

HEWLETT-PACKARD

**DISK PRODUCT
SPECIFICATIONS
AND
SITE ENVIRONMENTAL
REQUIREMENTS**

Disk Product Specifications and Site Environmental Requirements



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Preface

This manual contains detailed product specifications and environmental requirements for Hewlett-Packard disk products. This information is intended primarily to aid HP CEs in assisting customers in establishing the proper operating environment for their disk products. However, this manual may be of use to anyone involved in the planning of computer operating sites. It is assumed anyone involved in site preparation is familiar with the terms and concepts associated with product specifications and environmental topics.

The information in this manual is organized into the following chapters and appendixes:

- Chapters 1 - 3 contain general information about environmental parameters and factors involved in site selection. This material should provide a better understanding of environmental issues and how they affect the performance and reliability of disk products.
- Appendix A contains the detailed product specifications and environmental requirements information. A table at the beginning of the appendix lists all the products included.
- Appendixes B and C contains condensed specifications and environmental requirements for products not included in Appendix A. These are disk products no longer in production.
- Appendix D contains power cord option information.

This manual should be available early enough in the site planning stage to allow the customer adequate time to provide the proper operating environment for the disk product when it arrives. Using the information in Appendix A, the customer can establish the environmental operating limits that meet the product requirements.

Regulatory Statements

The products listed in Appendix A meet either FCC classification A or B. Refer to the Electromagnetic Emissions specifications to determine the classification of the product.

For USA Only

The Federal Communications Commission (in 47 CFR 15.818) has specified that the following notice be brought to the attention of the users of this product.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

For USA Only

The Federal Communications Commission (in 47 CFR 15.838) has specified that the following notice be brought to the attention of the users of this product.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

Warning: This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection

against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: re-orient the receiving antenna; relocate the computer with respect to the receiver; move the computer away from the receiver; plug the computer into a different branch circuit. If necessary, the user should consult the dealer or authorized field service representative for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: *Interference Handbook*. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00450-7.

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General Information

Introduction

This manual provides product specifications and environmental requirements for many of Hewlett-Packard's rigid disk products. The disk products covered in this manual are listed in appendixes A, B, and C.

The information in this manual covers only the specified Hewlett-Packard disk products. The customer is responsible for meeting the site environmental requirements for the rest of the system components. If the disk product is to be installed on Hewlett-Packard computer equipment, appropriate site preparation documentation, including environmental requirements, will be provided for each system component.

Product Testing

The quality and reliability features of a product must be developed early in the product design stage and carried through the manufacturing process. Hewlett-Packard seeks to design and build the highest quality and reliability into our products starting at the bread-board design stage.

To ensure that the product design meets its quality goals, Hewlett-Packard employs a rigorous type testing program. With type testing, a group of units are tested and the results are used to represent that particular product.

Due to the length of testing time, and in some cases the increased stress levels applied to the product, it is not practical to test each product manufactured to every environmental specification. However, certain tests are performed on each product as it completes the manufacturing cycle. This testing ensures that each product is as good as the product that was environmentally tested.

Customer Responsibility

While Hewlett-Packard provides consultation on site environmental requirements, the scheduling, planning, preparation and verification of a site environment suitable for installation of an HP disk product is the customer's responsibility. Hewlett-Packard Sales and Support Personnel are available during the pre-installation period to assist the customer.

The customer is responsible for furnishing all labor and materials for site preparation, site maintenance, conformance to local codes, and the compatibility of Hewlett-Packard products with local laws, codes and licenses. The customer is solely responsible for establishing and maintaining the site requirements specified at the site planning meeting. Failures resulting from such unspecified environmental or physical phenomena are not covered by warranty or maintenance agreement. Such phenomena include, but are not limited to, unusual shock or electrical damage, accident, fire or water damage, neglect, air conditioning failure, humidity control failure, damages during transportation by customer or causes other than ordinary use, or toxic or corrosive chemicals present in the air.

Customer Engineering Services

Hewlett-Packard offers complete on-site customer engineering maintenance service on a world-wide basis. Charges for this service, quoted as a basic monthly maintenance charge (BMMC), are among the lowest in the industry, contributing to the low overall cost of ownership associated with the purchase of an HP disk product.

Provisions of the BMMC require compliance with the specifications and/or recommendations listed in this manual, unless escalation procedures are implemented. Conditions that are identified as having a detrimental effect on product performance (e.g., corrosive gases, noisy or unstable power source, etc.) must be corrected prior to installation.

For further details, contact your nearest Hewlett-Packard Sales and Support Office.

1-2 General Information

Environmental Requirements

Introduction

Environmental requirements are those items required to ensure that Hewlett-Packard disk products meet their published operational characteristics. Each environmental item has a specific measurable parameter or information that affects the operational characteristics of the drive. Continual operation of a disk product outside the limits of the recommended environmental limits may result in degradation of product operation. The environmental requirements cover both the actual physical location of the disk product and the associated area.

The following items are considered environmental requirements:

- Temperature.
- Humidity.
- Shock.
- Vibration.
- Altitude.
- Electromagnetic Susceptibility.
- Power.
- Contaminants.
- Cooling Requirements.
- Tilting.

Effects of Climate

All HP disk products can operate in an environment suitable for human occupancy as long as moisture will not condense within the environment, and room air does not contain chemical contaminants which may degrade disk product components. Along with the environment in which the product operates, the effects of outside temperature, humidity, altitude and other regional characteristics must be taken into consideration. For example:

- At higher altitudes, the efficiency of a cooling fan decreases because of reduced air density. Consider keeping the disk product enclosure at a lower temperature to compensate for the reduced air density at the air intake vents.
- In locations where extremes of temperature and humidity prevail, consider the effects of such conditions on the disk product when the main power is shut down. For instance, in northern regions, the effects of winter nighttime temperatures should be considered when the main power is shut off.
- In warm, humid regions, a fungus growth prevention program should be considered.
- In shoreline installations, the site may require special air conditioners, dehumidifiers, and other items to reduce high humidity and corrosive salt in the air.

Reliability and performance are maximized when the product is operated within the recommended temperature and humidity range. The recommended temperature and relative humidity limits for each disk product are included in appendix A.

2-2 Environmental Requirements

Vibration and Shock

Vibration can cause slow degradation of mechanical parts and, when severe, can cause data errors in disk products; therefore, it should be avoided or controlled. Also, mechanical connections such as PCA connectors and cable connectors may be affected. The best preventive measure is to locate the site away from vibration-generating sources, such as heavy industrial machinery (stamp mills, etc.). Care in handling the disk product will also avoid problems resulting from sudden shock.

Hewlett-Packard disk products are tested using random vibration techniques. Random vibration is superior as a test technique in that all product resonances can be excited simultaneously. This is especially necessary with products whose performance characteristics are statistical in nature and can only be measured over a period of time, such as disk drives and tape drives. It is impractical to do a long-duration, single-frequency test at every frequency. In addition, a sweep through the frequency range does not give adequate statistics for problem frequencies. Only random vibration offers both thoroughness and timeliness.

Some environments contain vibration at discrete frequencies, whereas other environments contain broadband vibrations. Random vibration test-and-measurement techniques work for both environments. A frequency spectrum reveals the nature and magnitude of the vibration environment and can be compared directly to the spectra in this specification.

Random vibration testing has been used extensively in military and aerospace applications but does not have widespread use in commercial markets due to the high cost of test equipment. In our continuing effort to build quality products, cost alone cannot justify a compromised test program. Because it is relatively new in this market, some explanation of terms and concepts is appropriate.

Random vibration has a magnitude that is not specified for any given instant of time. The instantaneous magnitude of a random vibration is specified only by probability distribution functions giving probable fraction of the total time that the magnitude lies within a specified frequency range. Random vibration contains no periodic or quasi-periodic constituents.

The magnitude of this distribution is measured in power spectral density (PSD) which is the limiting mean square acceleration per unit bandwidth. It

is measured in g^2/Hz and reveals how much energy is applied at a particular frequency.

A site can be qualified by comparing a frequency spectrum of the intended environment to the product specification spectra. The environment should be under the specification at every frequency. Exceptions will be evaluated on a case-by-case basis.

The two pairs of unpackaged vibration profiles used to test HP disk products are shown in Figure 2-1 through Figure 2-4. Each product is tested using one of the profile pairs, which include both operating and nonoperating vibration profiles. Each product's vibration specifications refer to the vibration profiles used to test the product. The vibration test verifies the product's operational and mechanical integrity.

The unpackaged operating and nonoperating shock profile used to test most HP disk products is shown in Figure 2-5. The shock test also verifies the product operational and mechanical integrity. The product shock specifications indicate the maximum acceleration levels at which no data loss will occur and no operator intervention will be required.

Altitude

Altitude must be considered for operating conditions. In the operating environment, the lower air density at extremely high altitudes may be insufficient to provide adequate cooling to the disk product, which may decrease performance and reliability.

2-4 Environmental Requirements

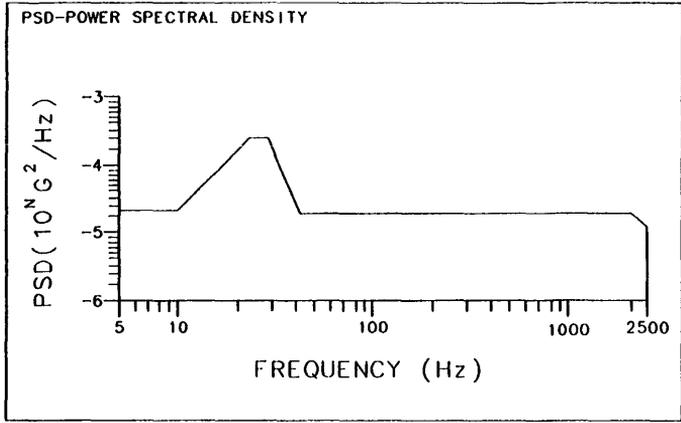


Figure 2-1. Random Vibration Profile 1: Operating

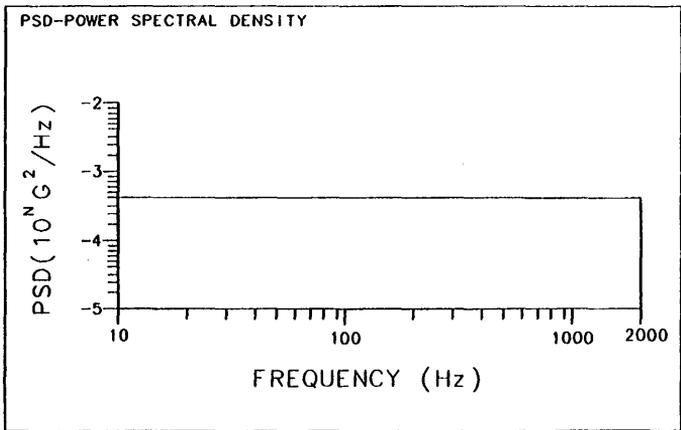


Figure 2-2. Random Vibration Profile 2: Nonoperating

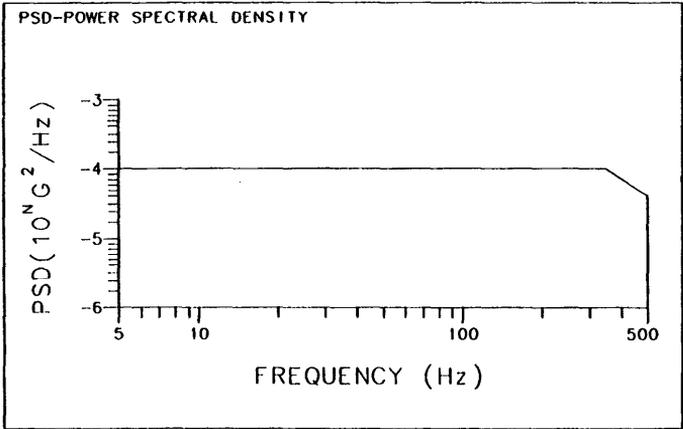


Figure 2-3. Random Vibration Profile 3: Operating

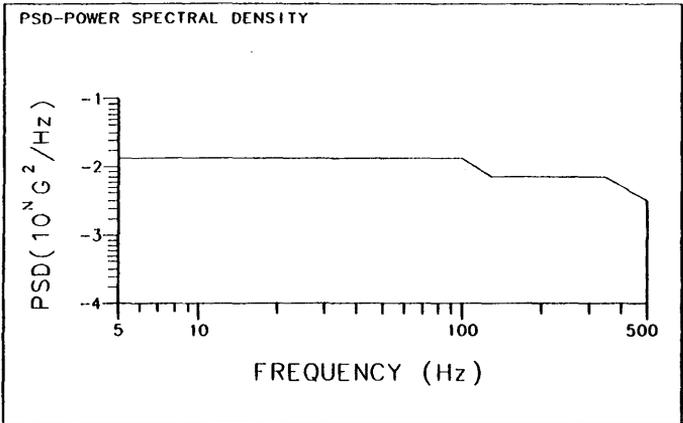


Figure 2-4. Random Vibration Profile 4: Nonoperating

2-6 Environmental Requirements

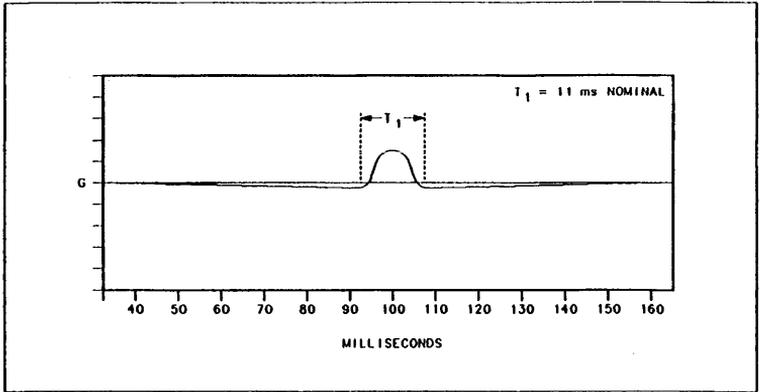


Figure 2-5. Shock Profile: Operating and Nonoperating

Electromagnetic Susceptibility

Every reasonable attempt is made to make HIP disk products resistant to electromagnetic interference (EMI). However, in order to minimize the possibility of experiencing difficulty, it may be necessary to take unique steps. Such steps may include, but not be limited to, the following:

- Improving grounding techniques.
- Placing the drive in a grounded screen enclosure.
- Placing grounded copper screens on all windows.

Radiated Interference Susceptibility

Electronic equipment, including disk drives and tape drives, may exhibit unacceptable behavior if operation is attempted in environments where electromagnetic fields exist. Such environments might occur near radio and TV transmitting towers, or near radar installations like those found at airports. If radiated electromagnetic fields are suspected or verified (by direct measurement

using spectrum analyzers or field strength meters), precautions should be taken to shield the product from the electromagnetic field.

Conducted Interference Susceptibility

Radio frequency noise may be introduced into a disk product through the ac power line as well as through the air as an electric field. Power line conditioners and line filters are very effective in eliminating conducted radio frequency interference (RFI).

Electrostatic Discharge

Electrostatic discharge, commonly known as static electricity, may cause corruption of data, improper operation, or electronic failure. Carpeting, low humidity, and leather-soled shoes may all contribute to unacceptable electrostatic fields. If static discharges are detected (as when touching door knobs, or metallic objects), humidifiers, antistatic mats and other antistatic procedures should be implemented.

Magnetic Susceptibility

Disk drives, tape drives, and magnetic media (tapes, floppy disks and removable disk packs), may all exhibit destruction of stored data if exposed to magnetic fields. Keep all magnetic materials away from magnetic media and recording devices.

Power Line Irregularities

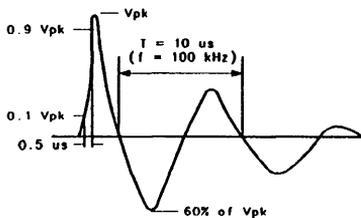
In some geographic areas, the available power used for the disk product may experience excessive voltage sags, surges, transients, outages, or other irregularities unacceptable for reliable operation. Therefore, a power quality survey must be conducted. The results of the survey should be analyzed for correct voltage, current, and phase; and the absence of detrimental power line transients and conducted interference, which can cause a malfunction to occur. If any item does not meet the specified requirements, action must be taken to correct the situation.

