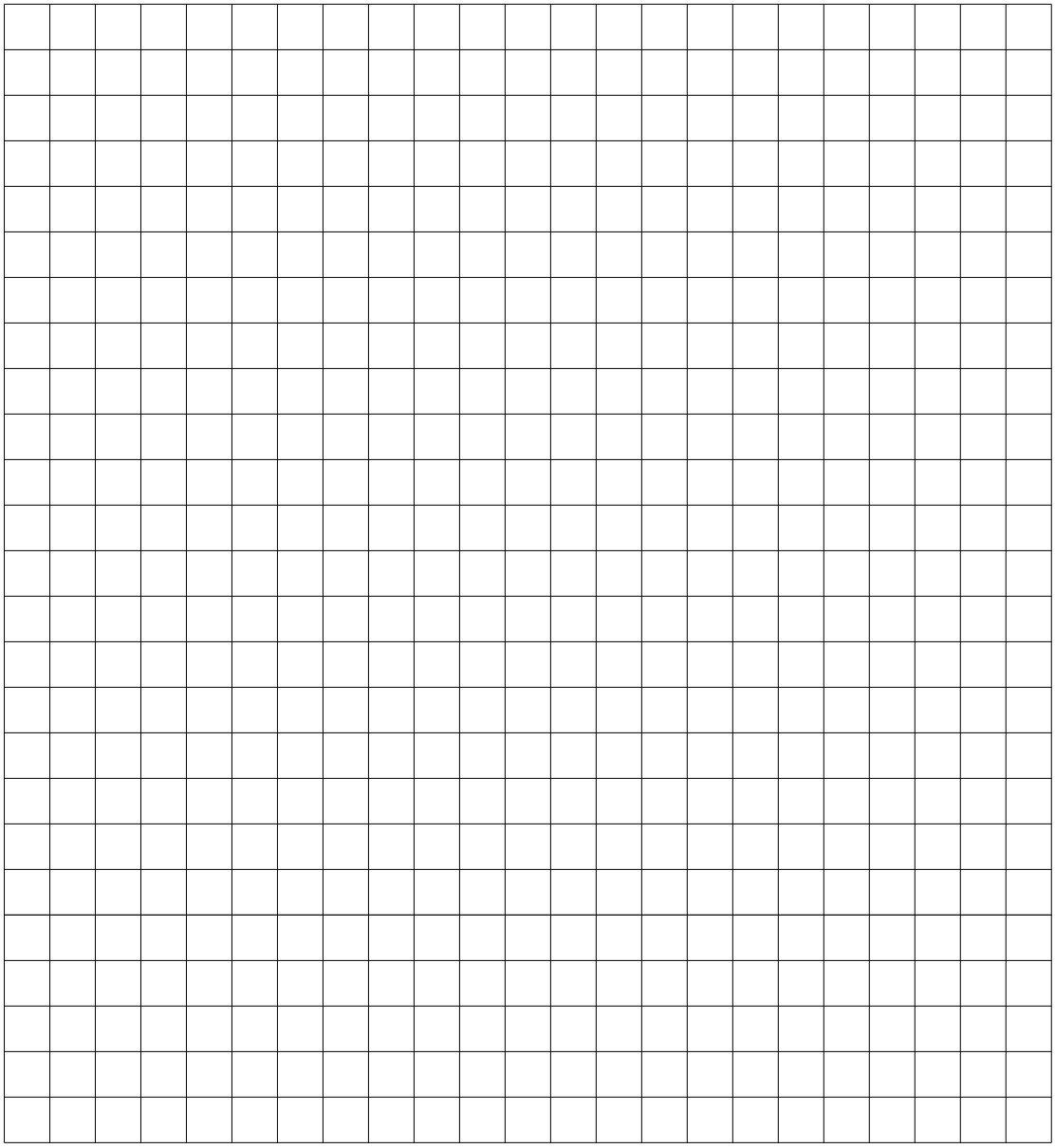
1 square = 1 foot



EXSM015
8/21/97

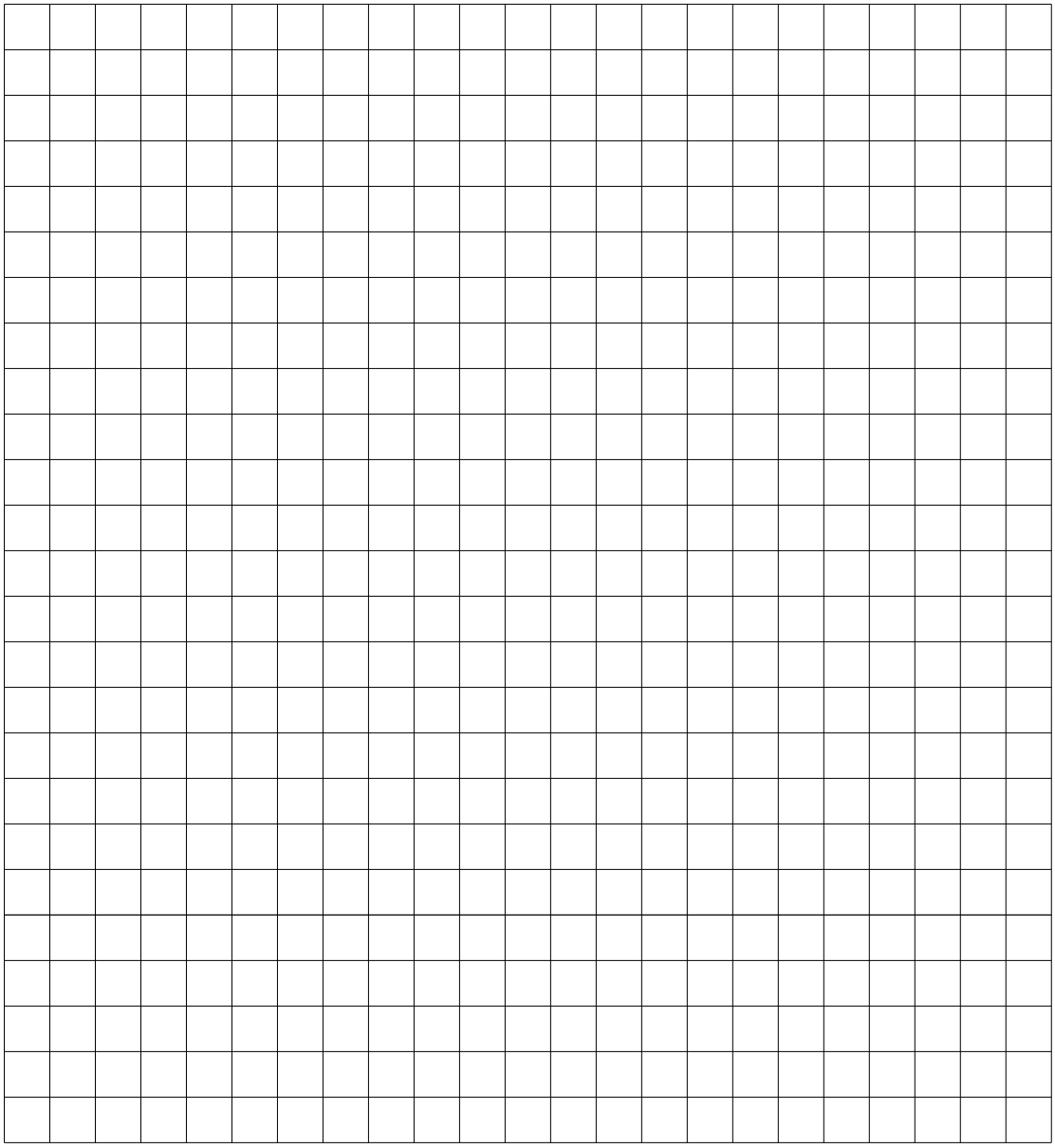
Computer room layout plan

1 square = 1 foot



EXSM015
8/21/97

1 square = 1 foot



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