2-8 Environmental Requirements

Power line irregularities may be divided into the following categories:

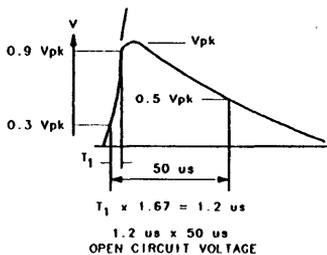
- **Line Dropout.** HP disk products are designed to recover gracefully from short duration line dropouts. However, to ensure that long duration power line dropouts do not affect the continued operation of the disk product, an uninterruptible power supply (UPS) is required. Line conditioners and regulators will not help in this situation.
- **Over or Under Voltage.** Fluctuations from the nominal line voltage are experienced as the result of equipment on the power distribution network being turned on or off. Line voltage fluctuations can be caused by equipment anywhere on the power distribution network, not only that in the immediate vicinity. A power failure many miles away may cause voltage fluctuations. In a worst case situation, (e. g. brown out), a UPS is one example of a device that can provide uninterrupted power.
- **Line Transients.** Just as radio frequency noise may be transmitted over the ac power line, electrical noise may also be evidenced at the ac power outlet. Line transients may result in interrupted operation, blown fuses, or electrical failure. The waveforms used to test the power line transient response of HP disk products are shown in Figure 2-6. Two of the waveforms in the figure (A and B) are described in the *IEEE Guide on Surge Voltages in AC Circuits up to 600V, Final Draft*.
- **Neutral-to-Ground Noise.** This is the noise exhibited between the neutral and ground lines.
- **Ground-to-Ground Noise.** This is the noise exhibited between the product ground and earth ground.
- **Power Line Distortion.** This is an undesirable change in the original signal waveform that results in an unfaithful representation of the desired waveform. Waveform clipping is one example of this type of distortion. Noise in the form of extraneous signals superimposed on the desired waveform is not defined as distortion.

Power line conditioners may be helpful in regulating and conditioning ac power. Problems associated with power line irregularities are often very difficult to diagnose due to the unpredictable and intermittent nature of the problem.

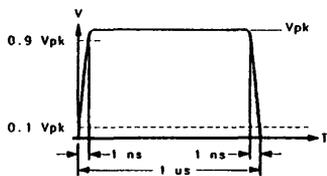


Oscillatory wave 0.5 us rise time. 100 kHz decaying at 40% for each successive peak.

A. RING WAVE (0.5 us-100 kHz) OPEN CIRCUIT VOLTAGE



B. UNIDIRECTIONAL WAVES



C. FAST RISE TIME TRANSIENT

u = 10⁻⁶

Figure 2-6. Transient Voltage Waveforms

2-10 Environmental Requirements

Contaminants

Contaminants consist primarily of particulates or corrosives. Both may be airborne in atmospheric dust as a complex mixture of smokes, mists, fumes, dry granular particles, and fibers. The components of any mixture may consist of soot and smoke, silica, clay, organic materials, and metallic fragments. A sample may also include living organisms such as mold spores and bacteria.

Contaminants vary with locality, season of the year, direction and strength of the wind, and proximity of dust sources. Size of the particles also varies with differing conditions. The size ranges of typically encountered airborne particles are shown in Figure 2-7. The comparative sizes of some common contaminants and the head/disk gap of a disk drive are shown in Figure 2-8.

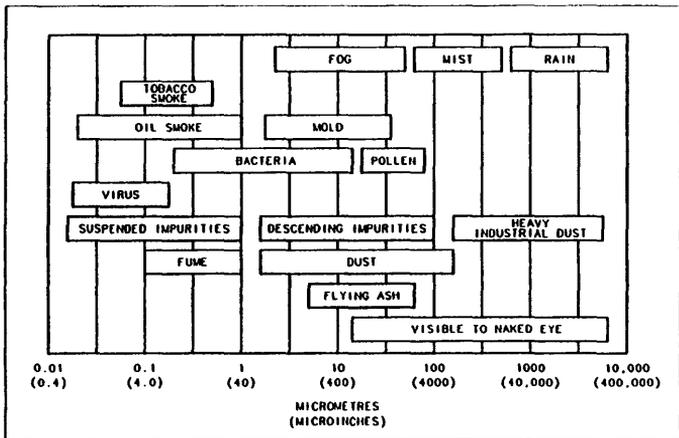


Figure 2-7. Size of Common Air Contaminants

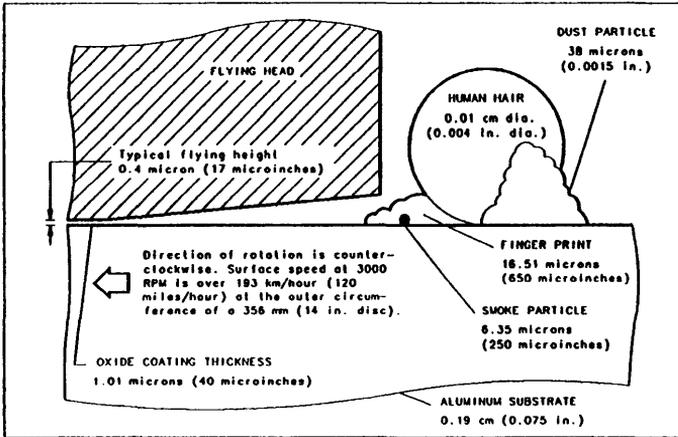


Figure 2-8. Contaminant Sizes Compared to Disk/Head Spacing

Note



Contaminants as yet have no measurable parameters except as rated for the product's particulate filter. Chemical contaminants that can corrode disk product components are presently being researched by Hewlett-Packard. Operating a disk product in an environment known to contain significant amounts of the listed contaminants will lead to malfunctions requiring extensive servicing. Therefore, we recommend that IIP disk products not be stored or operated in areas that contain the corrosive contaminants listed in the following paragraphs.

Particulate Contaminants

Particulate contaminants consist primarily of dust particles which are of various physical compositions. These particles present a clear abrasive hazard if introduced into the disk product's operating environment. In some instances, the particles are conductive and can short-circuit wiring in the disk product if an excessive amount accumulates. Also, film-forming particles and residues cause connector problems. Avoid operation in particularly dusty areas (e.g., factory floors, sawmills, etc).

In environments that contain hydrocarbons, particulate accumulation on the printed circuit assemblies (PCAs) causes an increase in the internal temperature of the disk product. Continual accumulations of particulates eventually prevent the product from maintaining the correct amount of cooling on the PCAs. This causes the product to operate beyond the specified temperature range and a malfunction may occur.

The particulate upper limit is expressed as the arithmetic mean value in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or micrograms per square centimeter per 30 days ($\mu\text{g}/\text{m}^2/30$ days). If particulate limits are not available for a product, the limits will not be listed in the table for that product. Operating an HP disk product at the upper limit may require an increase in the number of times the absolute filter must be changed, resulting in an increased basic monthly maintenance charge (BMMC).

Corrosive Contaminants

Corrosion is a complex form of material deterioration and is generally defined as the destruction of material by chemical or electrochemical reaction with its environment. Some effects of corrosion in disk products are the destruction of magnetic surfaces on disks and tapes, deterioration of plastics used in the equipment, and general degradation of conformal coatings on PCAs.

Many common problems can be avoided by isolating the product from contaminant-producing machinery. Examples of this type of machinery are office copiers, milling machines, and equipment that produces corrosive vapors or particulates. However, in areas where the atmosphere contains large amounts of various corrosive contaminants, more drastic measures must be taken to ensure clean air in the environment where the disk product is used.

Most environments are corrosive to some degree. Examples are air and moisture; fresh, distilled, or salt water; urban and industrial atmospheres; steam and other gases such as chlorine, ammonia, hydrogen sulfide, sulfur dioxide, and fuel gases; mineral acids such as hydrochloric, sulfuric, and nitric.

In general, inorganic materials are more corrosive than organic. For example, corrosion in the petroleum industry is due more to sodium chloride, sulfur, hydrochloric and sulfuric acids, and water than to oil, naphtha, or gasoline.

Corrosive environments such as that found in steel, acid, and paper manufacturing industries usually preclude the use of filtered ambient air for forced convection cooling. Corrosives generally cannot be filtered out by normal filtration methods, and the techniques that must be used are complex and costly. In these cases, the disk product must be enclosed in a highly controlled environment.

Note

Although the term "environment" as used here refers only to atmospheric contaminants, there is a strong link between corrosion rates and temperature and humidity conditions. Many corrosion processes (film thickness build-up, etc.) accelerate rapidly at high humidities and temperatures. This means that corrosive environments that possess high temperatures and humidities should be of particular concern.

The following are typical corrosive contaminants:

- **Sulfur Dioxide.** Sulfur dioxide is generally considered the most corrosive of the common contaminant gases. In combination with water, it forms sulfurous acid mist, an active and rapidly corrosive compound. It is known to produce molecular separation in polymers, and to cause spots on microfilm materials. This acid is found in industrial environments and causes deterioration of disk surfaces.
- **Total Oxidants.** The presence of strong oxidizing gases in the atmosphere, particularly ozone, is known to be potentially harmful to any organic material. The damaging effects most often encountered are the cross linking of elastomers, the cracking of stressed rubber, and the oxidation of silver.

2-14 Environmental Requirements

- **Hydrogen Sulfide.** Hydrogen sulfide is a rapid corrosive agent, particularly to copper and silver. Hydrogen sulfide is a common atmospheric contaminant found near oil fields, sulfur springs, and marshy areas, and occasionally is emitted from industrial or sewage treatment activities.
- **Ammonia.** In sufficient concentrations, ammonia has been found to cause cracking of stressed brass, decreased insulation resistance, and increased loss factor in certain insulators.
- **Halogens.** Halogens are chemical elements that are fairly corrosive. The halogens include fluorine, bromine, chlorine, and iodine. Halogens react strongly with metals and hydrogen to form halides. The metal halides are solid water-soluble salts such as table salt (sodium chloride). Halogens usually occur in salt deposits and sea water environments. Halogens (and their compounds) are widely used in medicine, photographic films, sanitation processes, disinfectants, insecticides, some textile processes, paints, bleaches and plastics.

Cooling Requirements

An internal fan provides adequate ventilation when the disk product is operated in the appropriate environment. To obtain maximum efficiency, allow the required clearances between the front and rear of the disk product. Air conditioning may be required to maintain the correct operating temperature. Install required air conditioning before operating HP disk products.

Tilting

Operating the drive at an angle greater than that specified may result in decreased performance due to increased seek times. A tilted drive may not be capable of meeting its seek time specifications. If the tilt angle is severe enough, the drive may be unable to seek at all.

Site Planning

Introduction

The purpose of site planning is to provide an optimum environment for computer products. By providing this optimum environment, customers will receive maximum satisfaction and success from their equipment. Continually operating a product at an extreme of the environmental requirements can reduce the product reliability.

Since Hewlett-Packard is dedicated to customer satisfaction, we make every effort to provide recommended operating environmental limits for our disk products. By providing an environment that fits within the range of the recommended environmental specifications, customers should receive maximum long-term, trouble-free operation of their Hewlett-Packard disk products.

Environmental Specifications

Three different specifications are given for most environmental requirements:

- Recommended Specifications.
- Operating Specifications.
- Nonoperating Specifications.

Recommended Specifications

Through experience, Hewlett-Packard has defined the specifications that will provide maximum long-term success for our customers. These are the recommended specifications

If the product specifications do not include a recommended value for a specific environmental parameter, we recommend that the customer provide an environment that fits into the mid-range of the operating specifications, where practical.

Operating Specifications

Operating specifications are those specifications that Hewlett-Packard, through type testing, has determined provide a safe (survival) operating range for the product. It also must be understood that continual operation at the extremes of this operating range results in stress on the product and can result in early failure or less reliable operation.

All possible combinations of stresses have not been type tested. The results of simultaneously applying worst case extremes of several environmental parameters are unpredictable.

Nonoperating Specifications

Nonoperating specifications are designated limits for transit and short-term storage of the product. Type testing has been completed to ensure that HP disk products will operate properly if these nonoperating specifications are not exceeded.

Long-Term Storage

If the product will be stored for an extended period of time, it must be properly packaged. The shipping carton is not designed to serve as a storage container and does not offer the necessary protection for long-term storage.

Long-term storage frequently requires the use of hermetically sealed packaging and desiccant. If you are not familiar with the requirements involved in preparing electro-mechanical equipment for long-term storage, contact a

3-2 Site Planning

commercial packaging company specializing in long-term storage for help in designing the proper packaging.

For further information contact your local Hewlett-Packard Sales Office.

Environments

There are basically two environments in which Hewlett-Packard disk products should be operated: the controlled computer room environment, and the general office environment.

Note



While many HP disk products have been operated successfully in environmental circumstances not optimally suited for reliable operation, there have also been circumstances where reliability has been adversely affected.

It is Hewlett-Packard's goal that our customers be highly successful in the use of our products. Therefore, we highly recommend that the time, energy, and effort be made to provide a benign environment for our products. Such an effort will be to the long term benefit of our customers.

Controlled Computer Room Environment

A controlled computer room is a physical area where all elements of the environment are closely controlled and monitored. Temperature, humidity, power, and all other environmental parameters are constantly maintained at levels consistent with the recommended specifications of the disk products and other equipment within the area.

As the name implies, this type of environment is usually created to support large computer systems which require strict environmental control. The disk products connected to such systems are typically the larger, higher capacity models.

General Office Environment

The general office environment includes those areas where personnel work on a full-time basis, and where environmental elements are subject to greater variations than those in a controlled computer room. Although greater environmental variations occur within this type of environment, the environmental limits of the disk products must not be exceeded.

When operating disk products in a general office environment it is recommended that customers make every effort to minimize adverse affects on the product. This includes, but is not limited to, providing a clean power source, reducing temperature and humidity swings, and controlling the circumstances where electrostatic discharge can cause reliability problems.

Acoustics

There are two methods of specifying acoustic emissions: sound pressure level and sound power level. Although sound pressure level is more commonly quoted because it yields a significantly lower number, sound power level is the more meaningful of the two measurements.

Sound pressure levels result from measuring only what reaches the sound meter. The disadvantage in comparing sound pressure levels is that the values are dependent upon test methods and measurement distances. For example, if sound pressure is measured from a long distance, the result is a very low number, although the product may be producing a lot of noise.

Sound power levels, however, take measurement distance and method into account and yield the actual noise level emitted by the product. Sound power level is the only valid number to use when comparing products.

Where applicable, the product specifications include both measurements to indicate the difference between the two values. The sound pressure values quoted in the product specifications are an average of nine points that lie on a parallelepiped whose surfaces are one meter from every product boundary.

3-4 Site Planning

Product Specifications

Introduction

This chapter contains detailed specifications and characteristics for the Hewlett-Packard disk products listed in table A-1. The information for each product is divided into four categories:

- **Operating specifications** - includes performance and capacity data.
- **Physical characteristics** - includes information on the size and weight of the product.
- **Operating characteristics** - includes such product characteristics as power, heat dissipation, acoustic emissions, electromagnetic emissions, and compliance to safety standards.
- **Environmental requirements** - includes operating, nonoperating, and recommended environmental limits for the product.

All product specifications are type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure they continue to meet published specifications. The specifications and characteristics for each disk product are applicable only when the product is installed and operated within its environmental limits.

For long-term, trouble-free operation, disk products should not be operated at their maximum environmental limits for extended periods of time. The recommended operating conditions included in each table define a less stressful operating environment for the product. Operating the product within its recommended operating range will ensure maximum customer satisfaction.

Note

Environmental specifications apply when the product is not connected to an HP system. When the product is connected to an HP system, the most stringent environmental and performance specifications listed for any single HP component within the system are applicable and supersede the disk product specifications.

Table A-1. Disk Products Covered

Product	Page
HP 7907A	A-3
HP 7911, 7912, 7914	A-11
HP 7914ST	A-22
HP 7914TD	A-29
HP 7914CT	A-36
HP 7933H, 7935H, 7933XP, 7935XP	A-45
HP 97935A (Media Module)	A-56
HP 7941A, 7945A	A-59
HP 7942A, 7946A	A-68
HP 7957A, 7958A	A-78
HP 7936H, 7937H, 7936XP, 7937XP, 7936FL, 7937FL	A-87
HP 19514A	A-97
HP 7957B, 7958B, 7959B	A-107
HP 7957S, 7958S, 7959S	A-116
HP 7961B, 7962B, 7963B	A-125
HP 9262B, 9263B	A-135
HP Series 6000, Models 335H, 670H, and 670XP	A-146
HP Series 6000, Models 670FL and 1.34FL	A-159
HP Series 6000, Models 330S and 660S	A-172
HP C226XA-Series Network Mass Storage Systems	A-184
HP C222XA-Series Hard Disk Drives	A-194
HP C2224 DDS-Format DAT Drive	A-198

A-2 Product Specifications

HP 7907A Disk Drive Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	4.0 ms
Average seek time (including settling):	30 ms
Average rotational delay:	8.5 ms
Average time to transfer 1 kilobyte: (at 625 kilobytes/sec)	1.8 ms

Total average transaction time: (excluding system overhead)	44.3 ms
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Disk performance index:	22.6 I/Os per second ¹
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¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,384	64		
Surface	10,272,768	40,128	627	1
Removable	20,545,536	80,256	1,254	2
Total	41,091,072	160,512	2,508	4

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height (with feet):	180.3 mm (7.1 in.)
Height (without feet):	174.1 mm (6.9 in.)
Width:	325.1 mm (12.8 in.)
Depth:	487.7 mm (19.2 in.)

SERVICE CLEARANCE:

Front:	177.8 cm (7 in.)
Rear:	10.2 cm (4 in.)

WEIGHT

Net:	24.9 kg (55 lb)
Shipping:	29.1 kg (64.2 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	200 W (683 Btu/hr; 172 kcals/hr)
Typical:	145 W (495 Btu/hr; 125 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level B computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.

Magnetic nonoperating:	<5.25 milligauss at 4.6 m (15 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

HP 7907A

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 200 W (90 V, 60 Hz) 230 V setting; 200 W (180 V, 50 Hz)
Typical Power:	115 V setting; 145 W (115 V, 60 Hz) 230 V setting; 145 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 3.0 A (true rms at 90 V, 60 Hz) 230 V setting; 1.7 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 1.7 A (true rms at 115 V, 60 Hz) 230 V setting; 1.0 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	54 dB(A)
Sound power level (L_{wA}):	67 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	10°C to 40°C (50°F to 104°F)
Nonoperating range:	-40°C to 75°C (-40°F to 167°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	5% to 95% relative humidity, noncondensing
Nonoperating:	5% to 95% relative humidity, noncondensing

VIBRATION

Operating: Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.
(See figure 2-3)

Nonoperating: Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.
(See figure 2-4)

SHOCK

Recommended operating range: <1.0 g
Operating: 2 g maximum at 11 ms, half sine waveform
Nonoperating: 20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 3,000 m (9,840 ft)
Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):
Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):
Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):	
Recommended operating limit:	<0.5 V rms
Operating limit:	<1 V rms
Electrostatic Discharge:	
Recommended operating limit:	<5 kV
Operating limit:	<15 kV
Magnetic:	<4 gauss, 47.5 to 198 Hz
Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):	
Oscillatory wave (100 kHz ringing wave):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1.5 kV (open circuit voltage)
Unidirectional wave (one 20 μs wide pulse):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1 kV (open circuit voltage)
Fast rise time transients:	
Recommended operating limit:	<500 V (into 50 Ω load)
Operating limit:	<1 kV (into 50 Ω load)

POWER REQUIREMENTS

Voltages (true rms):

115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230 V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

HP 7907A

Frequency:	47.5-66 Hz
Maximum Power:	115 V setting; 270 VA (90 V, 60 Hz) 230 V setting; 306 VA (230 V, 50 Hz)
Typical Power:	115 V setting; 195 VA (115 V, 60 Hz) 230 V setting; 230 VA (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 3.0 A (true rms at 90 V, 60 Hz) 230 V setting; 1.7 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 1.7 A (true rms at 115 V, 60 Hz) 230 V setting; 1.0 A (true rms at 230 V, 50 Hz)
Distortion:	<5% flat-topped harmonic distortion
Line Surge and Sag:	
Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec
Line Dropout:	Must not exceed 10 ms

TILT

When mounted using an HP 19507A Rackmount Kit, the HP 7907 shall meet all performance specifications throughout a 360° rotation. Shock and vibration testing has not been performed on the HP 7907 while being tilted.

A-10 Product Specifications

HP 7911, 7912, and 7914 Disk Drives Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

DISK DRIVE PERFORMANCE

	7911	7912	7914
Average controller overhead time:	4.0 ms	4.0 ms	4.0 ms
Average seek time:	27.1 ms	28.1 ms	28.1 ms
Average rotational delay:	8.3 ms	8.3 ms	8.3 ms
Average time to transfer 1 kilobyte:	1.2 ms	1.2 ms	1.2 ms
Total average transaction time: (excluding system overhead)	40.6 ms		41.6 ms
Disk performance index: (in I/Os per second ¹)	24.6		24.0

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

TAPE DRIVE PERFORMANCE

Read/write tape speed: 152.4 cm/s (60 in./s)
 Search/rewind tape speed: 228.2 cm/s (90 in./s)

Data transfer rate: 35 kilobyte/s maximum¹

¹Maximum sustained transfer rate does not necessarily reflect system throughput, which varies depending upon application, file structures, and driver implementation.

DISK DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,384	64		
Head:				
7911/7912	9,376,148	36,608	572	
7914	18,874,368	73,728	1,152	
HP 7911	28,114,944	109,824	1,716	3
HP 7912	65,601,536	256,256	4,004	7
HP 7914	132,120,576	516,096	8,064	7

TAPE DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Words Per	Blocks Per	Tracks Per
Word	2			
Block	1,024	512		
Track:				
150 ft	1,046,578	523,264	1,022	
600 ft	4,186,112	2,093,056	4,088	
Cartridge:				
150 ft	16,744,448	8,372,224	16,352	16
600 ft	66,977,792	33,488,896	65,408	16

PHYSICAL CHARACTERISTICS

DIMENSIONS

P-Model:	
Height	720 mm (28.3 in.)
Width:	354 mm (14.0 in.)
Depth:	711 mm (28.0 in.)

See figure A-1 for R-model dimensions.

HP 7911, 7912, 7914

WEIGHT

P-Model:

Net: 85.4 kg (188 lb)
Shipping: 117.1 kg (258 lb)

R-Model:

Net: 67.2 kg (148 lb)
Shipping: 89.9 kg (198 lb)

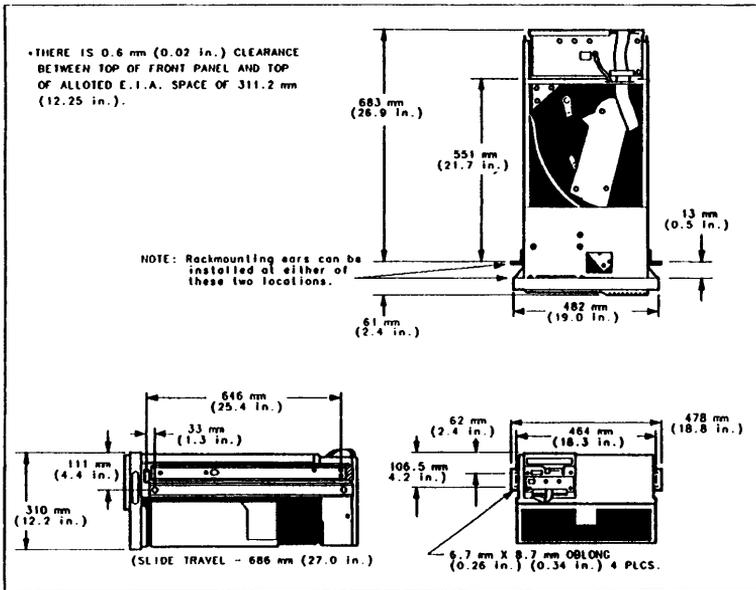


Figure A-1. HP 7911R/7912R/7914R Dimensions

A-14 Product Specifications

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum: 700 W (2389 Btu/hr; 602 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.
- The R-Model disk drive is intended for installation in an overall product that will affect the emissions characteristics. It is recommended that end-use products be tested for RFI emissions.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltage:	100, 120, 220, 240 V; +5%, -10%
Frequency:	50 Hz, 60 Hz; +10%, -5%
Phase:	Single
Maximum Current:	8 A at 120 V, 60 Hz
Typical Current:	4.2 A at 120 V, 60 Hz
Power:	700 watts maximum
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).

ACOUSTIC EMISSIONS

P-Model:	
Average sound pressure level (L_{pA}):	54 dB(A)
Sound power level (L_{wA}):	68 dB(A)

R-Model not specified due to dependance on rack-mount configuration.

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the IIP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	10°C to 40°C (50°F to 104°F)
Nonoperating range:	-40°C to 60°C (-40°F to 140°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	20% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	10% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))

VIBRATION
Operating:**R-Model:**

(See figure 2-1)

Random vibration with power spectral density (PSD) of $0.000025 \text{ g}^2/\text{Hz}$ from 5 to 10 Hz; 7.5 dB/octave from 10 to 25 Hz; PSD of $0.00025 \text{ g}^2/\text{Hz}$ from 25 to 30 Hz; -24 dB/octave from 30 to 40 Hz; PSD of $0.000025 \text{ g}^2/\text{Hz}$ from 40 to 2000 Hz; -9.3 dB/octave from 2000 to 2500 Hz; PSD of $0.0000125 \text{ g}^2/\text{Hz}$ at 2500 Hz.

P-Model:

Random vibration with power spectral density (PSD) of $0.000009 \text{ g}^2/\text{Hz}$ from 5 to 2500 Hz;

Nonoperating:

(See figure 2-2)

Random vibration with power spectral density (PSD) of $0.0005 \text{ g}^2/\text{Hz}$ from 10 to 2000 Hz.

SHOCK
Recommended operating range:

<0.67 g

Operating:

2 g maximum at 11 ms, half sine waveform

ALTITUDE
Operating:

maximum 4,600 m (15,000 ft)

Nonoperating:

maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m

Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms

Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V (p-p)

Operating limit: <1 V (p-p)

Electrostatic Discharge:

Recommended operating limit: <5 kV

Operating limit: <12.5 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 20 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1 kV (open circuit voltage)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS**Voltage:**

Recommended range: The daily average not to vary more than $\pm 2\%$ from the correct line voltage

Operating range: 100, 120, 220, 240 V; +5%, -10%

Frequency:

Recommended range: 47.5 to 52.5 Hz, 57 to 66 Hz

Operating range: 50 Hz, 60 Hz; +10%, -5%

Phase:

Single

Current:

8 A maximum at 120 V, 60 Hz)

Distortion:

<5% flat-topped harmonic distortion

Line Surge and Sag:

80% and 120% typical line voltage for 30 s
70% and 130% typical line voltage for 0.5 s

TILT

Can be operated in any position; however, the drive should not be rotated about its axis (vertical axis for P-model, horizontal axis for R-model) at a rate greater than 0.2 radians/second due to gyroscopic effects. Rotation beyond this rate can cause errors which require reinitialization of the media.

HP 7914ST Disk/Tape Subsystem Specifications

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height	160 cm (62.9 in.)
Width:	63 cm (24.8 in.)
Depth:	81 cm (31.9 in.)

WEIGHT

Net (total):	
Standard:	269.0 kg (593 lb)
Option 114:	332.5 kg (846 lb)
Shipping (total):	
Standard (2 boxes):	294.8 kg (650 lb)
Option 114 (3 boxes):	383.7 kg (846 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Standard:	1,250 W (4,266 Btu/hr; 1,075 kcals/hr)
Option 240:	1,300 W (4,437 Btu/hr; 1,118 kcals/hr)
Option 114:	1,900 W (6,485 Btu/hr; 1,634 kcals/hr)
Option 240/114:	1950 W (6655 Btu/hr; 1677 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltage: 120, 220, 240 V, single phase; +5%, -10%

Frequency: 50 Hz, 60 Hz; +10%, -5%

Current: 16 A maximum at 120 V (with two drives)
8 A maximum at 220 or 240 V (with two drives)

Power:
Standard: 860 watts maximum at 66 Hz, 120 V
Option 114: 1,440 watts maximum at 66 Hz, 120 V

Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	52 dB(A) (one drive) 54 dB(A) (two drives)
Sound power level (L_{wA}):	68 dB(A) (one drive) 68 dB(A) (two drives)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the IIP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	15°C to 32°C (59°F to 90°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	20% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	10% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))

VIBRATION (Tested in vertical axis only)

Operating:
(See figure 2-3) Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.

Nonoperating:
(See figure 2-4) Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.

SHOCK

Recommended operating range: <0.67 g
Operating: 2 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 3,000 m (9,840 ft)
Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE**Radiated (14 kHz to 1 GHz):****Recommended operating limit:** <0.5 V/m**Operating limit:** <3 V/m**Conducted (30 Hz to 50 kHz):****Recommended operating limit:** <1 V rms**Operating limit:** <3 V rms**Conducted (50 kHz to 400 MHz):****Recommended operating limit:** <0.5 V (p-p)**Operating limit:** <1 V (p-p)**Electrostatic Discharge:****Recommended operating limit:** <5 kV**Operating limit:** <10 kV**Magnetic:**

<4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):**Oscillatory wave (100 kHz ringing wave):****Recommended operating limit:** <500 V (open circuit voltage)**Operating limit:** <1 kV (open circuit voltage)**Unidirectional wave (one 20 μ s wide pulse):****Recommended operating limit:** <500 V (open circuit voltage)**Operating limit:** <1 kV (open circuit voltage)

POWER REQUIREMENTS

Voltage:

Recommended range: The daily average not to vary more than $\pm 2\%$ from the correct line voltage

Operating range: 120, 220, 240 V, single phase; +5%, -10%

Frequency:

Recommended range: 47.5 to 52.5 Hz, 57 to 66 Hz

Operating range: 50 Hz, 60 Hz; +10%, -5%

Current:

16 A maximum at 120 V (with two drives)

8 A maximum at 220 or 240 V (with two drives)

Power:

Standard: 860 watts maximum at 66 Hz, 120 V

Option 114: 1,440 watts maximum at 66 Hz, 120 V

Distortion:

<5% flat-topped harmonic distortion

Line Surge and Sag:

80% and 120% typical line voltage for 30 s

70% and 130% typical line voltage for 0.5 s

TILT

Can be operated in any position; however, the drive should not be rotated about its axis (vertical axis for P-model, horizontal axis for R-model) at a rate greater than 0.2 radians/second due to gyroscopic effects. Rotation beyond this rate can cause errors which require reinitialization of the media.

HP 7914TD Disk/Tape Subsystem Specifications

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height	161.3 cm (63.5 in.)
Width:	63.5 cm (25.0 in.)
Depth:	81.3 cm (32.0 in.)

WEIGHT

Net (total):	
Standard:	272.2 kg (600 lb)
Option 114:	339.4 kg (748 lb)
Shipping (total):	
Standard (2 boxes):	364.7 kg (804 lb)
Option 114 (3 boxes):	454.6 kg (1,002 lb)

OPERATING CHARACTERISTICS

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.

HP 7914TD

- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some IIP systems. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltage: 120, 240 V, single phase; +5%, -10%
220 V, single phase; \pm 5%,
208, 240 V, two phase; +5%, -10%

Frequency: 50 Hz, 60 Hz; +10%, -5%

Current: 16 A maximum at 120 V (with two drives)
8 A maximum at 220 or 240 V (with two drives)

Power:
Standard: 925 watts maximum at 66 Hz, 120 V
Option 114: 1,625 watts maximum at 66 Hz, 120 V

Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	60 dB(A) (two drives)
Sound power level (L_{wA}):	76 dB(A) (two drives)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (IIP) system. When this product is connected with IIP systems, the more stringent environmental and performance specifications listed for any single IIP device within the IIP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	10°C to 40°C (50°F to 104°F)
Nonoperating range:	-40°C to 60°C (-40°F to 140°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	20% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	10% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))

VIBRATION

Operating: (See figure 2-1)	Random vibration with power spectral density (PSD) of 0.000025 g^2/Hz from 5 to 10 Hz; 7.5 dB/octave from 10 to 25 Hz; PSD of 0.00025 g^2/Hz from 25 to 30 Hz; -24 dB/octave from 30 to 40 Hz; PSD of 0.000025 g^2/Hz from 40 to 2000 Hz; -9.3 dB/octave from 2000 to 2500 Hz; PSD of 0.0000125 g^2/Hz at 2500 Hz.
Nonoperating: (See figure 2-2)	Random vibration with power spectral density (PSD) of 0.0005 g^2/Hz from 10 to 2000 Hz.

SHOCK

Recommended operating range:	<0.67 g
Operating:	2 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:	maximum 3,000 m (9,840 ft)
Nonoperating:	maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m

Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms

Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V (p-p)

Operating limit: <1 V (p-p)

Electrostatic Discharge:

Recommended operating limit: 750 V

Operating limit: <1.5 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 20 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1 kV (open circuit voltage)

POWER REQUIREMENTS

Voltage:	120, 240 V, single phase; +5%, -10% 220 V, single phase; \pm 5%, 208, 240 V, two phase; +5%, -10%
Frequency:	
Recommended range:	47.5 to 52.5 Hz, 57 to 66 Hz
Operating range:	50 Hz, 60 Hz; +10%, -5%
Current:	16 A maximum at 120 V (with two drives) 8 A maximum at 220 or 240 V (with two drives)
Power:	
Standard:	925 watts maximum at 66 Hz, 120 V
Option 114:	1,625 watts maximum at 66 Hz, 120 V
Distortion:	<5% flat-topped harmonic distortion
Line Surge and Sag:	80% and 120% typical line voltage for 30 s 70% and 130% typical line voltage for 0.5 s

TILT

Can be operated in any position; however, the drive should not be rotated about its axis (vertical axis for P-model, horizontal axis for R-model) at a rate greater than 0.2 radians/second due to gyroscopic effects. Rotation beyond this rate can cause errors which require reinitialization of the media.

HP 7914CT Disk/Tape Drive Specifications

OPERATING SPECIFICATIONS

Note  The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

DISK DRIVE PERFORMANCE

Average controller overhead time:	4.0 ms
Average seek time:	28.1 ms
Average rotational delay:	8.3 ms
Average time to transfer 1 kilobyte:	1.2 ms

Total average transaction time: (excluding system overhead)	41.6 ms
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Disk performance index:	24 I/Os per second ¹
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¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

TAPE DRIVE PERFORMANCE

Read/write tape speed: 152.4 cm/s (60 in./s)
 Search/rewind tape speed: 228.2 cm/s (90 in./s)
 Data transfer rate: 35 kilobyte/s maximum¹

¹ *Maximum sustained transfer rate does not necessarily reflect system throughput, which varies depending upon application, file structures, and driver implementation.*

DISK DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,384	64		
Head:	18,874,368	73,728	1,152	
HP 7914	132,120,576	516,096	8,064	7

TAPE DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Words Per	Blocks Per	Tracks Per
Word	2			
Block	1,024	512		
Track:				
150 ft	1,046,578	523,264	1,022	
600 ft	4,186,112	2,093,056	4,088	
Cartridge:				
150 ft	16,744,448	8,372,224	16,352	16
600 ft	66,977,792	33,488,896	65,408	16

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height	720 mm (28.3 in.)
Width:	375 mm (14.8 in.)
Depth:	777 mm (30.8 in.) (including baffle)

WEIGHT

Net:	109 kg (239 lb)
Shipping:	
Disk Drive	135 kg (297 lb)
Tape Drive	9 kg (19 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum: 700 W (2389 Btu/hr; 602 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some IIP systems. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces

Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltage:	100, 120, 220, 240 V; +5%, -10%
Frequency:	50 Hz, 60 Hz; +10%, -5%
Phase:	Single
Current:	8 A maximum at 120 V, 60 Hz
Power:	700 watts maximum
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).

ACOUSTIC EMISSIONS

P-Model:	
Average sound pressure level (L_{pA}):	50 dB(A)
Sound power level (L_{wA}):	63 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	10°C to 40°C (50°F to 104°F)
Nonoperating range:	-40°C to 60°C (-40°F to 140°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	20% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 24°C (75°F))
Nonoperating:	10% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))

VIBRATION

Operating:

R-Model: Random vibration with power spectral density (PSD) of $0.000009 \text{ g}^2/\text{Hz}$ from 10 to 2500 Hz.

Nonoperating:
(See figure 2-2)

Random vibration with power spectral density (PSD) of $0.0005 \text{ g}^2/\text{Hz}$ from 10 to 2000 Hz.

SHOCK

Recommended operating range: <0.67 g
Operating: 2 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 4,600 m (15,000 ft)
Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):	
Recommended operating limit:	<0.5 V (p-p)
Operating limit:	<1 V (p-p)
Electrostatic Discharge:	
Recommended operating limit:	<5 kV
Operating limit:	<12.5 kV
Magnetic:	<4 gauss, 47.5 to 198 Hz
Power line transients (per IEEE Standard P587.1/F):	
Oscillatory wave (100 kHz ringing wave):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1.5 kV (open circuit voltage)
Unidirectional wave (one 20 μs wide pulse):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1 kV (open circuit voltage)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltage:	
Recommended range:	The daily average not to vary more than $\pm 2\%$ from the correct line voltage
Operating range:	100, 120, 220, 240 V; +5%, -10%

HP 7914CT

Frequency:

Recommended range: 47.5 to 52.5 Hz, 57 to 66 Hz
Operating range: 50 Hz, 60 Hz; +10%, -5%

Phase: Single

Current: 8 A maximum at 120 V, 60 Hz

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag: 80% and 120% typical line voltage for 30 s
70% and 130% typical line voltage for 0.5 s

Neutral-to-Ground Noise:

Recommended limit: <1 V (p-p)
Operating limit: <10 V (p-p)

Ground-to-Ground Noise:

Recommended limit: <1 V (p-p)
Operating limit: <10 V (p-p)

TILT

Can be operated in any position; however, the drive should not be rotated about its axis (vertical axis for P-model, horizontal axis for R-model) at a rate greater than 0.2 radians/second due to gyroscopic effects. Rotation beyond this rate can cause errors which require reinitialization of the media.

HP 7933H/35H and 7933XP/35XP Disk Drives Specifications

OPERATING SPECIFICATIONS

Note



The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	23,552	92		
Surface	31,112,192	121,532	1,321	1
Drive	404,458,496	1,579,916	17,173	13

PERFORMANCE

	XP-MODEL	H-MODEL
Average controller overhead:	4.5 ms	3.5 ms
Average seek time:	24.0 ms	24.0 ms
Average rotational delay ($\pm 10\%$):	11.1 ms	11.1 ms
Average time to transfer 1 kilobyte: (at 1 megabyte/sec)	1.0 ms	1.0 ms
Controller cache impact ¹ :	-16.6 ms	0 ms
Total average transaction time: (excluding system overhead)	24.0 ms	39.6 ms
Disk performance index: (in I/Os per second ²)	41.7	25.3

¹ *The reduction in time is due to the reduced number of seeks required for a disk drive with controller cache. The actual performance improvement on a drive will vary, depending on the read hit rate and the read percentage; the listed values are based on a read hit rate of 70% and a read percentage of 70-75%. Hit rate is defined as the number of times the drive finds information in cache divided by the number of times the information is requested from the drive.*

² *Average disk transactions per second. Refers to fundamental disk performance; actual I/O rates are application dependent and must take into account system overhead, the system configuration, and the locality of data on the disk. The read hit rate and the read percentage will also have a significant impact on performance of the XP-model drive.*

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height:	825 mm (32.5 in.)
Width:	552 mm (12.76 in.)
Depth:	834 mm (32.8 in.)

WEIGHT

Net:	154 kg (340 lb)
Shipping:	192 kg (423 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	1,300 W (4,437 Btu/hr; 1,118 kcal/hr)
Typical:	1,100 W (3,754 Btu/hr; 946 kcal/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some IIP systems. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <10 gauss on all surfaces

POWER CHARACTERISTICS

Voltage: 120, 208, 220, 240 V; $\pm 10\%$
Frequency: 47.5 to 63 Hz
Phase: Single
Power: 1,300 watts maximum
Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).
Current (nominal worst case): See table A-2.

Table A-2. Nominal Worst Case Current

Standard/ Option	Market Area	Voltage (Vac)	Disk Drive	Accessory Outlet	Total Current
Standard	USA	208	7.6 A	1.7 A	9.3 A
120	USA, Canada	120	13.0 A	3.0 A	16.0 A
210	Canada	208	7.6 A	1.7 A	9.3 A
220 221 222 223	Canada Continental Europe Switzerland Denmark	220	7.4 A	1.6 A	9.0 A
241 242	United Kingdom Australia, New Zealand	240	6.9 A	1.5 A	8.4 A

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}): 59 dB(A)
 Sound power level (L_{wA}): 73 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
HP 7933 operating range:	10°C to 40°C (50°F to 104°F)
HP 7935 operating range:	10°C to 32°C (50°F to 90°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating: (No media module installed)	5% to 95% relative humidity, noncondensing (wet bulb temp. not to exceed 29.5°C (85°F))

VIBRATION

Operating: (See figure 2-1)	Random vibration with power spectral density (PSD) of 0.000025 g ² /Hz from 5 to 10 Hz; 7.5 dB/octave from 10 to 25 Hz; PSD of 0.000025 g ² /Hz from 25 to 30 Hz; -24 dB/octave from 30 to 40 Hz; PSD of 0.000025 g ² /Hz from 40 to 2000 Hz; -9.3 dB/octave from 2000 to 2500 Hz; PSD of 0.0000125 g ² /Hz at 2500 Hz.
Nonoperating: (See figure 2-2)	Random vibration with power spectral density (PSD) of 0.0005 g ² /Hz from 10 to 2000 Hz.

SHOCK

Recommended operating range:	<0.67 g
Operating:	2 g maximum at 11 ms, half sine waveform.
Nonoperating:	10 g maximum at 11 ms, half sine waveform.

ALTITUDE

Operating:	maximum 3,000 m (9,840 ft)
Nonoperating:	maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m
Operating limit: <2 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V (p-p)
Operating limit: <1 V (p-p)

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic: <4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 20 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1 kV (open circuit voltage)

COOLING REQUIREMENTS

Allow a minimum of 508 mm (20 in.) in front and 762 mm (30 in.) behind for adequate air flow.

POWER REQUIREMENTS

Power cords:	See figure A-2 for required cords.
Voltage:	
Recommended range:	The daily average not to vary more than $\pm 2\%$ from the correct line voltage
Operating range:	120, 208, 220, 240 V; $\pm 10\%$
Frequency:	47.5 to 63 Hz
Phase:	Single
Current (nominal worst case):	See table A-2.
Power:	1,300 watts maximum
Distortion:	<5% flat-topped harmonic distortion
Line Surge and Sag:	80% and 120% typical line voltage for 30 s 70% and 130% typical line voltage for 0.5 s
Neutral-to-Ground Noise:	
Recommended limit:	<1 V (p-p)
Operating limit:	<2 V (p-p)
Ground-to-Ground Noise:	
Recommended limit:	<1 V (p-p)
Operating limit:	<2 V (p-p)

HP 7933H/35H, 7933XP/35XP

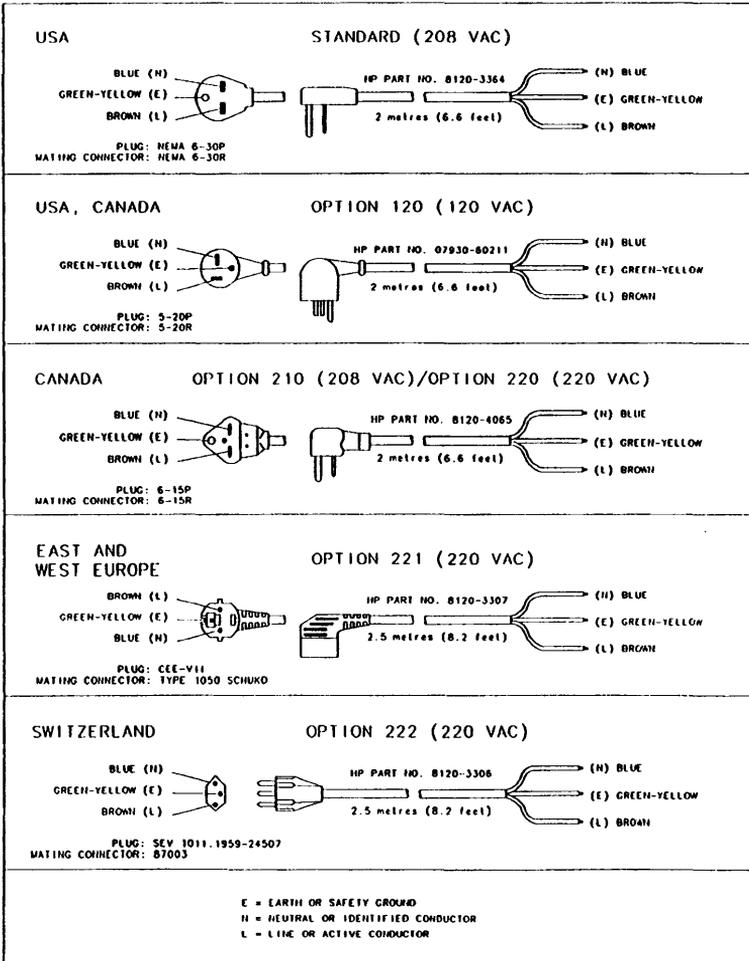


Figure A-2. HP 7933/7935 Power Cords

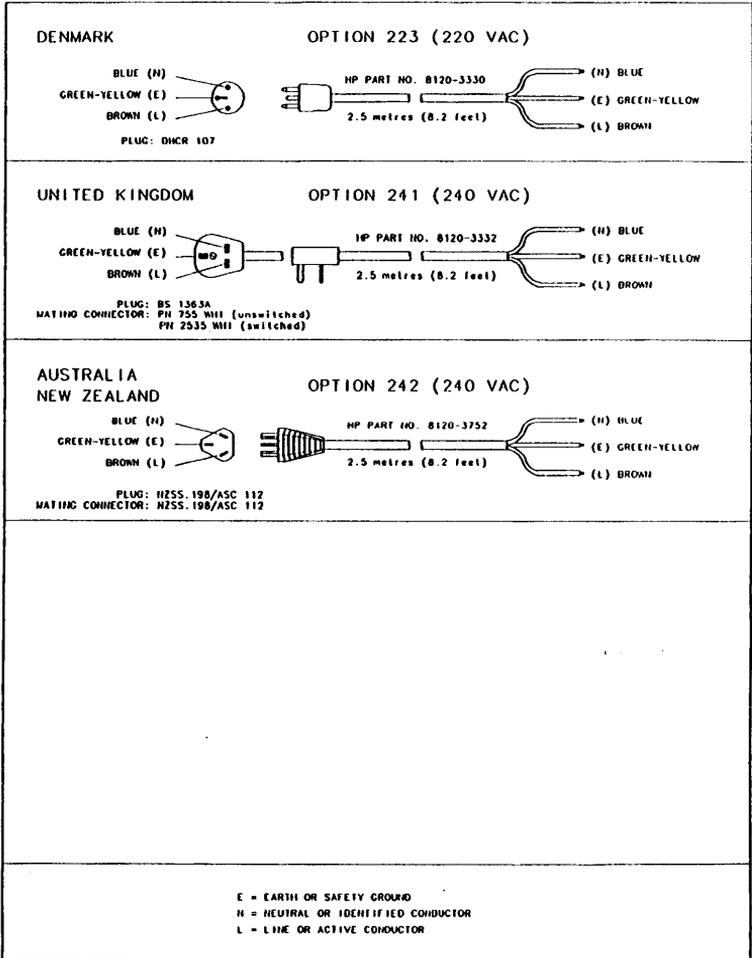


Figure A-2. HP 7933/7935 Power Cords (continued)

HP 97935A Media Module Specifications

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	10°C to 40°C (50°F to 104°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	8% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))

Note

The media module should not be installed if there are signs of moisture condensation in or on the media module.

VIBRATION

Operating: (See figure 2-1)	Random vibration with power spectral density (PSD) of 0.000025 g^2/Hz from 5 to 10 Hz; 7.5 dB/octave from 10 to 25 Hz; PSD of 0.00025 g^2/Hz from 25 to 30 Hz; -24 dB/octave from 30 to 40 Hz; PSD of 0.000025 g^2/Hz from 40 to 2000 Hz; -9.3 dB/octave from 2000 to 2500 Hz; PSD of 0.0000125 g^2/Hz at 2500 Hz.
Nonoperating: (See figure 2-2)	Random vibration with power spectral density (PSD) of 0.0005 g^2/Hz from 10 to 2000 Hz.

SHOCK¹

Operating:	2 g maximum at 11 ms, half sine waveform
Nonoperating:	30 g maximum at 11 ms, half sine waveform

¹*In decreasing order of severity, the effects of excessive shock on the media module are head crash, premature failure of spindle and actuator, or error rate.*

ALTITUDE

Operating:	maximum 3,000 m (9,840 ft)
Nonoperating:	maximum 15,000 m (49,200 ft)

HP 7941A and 7945A Disk Drives Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	10.1 ms
Average seek time (including settling):	30 ms
Average rotational delay:	8.3 ms
Average time to transfer 1 kilobyte: (at 625 kilobytes/sec)	2 ms
 Total average transaction time: (excluding system overhead)	 50.4 ms
 Disk performance index:	 20 I/Os per second ¹

¹Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	8,129	32		
Surface	7,929,856	30,976	968	1
HP 7941A	23,789,568	92,928	2,904	3
HP 7945A	55,508,992	216,832	6,776	7

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height 130 mm (5.1 in.)
Width: 325 mm (12.8 in.)
Depth: 285 mm (11.2 in.)

WEIGHT

Net: 9.9 kg (21.8 lb)
Shipping: 12.9 kg (28.5 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	85 W (290 Btu/hr; 73 kcals/hr)
Typical:	65 W (222 Btu/hr; 56 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level B computing devices. FTZ licensed on some IIP systems. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

HP 7941A, 7945A

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 85 W (90 V, 60 Hz) 230 V setting; 85 W (198 V, 50 Hz)
Typical Power:	115 V setting; 65 W (115 V, 60 Hz) 230 V setting; 65 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 1.6 A (true rms at 90 V, 60 Hz) 230 V setting; 1.0 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 0.8 A (true rms at 115 V, 60 Hz) 230 V setting; 0.5 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{wA}):	52 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range: 20°C to 25.5°C (68°F to 78°F)
Operating range: 5°C to 45°C (41°F to 113°F)
Nonoperating range: -40°C to 60°C (-40°F to 140°F)

Maximum rate of change: 10°C (18°F) per hour

HUMIDITY

Operating: 8% to 80% relative humidity, noncondensing
 (wet bulb temp. not to exceed 29°C (84°F))
Nonoperating: 5% to 90% relative humidity, noncondensing
 (wet bulb temp. not to exceed 29°C (84°F))

VIBRATION

Operating: Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.
(See figure 2-3)

Nonoperating: Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.
(See figure 2-4)

SHOCK

Recommended operating range: $<0.5 \text{ g}$
Operating: 1.5 g maximum at 11 ms, half sine waveform
Nonoperating: 20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 4,600 m (15,000 ft)
Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE**Radiated (14 kHz to 1 GHz):**

Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V rms
Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):**Oscillatory wave (100 kHz ringing wave):**

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 20 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1 kV (open circuit voltage)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltages (true rms):

115 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)
230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5-66 Hz

Maximum Power: 115 V setting; 144 VA (90 V, 60 Hz)
230 V setting; 198 VA (200 V, 50 Hz)

Typical Power: 115 V setting; 92 VA (115 V, 60 Hz)
230 V setting; 115 VA (230 V, 50 Hz)

Maximum Current: 115 V setting; 1.6 A (true rms at 90 V, 60 Hz)
(occurs during spin-up) 230 V setting; 1.0 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 0.8 A (true rms at 115 V, 60 Hz)
230 V setting; 0.5 A (true rms at 230 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag:
Transparent surge: 120% nominal line voltage for 0.5 sec
Recoverable surge/sag: 115 V setting; 70% and 130% typical
(per MIL-T-28800) line voltage for 0.5 sec

Line Dropout: Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 7942A and 7946A Disk Drives Specifications

OPERATING SPECIFICATIONS

 **Note** The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

DISK DRIVE PERFORMANCE

Average controller overhead time:	10.1 ms
Average seek time (including settling):	30 ms
Average rotational delay:	8.3 ms
Average time to transfer 1 kilobyte: (at 625 kilobytes/sec)	2 ms

Total average transaction time: (excluding system overhead)	50.4 ms
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Disk performance index:	20 I/Os per second ¹
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¹Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.

TAPE DRIVE PERFORMANCE

Read/write tape speed: 152.4 cm/s (60 in./s)
 Search/rewind tape speed: 228.2 cm/s (90 in./s)

Maximum sustained transfer rate: 34 kilobyte/s¹

¹ *Maximum sustained transfer rate does not necessarily reflect system throughput, which varies depending upon application, file structures, and driver implementation.*

DISK DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	8,129	32		
Surface	7,929,856	30,976	968	1
HP 7941A	23,789,568	92,928	2,904	3
HP 7945A	55,508,992	216,832	6,776	7

TAPE DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Words Per	Blocks Per	Tracks Per
Word	2	1		
Block	1,024	512		
Track:				
150 ft	1,046,578	523,264	1,022	
600 ft	4,186,112	2,093,056	4,088	
Cartridge:				
150 ft	16,744,448	8,372,224	16,352	16
600 ft	66,977,792	33,488,896	65,408	16

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height	208 mm (8.19 in.)
Width:	325 mm (12.8 in.)
Depth:	285 mm (11.2 in.)

WEIGHT

Net:	15.8 kg (34.8 lb)
Shipping:	19.6 kg (43.3 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	125 W (427 Btu/hr; 109 kcals/hr)
Typical:	120 W (410 Btu/hr; 103 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices.
- For Europe, designed to meet VDE 0871 for Level B computing devices. F.T.Z. licensed on some HP systems. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

HP 7942A, 7946A

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 125 W (100 V, 60 Hz) 230 V setting; 125 W (264 V, 50 Hz)
Typical Power:	115 V setting; 120 W (115 V, 60 Hz) 230 V setting; 120 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 2.3 A (true rms at 90 V, 60 Hz) 230 V setting; 1.3 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 1.50 A (true rms at 115 V, 60 Hz) 230 V setting; 0.80 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	40 dB(A)
Sound power level (L_{wA}):	52 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 40°C (41°F to 104°F)
Nonoperating range:	-40°C to 60°C (-40°F to 140°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	20% to 80% relative humidity, noncondensing (wet bulb temp. not to exceed 29°C (84°F))
Nonoperating:	5% to 95% relative humidity, noncondensing (wet bulb temp. not to exceed 29°C (84°F))

VIBRATION

Operating:
(See figure 2-1)

Random vibration with power spectral density (PSD) of $0.000025 \text{ g}^2/\text{Hz}$ from 5 to 10 Hz; 7.5 dB/octave from 10 to 25 Hz; PSD of $0.00025 \text{ g}^2/\text{Hz}$ from 25 to 30 Hz; -24 dB/octave from 30 to 40 Hz; PSD of $0.000025 \text{ g}^2/\text{Hz}$ from 40 to 2000 Hz; -9.3 dB/octave from 2000 to 2500 Hz; PSD of $0.0000125 \text{ g}^2/\text{Hz}$ at 2500 Hz.

Nonoperating:
(See figure 2-2)

Random vibration with power spectral density (PSD) of $0.0005 \text{ g}^2/\text{Hz}$ from 10 to 2000 Hz.

SHOCK

Recommended operating range: <0.5 g

Operating: 1.5 g maximum at 11 ms, half sine waveform

Nonoperating: 20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 4,600 m (15,000 ft)

Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE**Radiated (14 kHz to 1 GHz):**

Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V rms
Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (per IEEE Standard P587.1/F):**Oscillatory wave (100 kHz ringing wave):**

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 20 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1 kV (open circuit voltage)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltages (true rms):

115 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5-66 Hz

Maximum Power: 115 V setting; 207 VA (90 V, 60 Hz)
230 V setting; 234 VA (200 V, 50 Hz)

Typical Power: 115 V setting; 173 VA (115 V, 60 Hz)
230 V setting; 184 VA (230 V, 50 Hz)

Maximum Current: 115 V setting; 2.3 A (true rms at 90 V, 60 Hz)
(occurs during spin-up) 230 V setting; 1.3 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 1.50 A (true rms at 115 V, 60 Hz)
230 V setting; 0.80 A (true rms at 230 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag:	
Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec
Line Dropout:	Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 7957A and 7958A Disk Drives Specifications

OPERATING SPECIFICATIONS

Note  The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	3.0 ms
Average seek time (including settling):	29 ms
Average rotational delay:	8.3 ms
Average time to transfer 1 kilobyte: (at 853 kilobytes/sec)	1.2 ms
Total average transaction time: (excluding system overhead)	41.5 ms
Disk performance index:	24.1 I/Os per second ¹

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,128	63		
Surface	16,337,664	63,819	1,013	1
HP 7957A	81,688,320	319,095	5,065	5
HP 7958A	130,701,312	510,552	8,104	8

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height	132 mm (5.2 in.)
Width:	325 mm (12.8 in.)
Depth:	285 mm (11.2 in.)

WEIGHT

Net:	
Standard:	9.9 kg (21.8 lb)
Shipping:	
Standard:	12.9 kg (28.5 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	85 W (290 Btu/hr; 73 kcals/hr)
Typical:	65 W (222 Btu/hr; 56 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

A-80 Product Specifications

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 85 W (90 V, 60 Hz) 230 V setting; 85 W (198 V, 50 Hz)
Typical Power:	115 V setting; 65 W (115 V, 60 Hz) 230 V setting; 65 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 1.6 A (true rms at 90 V, 60 Hz) 230 V setting; 1.0 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 0.8 A (true rms at 115 V, 60 Hz) 230 V setting; 0.5 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{wA}):	52 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with IIP systems, the more stringent environmental and performance specifications listed for any single IIP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 45°C (41°F to 113°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	10°C (18°F) per hour

HUMIDITY

Operating:	8% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 29°C (84°F))
Nonoperating:	8% to 90% relative humidity, noncondensing (wet bulb temp. not to exceed 29°C (84°F))

VIBRATION

Operating: (See figure 2-3)	Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.
Nonoperating: (See figure 2-4)	Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.

SHOCK

Recommended operating range:	<0.67 g
Operating:	2 g maximum at 11 ms, half sine waveform
Nonoperating:	20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:	maximum 4,500 m (14,800 ft)
Nonoperating:	maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V rms
Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1 kV (open circuit voltage)

Fast rise time transients:

Recommended operating limit: <500 V (into 50 Ω load)
Operating limit: <1 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS**Voltages (true rms):**

115 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5-66 Hz

Maximum Power: 115 V setting; 184 VA (90 V, 60 Hz)
230 V setting; 230 VA (200 V, 50 Hz)

Typical Power: 115 V setting; 92 VA (115 V, 60 Hz)
230 V setting; 115 VA (230 V, 50 Hz)

Maximum Current: 115 V setting; 1.6 A (true rms at 90 V, 60 Hz)
(occurs during spin-up) 230 V setting; 1.0 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 0.8 A (true rms at 115 V, 60 Hz)
230 V setting; 0.5 A (true rms at 230 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

HP 7957A, 7958A

Line Surge and Sag:

Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec

Line Dropout: Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 7936H/37H, 7936XP/37XP, and 7936FL/37FL Disk Drives Specifications

OPERATING SPECIFICATIONS

Note



The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	31,488	123		
Surface	43,957,248	171,708	1,396	1
HP 7936	307,700,736	1,201,956	9,772	7
HP 7937	571,444,224	2,232,204	18,148	13

PERFORMANCE

	H- MODEL	FL- MODEL	XP- MODEL
Average controller overhead:	<1.0 ms	<1.4 ms	<1.2 ms
Average seek time:	20.5 ms	20.5 ms	20.5 ms
Average rotational delay ($\pm 10\%$):	8.3 ms	8.3 ms	8.3 ms
Average time to transfer 1 kilobyte: (at 1 megabyte/sec)	1.0 ms	0.54 ms	1.0 ms
Controller cache impact ¹ :	0 ms	0 ms	-15.8 ms
Total average transaction time: (excluding system overhead)	30.8 ms	30.74 ms	15.2 ms
Disk performance index: (in I/Os per second ²)	32.5	35.2	66.0

¹ *The reduction in time is due to the reduced number of seeks required for a disk drive with controller cache. The actual performance improvement on a drive will vary, depending on the read hit rate and the read percentage; the listed values are based on a read hit rate of 70% and a read percentage of 70-75%. Hit rate is defined as the number of times the drive finds information in cache divided by the number of times the information is requested from the drive.*

² *Average disk transactions per second. Refers to fundamental disk performance; actual I/O rates are application dependent and must take into account system overhead, the system configuration, and the locality of data on the disk. The read hit rate and the read percentage will also have a significant impact on performance of the XP-model drive.*

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height:	271.6 mm (10.69 in.)
Width:	324.2 mm (12.76 in.)
Depth:	740.7 mm (29.16 in.)

WEIGHT

Net:	
Standard:	56.7 kg (125 lb)
Shipping:	
Standard:	74.4 kg (164 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	350 W (1194 Btu/hr; 300 kcals/hr)
Typical:	320 W (1092 Btu/hr; 275 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):

115 V setting: 100 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)
230V setting: 200 V, 208 V, 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 48 to 52 Hz; 58 to 62 Hz

Maximum Power: 115 V setting; 350 W (120 V, 60 Hz)
230 V setting; 350 W (240 V, 50 Hz)

Typical Power: 115 V setting; 320 W (120 V, 60 Hz)
230 V setting; 320 W (240 V, 50 Hz)

Maximum Current: 115 V setting; 9.5 A (true rms at 90 V, 50 Hz)
(occurs for 9 sec. during spin-up) 230 V setting; 4.5 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 3.6 A (true rms at 90 V, 60 Hz)
115 V setting; 3.35 A (true rms at 100 V, 60 Hz)
115 V setting; 3.05 A (true rms at 120 V, 50 Hz)
115 V setting; 3.0 A (true rms at 120 V, 60 Hz)
230 V setting; 1.65 A (true rms at 180 V, 60 Hz)
230 V setting; 1.6 A (true rms at 200 V, 60 Hz)
230 V setting; 1.5 A (true rms at 208 V, 60 Hz)
230 V setting; 1.5 A (true rms at 220 V, 60 Hz)
230 V setting; 1.5 A (true rms at 240 V, 50 Hz)
230 V setting; 1.5 A (true rms at 240 V, 60 Hz)

Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS
(Measured outside cabinet)

Average sound pressure level (L_{pA}): <55 dB(A)
Sound power level (L_{WA}): <68 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	0°C to 55°C (32°F to 131°F)
Nonoperating range:	-40°C to 70°C (-40°F to 158°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	5% to 95% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	5% to 95% relative humidity, noncondensing

Note



Allow a minimum of 4 hours for temperature/humidity stabilization before operating the product when moving from one climate extreme to another.

VIBRATION

Operating: (See figure 2-3)	Random vibration with power spectral density (PSD) of 0.0001 g ² /Hz from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz in any direction.
Nonoperating: (See figure 2-4)	Random vibration with power spectral density (PSD) of 0.015 g ² /Hz from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of 0.008 g ² /Hz from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; sine vibration acceleration level of 0.5g, 5 to 500 Hz.

SHOCK

Recommended operating range: <0.67 g

Operating: 2 g maximum at 11 ms, half sine waveform.
This product will operate with no operator intervention through a 1-inch tilt drop about any of its base edges on a hard surface.

Nonoperating: This product will survive a 4-inch drop about any of its base edges on a hard surface.

ALTITUDE

Operating: maximum 4,572 m (15,000 ft)
Nonoperating: maximum 15,000 m (49,200 ft)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):
Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):
Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):
Recommended operating limit: <0.5 V rms
Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic: <4 gauss, 47.5 to 198 Hz

Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <1.0 kV (open circuit voltage)
Operating limit: <3.0 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1 kV (open circuit voltage)

Fast rise time transients:

Recommended operating limit: <500 V (into 50 Ω load)
Operating limit: <1.0 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow a minimum of 152 mm (6 in.) in front and behind for adequate air flow.

POWER REQUIREMENTS

Voltages (true rms):

115 V setting: 100 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)
230V setting: 200 V, 208 V, 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

HP 7936H/37H, 7936XP/37XP, 7936FL/37FL

Frequency:	48 to 52 Hz; 58 to 62 Hz
Maximum Power:	115 V setting; 387 VA (120 V, 60 Hz) 230 V setting; 422 VA (240 V, 50 Hz)
Typical Power:	115 V setting; 352 VA (120 V, 60 Hz) 230 V setting; 384 VA (240 V, 50 Hz)
Maximum Current: (occurs for 9 sec during spin-up)	115 V setting; 9.5 A (true rms at 90 V, 50 Hz) 230 V setting; 4.5 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 3.0 A (true rms at 120 V, 60 Hz) 230 V setting; 1.65 A (true rms at 180 V, 60 Hz)
Distortion:	<5% flat-topped harmonic distortion
Line Surge and Sag:	
Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec
Line Dropout:	Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 10 degrees of parallel to the horizon.

HP 19514A Cabinet Specifications

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height:	160 cm (63.0 in.)
Width:	90 cm (35.4 in.)
Depth:	82.5 cm (32.5 in.)

WEIGHT

Net:	
Cabinet:	180.0 kg (397 lb)
PDU:	36.1 kg (79.6 lb)
Disk Drives (8):	455 kg (1003 lb)
 Total:	 671.1 kg (1480 lb)
 Shipping:	
Cabinet and PDU:	262 kg (589 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	2600 W (8874 Btu/hr; 2236 kcals/hr)
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ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

POWER CHARACTERISTICS

Voltage (nominal):	200/208 V, 220/230 V, 240 V \pm 10%
Frequency:	50, 60 Hz \pm 2 Hz
Inrush Current*:	
Transformer inrush:	150 A for 2 ms (264 v)
Power supply inrush:	88 A for 2 cycles (264 v)
Motor spin-up inrush:	33 A for 8 seconds (180 v)
Minimum Steady-State Current*:	9.8 A (200 V, 60 Hz)
(no drives seeking)	9.5 A (208 V, 60 Hz)
	9.1 A (220 V, 60 Hz)
	8.7 A (240 V, 60 Hz)

Maximum Steady-State Current*:	16.0 A (200 V, 60 Hz)
(all drives seeking)	15.4 A (208 V, 60 Hz)
	14.6 A (220 V, 60 Hz)
	13.4 A (240 V, 60 Hz)

*All current measurements reflect a cabinet fully loaded with eight drives.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}): <70 dB(A)

SAFETY

- Compliant to CSA 22.2 No. 220
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 40°C (41°F to 104°F)
Nonoperating range:	-40°C to 70°C (-40°F to 158°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	5% to 95% relative humidity, noncondensing (wet bulb temp. not to exceed 25.6°C (78°F))
Nonoperating:	5% to 95% relative humidity, noncondensing

Note

Allow a minimum of 4 hours for temperature/humidity stabilization before operating the product when moving from one climate extreme to another.

VIBRATION (Vertical Axis Only)

Operating: (See figure 2-3)	Random vibration with power spectral density (PSD) of 0.0001 g ² /Hz from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz (~0.21 g rms), 30 minute duration.
Nonoperating: (See figure 2-4)	Random vibration with power spectral density (PSD) of 0.015 g ² /Hz from 5 to 100 Hz; -6 dB/octave from 100 to 150 Hz; then constant 150 to 350 Hz; -6 dB/octave from 350 to 500 Hz (~1.76 g rms), 10 minute duration.

SHOCK

Recommended operating range:	<0.67 g
Operating:	4 g maximum at 11 ms, half sine waveform
Nonoperating:	20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:	maximum 4,572 m (15,000 ft)
Nonoperating:	maximum 15,240 m (50,000 ft)
Maximum rate of change:	<5,000 ft/minute (1,524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit:	<0.5 V/m
Operating limit:	<3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit:	<1 V rms
Operating limit:	<3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit:	<0.5 V rms
Operating limit:	<1 V rms

Electrostatic Discharge:

Recommended operating limit:	<7.5 kV
Operating limit:	<15 kV

Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<3 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit:

<500 V (open circuit voltage)

Operating limit:

<1 kV (open circuit voltage)

Fast rise time transients:

Recommended operating limit:

<500 V (into 50 Ω load)

Operating limit:

<1 kV (into 50 Ω load)

VENTILATION

The rear of the cabinet must be a minimum of 61 cm (2 ft) from any solid surface to provide adequate ventilation. There are no special air conditioning requirements other than what may be required to maintain the specified temperature.

FLOOR LOADING

The fully loaded cabinet asserts a maximum floor load of 200 lbs per square foot and a maximum point load of 500 lbs. The location of the loaded cabinet should be verified against these numbers to ensure a safe installation.

POWER CORDS

The cabinet power cord and connector requirements are shown in figure A-3.

WALL CIRCUIT BREAKER REQUIREMENTS

When choosing wall circuit breaker for this installation refer to figure A-4. Trip characteristics for the wall circuit breaker and/or power conditioner must meet or exceed the supplied circuit breaker curve shown in figure A-4.

TRANSPORTATION SPECIFICATIONS

The transportation specifications assume that the cabinet is packaged and mounted on a pallet.

Warning



Following installation of the drives, the cabinet may be moved short distances on its casters for proper positioning. However, do not move a loaded cabinet long distances over rough surfaces or down an incline.

Impact:	The package will survive a vertical drop from 30 cm (12 inches) on the flat base. The package will survive four rotational edge drops from 30 cm (12 inches) or up to maximum height before tipover, whichever is less.
Swept Sine Vertical Vibration:	0.5 g (0 to peak) from 5 to 200 to 5 Hz resonant search; 1 octave per minute sweep rate; 5 minute resonant dwell at the package resonance.
Random Vertical Vibration:	Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 200 Hz (~1.57g RMS); 30 minute duration.

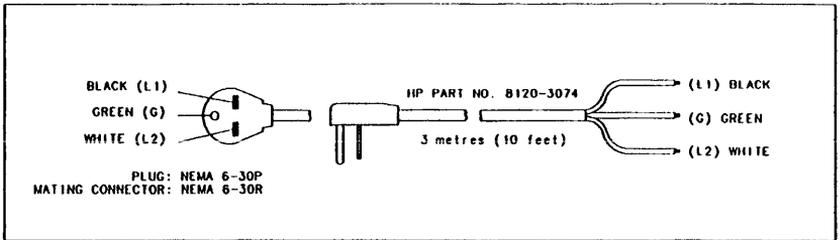


Figure A-3. PDU Power Cord

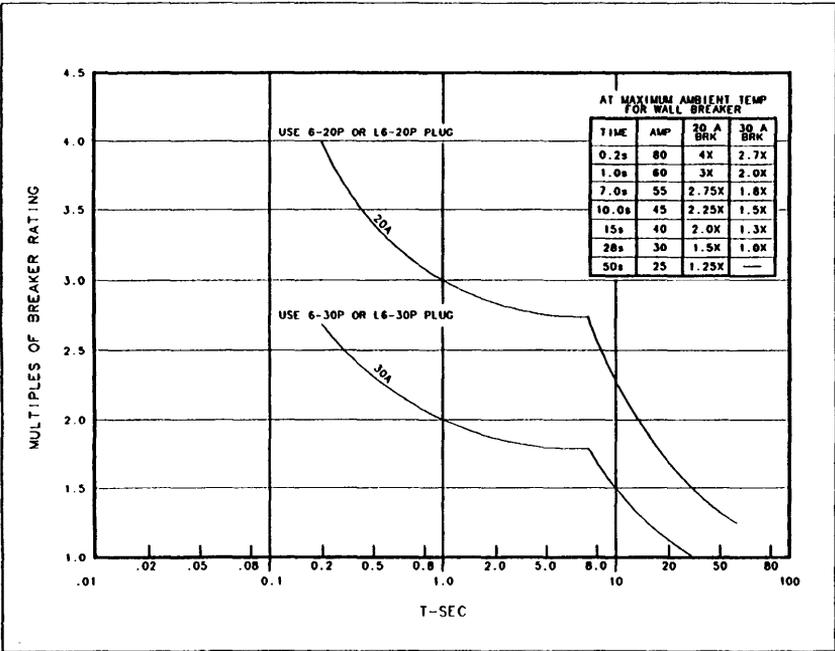


Figure A-4. Wall Breaker Trip Requirements

HP 7957B, 7958B, and 7959B Disk Drives Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	<1.0 ms
Average seek time (including settling):	17 ms
Average rotational delay:	8.96 ms \pm 1%
Average time to transfer 1 kilobyte: (at 700 kilobytes/sec)	1.4 ms
Total average transaction time: (excluding system overhead)	28.36 ms
Disk performance index:	35.3 I/Os per second ¹

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,128	63		
Surface: 7957B	20,466,432	79,947	1,269	1
7958B/59B	25,353,216	99,036	1,572	1
HP 7957B	81,865,728	319,788	5,076	4
HP 7958B	152,119,296	594,216	9,432	6
HP 7959B	304,238,592	1,188,432	18,864	12

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height (with cabinet feet):	132 mm (5.2 in.)
Height (without cabinet feet):	129 mm (5.1 in.)
Width:	325 mm (12.8 in.)
Depth:	285 mm (11.2 in.)

WEIGHT

Net:	
Standard:	10.6 kg (23.2 lb)
Shipping:	
Standard:	13.6 kg (29.9 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	85 W (290 Btu/hr; 73 kcals/hr)
Typical:	65 W (222 Btu/hr; 56 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level F/TZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

HP 7957B, 7958B, 7959B

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 85 W (90 V, 60 Hz) 230 V setting; 85 W (198 V, 50 Hz)
Typical Power:	115 V setting; 65 W (115 V, 60 Hz) 230 V setting; 65 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 1.8 A (true rms at 90 V, 60 Hz) 230 V setting; 1.2 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 1.0 A (true rms at 115 V, 60 Hz) 230 V setting; 0.6 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{wA}):	54 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 154 and CSA 22.2 No. 220
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 45°C (41°F to 113°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

VIBRATION

Operating:
(See figure 2-3)

Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz with no performance degradation beyond 10%, no damage and no operator intervention required.

Nonoperating:
(See figure 2-4)

Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.

SHOCK

Recommended operating range: <1 g

Operating: 4 g maximum at 11 ms, half sine waveform

Nonoperating: 20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 4,572 m (15,000 ft)

Nonoperating: maximum 15,240 m (50,000 ft)

Maximum rate of change: <5,000 ft/minute (1,524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):	
Recommended operating limit:	<0.5 V/m
Operating limit:	<3 V/m
Conducted (30 Hz to 50 kHz):	
Recommended operating limit:	<1 V rms
Operating limit:	<3 V rms
Conducted (50 kHz to 400 MHz):	
Recommended operating limit:	<0.5 V rms
Operating limit:	<1 V rms
Electrostatic Discharge:	
Recommended operating limit:	<5 kV
Operating limit:	<15 kV
Magnetic:	<4 gauss, 47.5 to 198 Hz
Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):	
Oscillatory wave (100 kHz ringing wave):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1.5 kV (open circuit voltage)
Unidirectional wave (one 50 μs wide pulse):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1 kV (open circuit voltage)
Fast rise time transients:	
Recommended operating limit:	<500 V (into 50 Ω load)
Operating limit:	<1 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltages (true rms):

115 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5-66 Hz

Maximum Power: 115 V setting; 184 VA (90 V, 60 Hz)
230 V setting; 230 VA (200 V, 50 Hz)

Typical Power: 115 V setting; 92 VA (115 V, 60 Hz)
230 V setting; 115 VA (230 V, 50 Hz)

Maximum Current: 115 V setting; 1.8 A (true rms at 90 V, 60 Hz)
(occurs during spin-up) 230 V setting; 1.2 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 1.00 A (true rms at 115 V, 60 Hz)
230 V setting; 0.6 A (true rms at 230 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag:	
Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec
Line Dropout:	Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 7957S, 7958S, and 7959S Disk Drives Specifications

OPERATING SPECIFICATIONS

Note  The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	<1.0 ms
Average seek time (including settling):	17 ms
Average rotational delay:	8.96 ms \pm 1%
Average time to transfer 1 kilobyte: (at 700 kilobytes/sec)	1.4 ms
Total average transaction time: (excluding system overhead)	28.36 ms
Disk performance index:	35.3 I/Os per second ¹

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,384	64		
Surface	26,918,912	105,152	1,643	1
HP 7957S	107,675,648	420,608	6,572	4
HP 7958S	161,513,472	630,912	9,858	6
HP 7959S	323,026,944	1,261,824	19,716	12

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height (with cabinet feet):	132 mm (5.2 in.)
Height (without cabinet feet):	129 mm (5.1 in.)
Width:	325 mm (12.8 in.)
Depth:	285 mm (11.2 in.)

WEIGHT

Net:	
Standard:	9.9 kg (21.8 lb)
Shipping:	
Standard:	12.9 kg (28.5 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:	60 W (205 Btu/hr; 52 kcals/hr)
Typical:	45 W (154 Btu/hr; 39 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level F1Z 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):	
115 V setting:	100 V, 115 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

Frequency:	47.5 to 66 Hz
Maximum Power:	115 V setting; 60 W (90 V, 60 Hz) 230 V setting; 60 W (198 V, 50 Hz)
Typical Power:	115 V setting; 45 W (115 V, 60 Hz) 230 V setting; 45 W (230 V, 50 Hz)
Maximum Current: (occurs during spin-up)	115 V setting; 1.0 A (true rms at 90 V, 60 Hz) 230 V setting; 0.6 A (true rms at 180 V, 50 Hz)
Typical Current:	115 V setting; 0.7 A (true rms at 115 V, 60 Hz) 230 V setting; 0.4 A (true rms at 230 V, 50 Hz)
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{wA}):	54 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 154 and CSA 22.2 No. 220
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478
- Meets VDE 0730 Part II

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with IIP systems, the more stringent environmental and performance specifications listed for any single IIP device within the IIP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 45°C (41°F to 113°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

VIBRATION

Operating: (See figure 2-3)	Random vibration with power spectral density (PSD) of 0.0001 g ² /Hz from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of 0.00005 g ² /Hz at 500 Hz with no performance degradation beyond 10%, no damage and no operator intervention required.
Nonoperating: (See figure 2-4)	Random vibration with power spectral density (PSD) of 0.015 g ² /Hz from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of 0.008 g ² /Hz from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of 0.0039 g ² /Hz at 500 Hz.

SHOCK

Recommended operating range:	<1 g
Operating:	2 g maximum at 11 ms, half sine waveform
Nonoperating:	20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:	maximum 4,572 m (15,000 ft)
Nonoperating:	maximum 15,240 m (50,000 ft)
Maximum rate of change:	<5,000 ft/minute (1,524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m

Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms

Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V rms

Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV

Operating limit: <15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: <500 V (open circuit voltage)

Operating limit: <1 kV (open circuit voltage)

Fast rise time transients:

Recommended operating limit: <500 V (into 50 Ω load)

Operating limit: <1 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS**Voltages (true rms):**

115 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5-66 Hz

Maximum Power: 115 V setting; 120 VA (90 V, 60 Hz)
230 V setting; 138 VA (200 V, 50 Hz)

Typical Power: 115 V setting; 80 VA (115 V, 60 Hz)
230 V setting; 92 VA (230 V, 50 Hz)

Maximum Current: 115 V setting; 1.0 A (true rms at 90 V, 60 Hz)
(occurs during spin-up) 230 V setting; 0.6 A (true rms at 180 V, 50 Hz)

Typical Current: 115 V setting; 0.7 A (true rms at 115 V, 60 Hz)
230 V setting; 0.4 A (true rms at 230 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

HP 7957S, 7958S, 7959S

Line Surge and Sag:

Transparent surge: 120% nominal line voltage for 0.5 sec
Recoverable surge/sag: 115 V setting; 70% and 130% typical
(per MIL-T-28800) line voltage for 0.5 sec

Line Dropout: Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 7961B, 7962B, and 7963B Disk Drives Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	<1.0 ms
Average seek time (including settling):	17 ms
Average rotational delay:	8.96 ms \pm 1%
Average time to transfer 1 kilobyte: (at 700 kilobytes/sec)	1.4 ms
Total average transaction time: (excluding system overhead)	28.36 ms
Disk performance index:	35.3 I/Os per second ¹

¹Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,128	63		
Surface: 7961B	20,466,432	79,947	1,269	1
7962B/63B	25,353,216	99,036	1,572	1
HP 7961B	81,865,728	319,788	5,076	4
HP 7962B	152,119,296	594,216	9,432	6
HP 7963B	304,238,592	1,188,432	18,864	12

PHYSICAL CHARACTERISTICS

DIMENSIONS

Height (with cabinet feet):	132 mm (5.2 in.)
Height (without cabinet feet):	129 mm (5.1 in.)
Width:	325 mm (12.8 in.)
Depth:	554 mm (21.8 in.)

WEIGHT

Net:	
Package with one disk mechanism:	14.8 kg (32.7 lb)
Each additional disk mechanism :	3.6 kg (7.9 lb)
Shipping:	
Package with one disk mechanism:	19.1 kg (42.1 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION

Maximum:

One disk mechanism:	73.5 W (251 Btu/hr; 63 kcals/hr)
Two disk mechanisms:	110.3 W (376 Btu/hr; 95 kcals/hr)
Three disk mechanisms:	147 W (502 Btu/hr; 126 kcals/hr)

Typical:

One disk mechanism:	65 W (222 Btu/hr; 56 kcals/hr)
Two disk mechanisms:	88.2 W (300 Btu/hr; 75 kcals/hr)
Three disk mechanisms:	118 W (401 Btu/hr; 100 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):

120 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

240V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 198 V to 264 V)

Frequency: 47.5 to 63 Hz

Maximum Power:

Three disk mechanisms: 120 V setting; 147 W (120 V, 60 Hz)
240 V setting; 145 W (240 V, 50 Hz)

Typical Power:

One disk mechanism: 120 V setting; 65 W (120 V, 60 Hz)
240 V setting; 65 W (240 V, 50 Hz)

Two disk mechanisms: 120 V setting; 88 W (120 V, 60 Hz)
240 V setting; 87 W (240 V, 50 Hz)

Three disk mechanisms: 120 V setting; 118 W (120 V, 60 Hz)
240 V setting; 116 W (240 V, 50 Hz)

Maximum Current: (occurs during spin-up)

Three disk mechanisms: 120 V setting; 2.45 A (true rms at 120 V, 60 Hz)
240 V setting; 1.36 A (true rms at 240 V, 50 Hz)

Typical Current:

One disk mechanism:	120 V setting; 1.00 A (true rms at 120 V, 60 Hz) 240 V setting; 0.60 A (true rms at 240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 1.47 A (true rms at 120 V, 60 Hz) 240 V setting; 0.82 A (true rms at 240 V, 50 Hz)
Three disk mechanisms:	120 V setting; 1.96 A (true rms at 120 V, 60 Hz) 240 V setting; 1.09 A (true rms at 240 V, 50 Hz)

Line Dropout:

No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{wA}):	55 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	5°C to 40°C (41°F to 104°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

VIBRATION

<p>Operating: (See figure 2-3)</p>	<p>Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz with no performance degradation beyond 10%, no damage and no operator intervention required.</p>
<p>Nonoperating: (See figure 2-4)</p>	<p>Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.</p>

SHOCK

<p>Recommended operating range:</p>	<p><1 g</p>
<p>Operating:</p>	<p>2 g maximum at 11 ms, half sine waveform</p>
<p>Nonoperating:</p>	<p>20 g maximum at 11 ms, half sine waveform</p>

ALTITUDE

<p>Operating:</p>	<p>maximum 4 572 m (15,000 ft)</p>
<p>Nonoperating:</p>	<p>maximum 15 240 m (50,000 ft)</p>
<p>Maximum rate of change:</p>	<p><5000 ft/minute (1 524 m/minute)</p>

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m
Operating limit: <3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms
Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: <0.5 V rms
Operating limit: <1 V rms

Electrostatic Discharge:

Recommended operating limit: <5 kV
Operating limit: <15 kV

Magnetic: <4 gauss, 47.5 to 198 Hz

Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: <500 V (open circuit voltage)
Operating limit: <1.5 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: <100 V (open circuit voltage)
Operating limit: <250 V (open circuit voltage)

Fast rise time transients:

Recommended operating limit: <500 V (into 50 Ω load)
Operating limit: <1 kV (into 50 Ω load)

**COOLING
REQUIREMENTS**

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltages (true rms):

120 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

240 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 198 V to 264 V)

Frequency: 47.5-63 Hz

Maximum Power:

Three disk mechanisms: 120 V setting; 251 VA (120 V, 60 Hz)
240 V setting; 266 VA (240 V, 50 Hz)

Typical Power:

Three disk mechanisms: 120 V setting; 200 VA (120 V, 60 Hz)
240 V setting; 215 VA (240 V, 50 Hz)

Maximum Current: (occurs during spin-up)

Three disk mechanisms: 120 V setting; 2.45 A (true rms at 120 V, 60 Hz)
240 V setting; 1.36 A (true rms at 240 V, 50 Hz)

HP 7961B, 7962B, 7963B

Typical Current:

One disk mechanism:	120 V setting; 1.00 A (true rms at 120 V, 60 Hz) 240 V setting; 0.60 A (true rms at 240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 1.47 A (true rms at 120 V, 60 Hz) 240 V setting; 0.82 A (true rms at 240 V, 50 Hz)
Three disk mechanisms:	120 V setting; 1.96 A (true rms at 120 V, 60 Hz) 240 V setting; 1.09 A (true rms at 240 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag:

Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec

Line Dropout: Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP 9262B and 9263B Disk Drives Specifications

OPERATING SPECIFICATIONS

Note

The following information stipulates the specifications and characteristics of this product when installed and operated within the limits specified under ENVIRONMENTAL REQUIREMENTS found elsewhere in this section.

PERFORMANCE

Average controller overhead time:	<1.0 ms
Average seek time (including settling):	17 ms
Average rotational delay:	8.96 ms \pm 1%
Average time to transfer 1 kilobyte: (at 700 kilobytes/sec)	1.4 ms
Total average transaction time: (excluding system overhead)	28.36 ms
Disk performance index:	35.3 I/Os per second ¹

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	16,128	63		
Surface	25,353,216	99,036	1,572	1
HP 9262B	152,119,296	594,216	9,432	6
HP 9263B	304,238,592	1,188,432	18,864	12

PHYSICAL CHARACTERISTICS

DIMENSIONS**Cabinet:**

Height (with cabinet feet):	132 mm (5.2 in.)
Height (without cabinet feet):	129 mm (5.1 in.)
Width:	325 mm (12.8 in.)
Depth:	577 mm (22.7 in.)

Disk Mechanism:

Height:	88 mm (3.5 in.)
Width:	151 mm (6.0 in.)
Depth:	272 mm (10.7 in.)

Transit Case:

Height:	178 mm (7.0 in.)
Width:	419 mm (16.5 in.)
Depth:	297 mm (11.7 in.)

WEIGHT**Net:**

Cabinet only:	12.5 kg (27.6 lb)
Cabinet with one disk mechanism:	17.1 kg (37.7 lb)
Cabinet with two disk mechanisms:	21.7 kg (47.8 lb)

Disk mechanism only:	4.6 kg (10.1 lb)
Disk mechanism in transit case:	6.4 kg (14.2 lb)

Shipping:

Cabinet only:	16.8 kg (37.0 lb)
Disk mechanism in transit case:	7.7 kg (17.0 lb)

OPERATING CHARACTERISTICS

HEAT DISSIPATION**Maximum:**

One disk mechanism:	73.5 W (251 Btu/hr; 63 kcals/hr)
Two disk mechanisms:	110.3 W (376 Btu/hr; 95 kcals/hr)

Typical:

One disk mechanism:	65 W (222 Btu/hr; 56 kcals/hr)
Two disk mechanisms:	88.2 W (300 Btu/hr; 75 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices. These products comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating: <5 gauss on all surfaces

POWER CHARACTERISTICS

Voltages (true rms):

120 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)
240V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 198 V to 264 V)
Frequency: 47.5 to 63 Hz

Maximum Power:

One disk mechanism:	120 V setting; 81 W (120 V, 60 Hz) 240 V setting; 81 W (240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 110 W (120 V, 60 Hz) 240 V setting; 108 W (240 V, 50 Hz)

Typical Power:

One disk mechanism:	120 V setting; 65 W (120 V, 60 Hz) 240 V setting; 65 W (240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 88 W (120 V, 60 Hz) 240 V setting; 87 W (240 V, 50 Hz)

Maximum Current: (occurs during spin-up)

One disk mechanism:	120 V setting; 1.25 A (true rms at 120 V, 60 Hz) 240 V setting; 0.75 A (true rms at 240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 1.84 A (true rms at 120 V, 60 Hz) 240 V setting; 1.02 A (true rms at 240 V, 50 Hz)

Typical Current:

One disk mechanism:	120 V setting; 1.00 A (true rms at 120 V, 60 Hz) 240 V setting; 0.60 A (true rms at 240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 1.47 A (true rms at 120 V, 60 Hz) 240 V setting; 0.82 A (true rms at 240 V, 50 Hz)

Line Dropout:

No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{WA}):	< 54 dB(A) (One disk mechanism)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ENVIRONMENTAL REQUIREMENTS

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

- Recommended operating range:** 20°C to 25.5°C (68°F to 78°F)
- Operating range:** 5°C to 40°C (41°F to 104°F)
- Nonoperating range:** -40°C to 65°C (-40°F to 149°F)

- Maximum rate of change:** 20°C (36°F) per hour

HUMIDITY

- Operating:** 8% to 80% relative humidity, noncondensing
- Nonoperating:** 5% to 80% relative humidity, noncondensing

VIBRATION

Operating:
(See figure 2-3) Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz with no performance degradation beyond 10%, no damage and no operator intervention required.

Nonoperating:
(See figure 2-4) Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz.

SHOCK

Recommended operating range: <1 g
Operating: 2 g maximum at 11 ms, half sine waveform
Nonoperating: 20 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating: maximum 4 572 m (15,000 ft)
Nonoperating: maximum 15 240 m (50,000 ft)
Maximum rate of change: <5000 ft/minute (1 524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):	
Recommended operating limit:	<0.5 V/m
Operating limit:	<3 V/m
Conducted (30 Hz to 50 kHz):	
Recommended operating limit:	<1 V rms
Operating limit:	<3 V rms
Conducted (50 kHz to 400 MHz):	
Recommended operating limit:	<0.5 V rms
Operating limit:	<1 V rms
Electrostatic Discharge:	
Recommended operating limit:	<5 kV
Operating limit:	<15 kV
Magnetic:	<4 gauss, 47.5 to 198 Hz
Power line transients (Oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):	
Oscillatory wave (100 kHz ringing wave):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1.5 kV (open circuit voltage)
Unidirectional wave (one 50 μs wide pulse):	
Recommended operating limit:	<100 V (open circuit voltage)
Operating limit:	<250 V (open circuit voltage)
Fast rise time transients:	
Recommended operating limit:	<500 V (into 50 Ω load)
Operating limit:	<1 kV (into 50 Ω load)

**COOLING
REQUIREMENTS**

Allow 76.2 mm (3 in.) in front and behind for adequate air flow

POWER REQUIREMENTS

Voltages (true rms):

120 V setting: 100 V, 115 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

240 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 198 V to 264 V)

Frequency: 47.5-63 Hz

Maximum Power:

One disk mechanism: 120 V setting; 128 VA (120 V, 60 Hz)
240 V setting; 147 VA (240 V, 50 Hz)

Two disk mechanisms: 120 V setting; 188 VA (120 V, 60 Hz)
240 V setting; 200 VA (240 V, 50 Hz)

Typical Power:

One disk mechanism: 120 V setting; 102 VA (120 V, 60 Hz)
240 V setting; 117 VA (240 V, 50 Hz)

Two disk mechanisms: 120 V setting; 151 VA (120 V, 60 Hz)
240 V setting; 160 VA (240 V, 50 Hz)

Maximum Current: (occurs during spin-up)

One disk mechanism: 120 V setting; 1.25 A (true rms at 120 V, 60 Hz)
240 V setting; 0.75 A (true rms at 240 V, 50 Hz)

Two disk mechanisms: 120 V setting; 1.84 A (true rms at 120 V, 60 Hz)
240 V setting; 1.02 A (true rms at 240 V, 50 Hz)

Typical Current:

One disk mechanism:	120 V setting; 1.00 A (true rms at 120 V, 60 Hz) 240 V setting; 0.60 A (true rms at 240 V, 50 Hz)
Two disk mechanisms:	120 V setting; 1.47 A (true rms at 120 V, 60 Hz) 240 V setting; 0.82 A (true rms at 240 V, 50 Hz)

Distortion: <5% flat-topped harmonic distortion

Line Surge and Sag:

Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag: (per MIL-T-28800)	115 V setting; 70% and 130% typical line voltage for 0.5 sec

Line Dropout: Must not exceed 10 ms

TILT

The drive shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

Model 335H, 670H, and 670XP Disk Storage Systems Specifications

Operating Specifications

Note



The following information stipulates product specifications and characteristics when the product is installed and operated within the specified environmental limits.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	28,928	113		
Surface	41,916,672	163,737	1,449	1
335H	335,333,376	1,309,896	11,592	8
670H/670XP	670,666,752	2,619,792	23,184	16

PERFORMANCE

	335H/670H	670XP
Average controller overhead:	1.1 ms	1.4 ms
Average seek time:	17 ms	17 ms
Average rotational delay ($\pm 1\%$):	7.5 ms	7.5 ms
Average time to transfer 1 kilobyte:	1.0 ms	1.0 ms
Average time to transfer 10 kilobytes:	10.0 ms	
Controller cache impact ¹ :	0 ms	-13.4 ms
Total average transaction time:		
(excludes system overhead)		
1 kilobyte:	26.6 ms	13.5 ms
10 kilobyte:	35.6 ms	
Disk performance index (1 kilobyte):	37.6	74.1
Disk performance index (10 kilobytes):	28.1	
(in I/Os per second ²)		

¹The reduction in time is due to the reduced number of seeks required for a disk storage system with controller cache. The actual performance improvement will vary, depending on timing of I/Os and the specific environment. The listed values are based on maximum rates with a typical MPE V read hit rate of 75 percent and a read percentage of 74 percent.

²True I/O rates are application dependent and must take into account system overhead, individual system configuration specifications, and data locality on the disk.

Models 335H, 670H, and 670XP**HP Series 6000**

Data transfer rate: (Megabytes per second)	
Average at full volume:	1.40
Instantaneous:	2.5
Average/track:	1.84
Single-track seek:	3.5 ms
Maximum seek:	32 ms
Head switch:	2.9 ms
Rotational speed:	4,002 rpm ($\pm 1\%$)

Physical Characteristics

DIMENSIONS

Height:	132 mm (5.2 in.)
Width:	325 mm (12.8 in.)
Depth:	570 mm (22.5 in.)

WEIGHT

Net:	14 kg (31 lb)
Shipping:	19.5 kg (43 lb)

Operating Characteristics

HEAT DISSIPATION**Maximum:**

335H, 670H:	90 W (307 Btu/hr; 77 kcals/hr)
670XP:	105 W (359 Btu/hr; 90 kcals/hr)

Typical:

335H, 670H:	60 W (205 Btu/hr; 52 kcals/hr)
670XP:	70 W (239 Btu/hr; 60 kcals/hr)

ELECTROMAGNETIC EMISSIONS**Radiated and conducted interference:**

- For U.S.A., designed to meet 47 CFR, Part 15 of the FCC rules for Class A digital devices.
- For Europe, designed to meet CEM 22.
- For Germany, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS**Voltages (true rms):**

115 V setting:	100 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230 V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5 to 66 Hz

Maximum Power (in watts):

335H, 670H:	115 V setting; 90 W (120 V, 60 Hz) 230 V setting; 90 W (240 V, 50 Hz)
670XP:	115 V setting; 105 W (120 V, 60 Hz) 230 V setting; 105 W (240 V, 50 Hz)

Typical Power (in watts):

335H, 670H:	115 V setting; 60 W (120 V, 60 Hz) 230 V setting; 60 W (240 V, 50 Hz)
670XP:	115 V setting; 70 W (120 V, 60 Hz) 230 V setting; 70 W (240 V, 50 Hz)

Maximum Current (occurs during spin-up):

335H, 670H:	115 V setting; 1.9 A (true rms at 90 V, 60 Hz) 230 V setting; 1.3 A (true rms at 180 V, 50 Hz)
670XP:	115 V setting; 2.0 A (true rms at 90 V, 60 Hz) 230 V setting; 1.4 A (true rms at 180 V, 50 Hz)

Typical Current:

335H, 670H:	115 V setting; 0.96 A (true rms at 90 V, 60 Hz) 230 V setting; 0.52 A (true rms at 180 V, 50 Hz)
670XP:	115 V setting; 1.1 A (true rms at 90 V, 60 Hz) 230 V setting; 0.62 A (true rms at 180 V, 50 Hz)

Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Sound power level (L_{wA}): <56 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 220.
- Meets all applicable safety standards of IEC 950, EN 60950.
- UL listed to UL 478 (Fifth Edition).
- Meets the general approval NS/G/1234/J/100003 requirements.

Environmental Requirements

Note

The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	0°C to 50°C (32°F to 122°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

Note  Allow a minimum of 2 hours for temperature/humidity stabilization before operating the product when moving from one climate extreme to another.

RANDOM VIBRATION

Operating: (See figure 2-3)	Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz with no performance degradation beyond 10 percent, no damage and no operator intervention required.
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Nonoperating: (See figure 2-4)	Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.
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SHOCK

Recommended operating range: <1 g

Operating:

No operator perceivable errors: In horizontal direction, 2 g maximum at 11 ms, half sine waveform. In vertical direction, 1.5 g maximum at 11 ms, half sine waveform.

No data loss or damage: 4 g maximum at 11 ms, half sine waveform

Nonoperating (no damage): 24 g maximum at 11 ms, half sine waveform
20 g maximum at 26 ms, trapezoidal waveform

ALTITUDE

Operating: maximum 3048 m (10,000 ft)
minimum -305 m (-1000 ft)

Nonoperating: maximum 15,240 m (50,000 ft)
minimum -305 m (-1000 ft)

Maximum rate of change: <5,000 ft/minute (1,524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m

Operating limit: <10 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms

Operating limit: <3 V rms

Conducted (50 kHz to 400 MHz):	
Recommended operating limit:	<0.5 V rms
Operating limit:	<1 V rms
Electrostatic Discharge:	
Recommended operating limit:	<5 kV
Operating limit:	
No data loss:	<15 kV
No physical damage:	<25 kV
Magnetic:	<5 gauss, 47.5 to 198 Hz
Power line transients (oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):	
Oscillatory wave (100 kHz ringing wave):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	<1.5 kV, <50 A (open circuit voltage)
Unidirectional wave (one 50 μs wide pulse):	
Recommended operating limit:	<500 V (open circuit voltage)
Operating limit:	
Automatic ranging power supply:	<1 kV, <100 A (open circuit voltage)
Non-automatic ranging power supply:	<250 V, <100 A (open circuit voltage)
Fast rise time transients:	
Recommended operating limit:	<500 V (into 50 Ω load)
Operating limit:	<1.0 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow a minimum of 152 mm (6 in.) in front and behind for adequate air flow.

POWER REQUIREMENTS

Voltages (true rms):

115 V setting:	100 V, 120 V, single phase (inclusive tolerance range is 90 V to 132 V)
230 V setting:	220 V, 240 V, single phase (inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5 to 66 Hz

Maximum Power (in voltamperes):

335H, 670H:	115 V setting; 165 VA (90 V, 60 Hz) 230 V setting; 165 VA (200 V, 50 Hz)
670XP:	115 V setting; 190 VA (90 V, 60 Hz) 230 V setting; 190 VA (200 V, 50 Hz)

Typical Power (in voltamperes):

335H, 670H:	115 V setting; 115 VA (115 V, 60 Hz) 230 V setting; 115 VA (230 V, 50 Hz)
670XP:	115 V setting; 130 VA (115 V, 60 Hz) 230 V setting; 130 VA (230 V, 50 Hz)

Current:	For maximum and typical current values refer to the power characteristics included under Operating Characteristics.
Distortion:	<10 percent flat-topped harmonic distortion
Line Surge and Sag:	
Transparent surge:	Nominal line voltage can deviate ± 20 percent for up to 30 seconds with no damage, loss of data, or operator intervention
Recoverable surge/sag:	Nominal line voltage can deviate ± 30 percent for up to
(per MIL-T-28800)	0.5 second with no damage, loss of data, or operator intervention
Line Dropout:	Must not exceed 20 ms

TILT

The disk storage system shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

Model 670FL and 1.34FL Disk Storage Systems Specifications

Operating Specifications

Note



The following information stipulates product specifications and characteristics when the product is installed and operated within the specified environmental limits.

FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	256			
Track	28,928	113		
Surface	41,916,672	163,737	1,449	1
670FL	670,666,752	2,619,792	23,184	16
1.34FL	1,341,333,504	5,239,584	46,368	32

PERFORMANCE

Average controller overhead:	1.6 ms
Average seek time:	17 ms
Average rotational delay:	7.5 ms
Average time to transfer 1 kilobyte:	0.54 ms
Average time to transfer 10 kilobytes:	5.4 ms

Total average 1 kilobyte transaction time:	26.6 ms
Total average 10 kilobyte transaction time: (excludes system overhead)	31.5 ms

Disk performance index (1 kilobyte):	37.6 I/Os per second ¹
Disk performance index (10 kilobytes):	31.8 I/Os per second
Full pipeline index ² (1 kilobyte):	39.9 I/Os per second
Full pipeline index (10 kilobytes):	33.4 I/Os per second

¹ True I/O rates are application dependent and must take into account system overhead, individual system configuration specifications, and data locality on the disk.

² Pipelining allows the overlapping of transaction processing so controller overhead can be masked on busy disks. The controller overhead in this case is zero.

HP Series 6000**Models 670FL and 1.34FL**

Data transfer rate: (Megabytes per second)	
Average at full volume:	1.40
Instantaneous:	2.5
Average/track:	1.84
Single-track seek:	3.5 ms
Maximum seek:	32 ms
Head switch:	2.9 ms
Rotational speed:	4,002 rpm ($\pm 1\%$)

Physical Characteristics

DIMENSIONS

Height:	132 mm (5.2 in.)
Width:	325 mm (12.8 in.)
Depth:	570 mm (22.5 in.)

WEIGHT

Net:	
670FL:	14 kg (31 lb)
1.34FL:	16.8 kg (37 lb)
Shipping:	
670FL:	19.5 kg (43 lb)
1.34FL:	22.2 kg (49 lb)

Operating Characteristics

HEAT DISSIPATION**Maximum:**

670FL:	135 W (461 Btu/hr; 116 kcals/hr)
1.34FL:	175 W (598 Btu/hr; 151 kcals/hr)

Typical:

670FL:	90 W (307 Btu/hr; 77 kcals/hr)
1.34FL:	115 W (393 Btu/hr; 99 kcals/hr)

ELECTROMAGNETIC EMISSIONS**Radiated and conducted interference:**

- For U.S.A., designed to meet 47 CFR, Part 15 of the FCC rules for Class A digital devices.
- For Europe, designed to meet CSCR 22.
- For Germany, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	<5 gauss on all surfaces

POWER CHARACTERISTICS**Voltages (true rms):**

115 V setting: 100 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5 to 66 Hz

Maximum Power (in watts):

670FL: 115 V setting; 135 W (120 V, 60 Hz)
230 V setting; 135 W (240 V, 50 Hz)

1.34FL: 115 V setting; 175 W (120 V, 60 Hz)
230 V setting; 175 W (240 V, 50 Hz)

Typical Power (in watts):

670FL: 115 V setting; 90 W (120 V, 60 Hz)
230 V setting; 90 W (240 V, 50 Hz)

1.34FL: 115 V setting; 115 W (120 V, 60 Hz)
230 V setting; 115 W (240 V, 50 Hz)

Maximum Current: (occurs during spin-up)

670FL: 115 V setting; 3.58 A (true rms at 90 V, 60 Hz)
230 V setting; 2.12 A (true rms at 180 V, 50 Hz)

1.34FL: 115 V setting; 4.77 A (true rms at 90 V, 60 Hz)
230 V setting; 2.83 A (true rms at 180 V, 50 Hz)

HP Series 6000**Models 670FL and 1,34FL****Typical Current:**

670FL:	115 V setting; 1.17 A (true rms at 115 V, 60 Hz) 230 V setting; 0.65 A (true rms at 230 V, 50 Hz)
1.34FL:	115 V setting; 1.5 A (true rms at 115 V, 60 Hz) 230 V setting; 0.83 A (true rms at 230 V, 50 Hz)

Line Dropout:

No effect on performance; no operator intervention required for dropout equal to or less than 10 ms.

ACOUSTIC EMISSIONS

Sound power level (L_{wA}): <56 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 220.
- Meets all applicable safety standards of IEC 950, EN 60950.
- UL listed to UL 478 (Fifth Edition).
- Meets the general approval NS/G/1234/J/100003 requirements.

Environmental Requirements

Note



The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	0°C to 50°C (32°F to 122°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

Note

Allow a minimum of 2 hours for temperature/humidity stabilization before operating the product when moving from one climate extreme to another.

RANDOM VIBRATION

Operating:
(See figure 2-3)

Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz with no performance degradation beyond 10 percent, no damage and no operator intervention required.

Nonoperating:
(See figure 2-4)

Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz.

SHOCK

Recommended operating range: <1 g

Operating:

No operator perceivable errors: In horizontal direction, 2 g maximum at 11 ms, half sine waveform. In vertical direction, 1.5 g maximum at 11 ms, half sine waveform.

No data loss or damage: 4 g maximum at 11 ms, half sine waveform

Nonoperating (no damage): 24 g maximum at 11 ms, half sine waveform
20 g maximum at 26 ms, trapezoidal waveform

ALTITUDE

Operating: maximum 3048 m (10,000 ft)
minimum -305 m (-1000 ft)

Nonoperating: maximum 15,240 m (50,000 ft)
minimum -305 m (-1000 ft)

Maximum rate of change: <5,000 ft/minute (1,524 m/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: <0.5 V/m

Operating limit: <10 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: <1 V rms

Operating limit: <3 V rms

HP Series 6000**Models 670FL and 1.34FL****Conducted (50 kHz to 400 MHz):****Recommended operating limit:** <0.5 V rms**Operating limit:** <1 V rms**Electrostatic Discharge:****Recommended operating limit:** <5 kV**Operating limit:****No data loss:** <15 kV**No physical damage:** <25 kV**Magnetic:**

<5 gauss, 47.5 to 198 Hz

Power line transients (oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):**Oscillatory wave (100 kHz ringing wave):****Recommended operating limit:** <500 V (open circuit voltage)**Operating limit:** <1.5 kV, <50 A (open circuit voltage)**Unidirectional wave (one 50 μ s wide pulse):****Recommended operating limit:** <500 V (open circuit voltage)**Operating limit:****Automatic ranging power supply:** <1 kV, <100 A (open circuit voltage)**Non-automatic ranging power supply:** <250 V, <100 A (open circuit voltage)**Fast rise time transients:****Recommended operating limit:** <500 V (into 50 Ω load)**Operating limit:** <1.0 kV (into 50 Ω load)

COOLING REQUIREMENTS

Allow a minimum of 152 mm (6 in.) in front and behind for adequate air flow.

POWER REQUIREMENTS**Voltages (true rms):**

115 V setting: 100 V, 120 V, single phase
(inclusive tolerance range is 90 V to 132 V)

230 V setting: 220 V, 240 V, single phase
(inclusive tolerance range is 180 V to 264 V)

Frequency: 47.5 to 66 Hz

Maximum Power (in voltamperes):

670FL: 115 V setting; 322 VA (90 V, 60 Hz)
230 V setting; 382 VA (180 V, 50 Hz)

1.34FL: 115 V setting; 429 VA (90 V, 60 Hz)
230 V setting; 509 VA (180 V, 50 Hz)

Typical Power (in voltamperes):

670FL: 115 V setting; 135 VA (115 V, 60 Hz)
230 V setting; 150 VA (230 V, 50 Hz)

1.34FL: 115 V setting; 173 VA (115 V, 60 Hz)
230 V setting; 191 VA (230 V, 50 Hz)

HP Series 6000**Models 670FL and 1.34FL**

Current:	For maximum and typical current values refer to the power characteristics included under Operating Characteristics.
Distortion:	<10 percent flat-topped harmonic distortion
Line Surge and Sag:	
Transparent surge:	Nominal line voltage can deviate ± 20 percent for up to 30 seconds with no damage, loss of data, or operator intervention
Recoverable surge/sag:	Nominal line voltage can deviate ± 30 percent for up to
(per MIL-T-28800)	0.5 second with no damage, loss of data, or operator intervention
Line Dropout:	Must not exceed 20 ms

TILT

The disk storage system shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

Model 330S and 660S Mass Storage Systems Specifications

Operating Specifications

Note  The following information stipulates product specifications and characteristics when the product is installed and operated within the specified environmental limits.

HARD DISK DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	512			
Track	28,672	56*		
Surface:	41,488,384	81,032	1,447**	1
Model 330S	331,907,072	648,256	11,576	8
Model 660S	663,814,144	1,296,512	23,152	16

* There are 57 physical sectors per track. One is reserved for a spare, 56 are user accessible sectors.

** There are 1,457 physical tracks per surface. Eight are reserved for use as spares, one is used to store defect lists, one is used as a maintenance track, 1,447 are user accessible tracks.

HARD DISK DRIVE PERFORMANCE

Rotational speed:	4,002 rpm \pm 0.05%
Average seek time (including settling):	16.5 ms
Average rotational delay:	7.5 ms \pm 0.5%
Average time to transfer 1 kilobyte:	0.7 ms
Average controller overhead time:	<0.5 ms

Total average transaction time: 25.1 ms

Disk performance index: 39.8 I/Os per second¹

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual host computer system configuration specifications.*

HARD DISK DRIVE TRANSFER RATE

Data transfer rate (synchronous burst):	4.0 Megabytes per second
Data transfer rate (asynchronous burst):	1.5 Megabytes per second

HARD DISK DRIVE FUNCTIONAL CHARACTERISTICS

Average spin-up time
(from start of spin-up to ready for access): 19 seconds

Physical Characteristics

DIMENSIONS

Height:	129 mm (5.1 in.)
Width:	325 mm (12.8 in.)
Depth:	571 mm (22.50 in.)

WEIGHT

Net:	
Package with one hard disk drive:	14.8 kg (32.7 lb)
Each additional SCSI mechanism:	3.6 kg (7.9 lb)
Shipping:	
Package with one hard disk drive:	19.1 kg (42.1 lb)

Operating Characteristics

HEAT DISSIPATION

Maximum:

Three hard disk drives: 147 W (502 Btu/hr; 126 kcals/hr)

Typical:

One hard disk drive: 65 W (222 Btu/hr; 56 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices. These products comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic interference:

Magnetic operating: <5 gauss on all surfaces

Magnetic nonoperating: <2 milligauss at 2 m (7 ft) on all surfaces

POWER CHARACTERISTICS

Note

The power supply in your mass storage system has an automatic ranging power supply, which makes a voltage selector switch and external fuse unnecessary. Automatic ranging power supplies have internal fuses that only fail if the power supply itself malfunctions.

Voltages (true rms):

120 V:	100 V, 115 V, 120 V, single phase
240 V:	220 V, 240 V, single phase
Inclusive Range:	88 V to 268 V

Frequency: 47.5 to 63 Hz (single phase)

Maximum Power:

Three hard disk drives:	120 V; 147 W (120 V, 60 Hz)
	240 V; 145 W (240 V, 50 Hz)

Typical Power:

One hard disk drive:	120 V; 65 W (120 V, 60 Hz)
	240 V; 65 W (240 V, 50 Hz)
Two hard disk drives:	120 V; 88 W (120 V, 60 Hz)
	240 V; 87 W (240 V, 50 Hz)
Three hard disk drives:	120 V; 118 W (120 V, 60 Hz)
	240 V; 116 W (240 V, 50 Hz)

Maximum Current (occurs during spin-up):

Three hard disk drives: 120 V; 2.45 A (true rms at 120 V, 60 Hz)
240 V; 1.36 A (true rms at 240 V, 50 Hz)

Typical Current:

Three hard disk drives: 120 V; 1.96 A (true rms at 120 V, 60 Hz)
240 V; 1.09 A (true rms at 240 V, 50 Hz)

Line Dropout:

No effect on performance; no operator intervention required for dropout equal to or less than 20 ms.

ACOUSTIC EMISSIONS

Average sound pressure level (L_{pA}): 44 dB(A)
Sound power level (one hard disk drive) (L_{wA}): 56 dB(A) maximum

SAFETY

- CSA certified to CSA 22.2 No. 220-M1986.
- Meets all applicable safety standards of IEC 950.
- UL listed to UL 478, 5th edition.
- Complies with DHHS 21 CFR for Class 1 Laser Products.
- Meets the general approval NS/G/1234/J/100003 requirements.

Environmental Requirements

Note



These are the specifications for the mass storage system with a hard disk drive only.

The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	0°C to 45°C (32°F to 113°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)

Maximum rate of change:	20°C (36°F) per hour
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HUMIDITY

Operating:	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

COOLING REQUIREMENTS

Allow 76.2 mm (3 in.) in front and behind for adequate air flow.

VIBRATION

Operating:	Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz at approximately 0.21 g rms.
Nonoperating:	Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz at approximately 209 g rms swept sine from 5 to 500 Hz; 1 octave per minute, 5 minute dwell at 4 resonances per axis 0.5 g (0-peak).

SHOCK

Recommended operating range:	<1 g
Operating:	<2 g maximum at 11 ms, half sine waveform
Nonoperating:	<24 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:	minimum -305 m (-1000 ft) maximum 3 046 m (10,000 ft)
Nonoperating:	minimum -305 m (-1000 ft) maximum 15 240 m (50,000 ft)
Maximum rate of change:	<1 524 m/minute (5000 ft/minute)

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE**Radiated (14 kHz to 1 GHz):**

Recommended operating limit: 0.5 V/m
Operating limit: 3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: 1 V rms
Operating limit: 3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: 0.5 V rms
Operating limit: 1 V rms

Electrostatic Discharge:

Recommended operating limit: 5 kV
Operating limit: 15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):**Oscillatory wave (100 kHz ringing wave):**

Recommended operating limit: 500 V (open circuit voltage)
Operating limit: 3.0 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: 100 V (open circuit voltage)
Operating limit: 250 V (open circuit voltage)

Fast rise time transients:

Recommended operating limit: 500 V (into 50 ohm load)
Operating limit: 1 kV (into 50 ohm load)

POWER REQUIREMENTS

Note

The power supply in your mass storage system has an automatic ranging power supply, which makes a voltage selector switch and external fuse unnecessary. Automatic ranging power supplies have internal fuses that only fail if the power supply itself malfunctions.

Voltages (true rms):

120 V: 100 V, 115 V, 120 V, single phase
240 V: 220 V, 240 V, single phase
Inclusive Range: 88 V to 268 V

Frequency: 47.5 to 63 Hz (single phase)

Maximum Power:

Three hard disk drives: 120 V; 147 VA (120 V, 60 Hz)
240 V; 145 VA (240 V, 50 Hz)

Typical Power:

Three hard disk drives: 120 V; 118 VA (120 V, 60 Hz)
240 V; 116 VA (240 V, 50 Hz)

Maximum Current (occurs during spin-up):

Three hard disk drives: 120 V; 2.45 A (true rms at 120 V, 60 Hz)
240 V; 1.36 A (true rms at 240 V, 50 Hz)

Typical Current:

Three hard disk drives: 120 V; 1.96 A (true rms at 120 V, 60 Hz)
240 V; 1.09 A (true rms at 240 V, 50 Hz)

Distortion:

<10% flat-topped harmonic distortion

Line Surge and Sag:

Transparent surge: 120% nominal line voltage for 0.5 sec
Recoverable surge/sag: 120 V; 70% and 125% typical line voltage for 0.5 second (per MIL-T-28800)

Line Dropout:

Must not exceed 20 ms

TILT

The mass storage system shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP C226XA-Series Network Mass Storage Systems Specifications

Note  These specifications apply when the storage system is operated with its supported accessory devices. To ensure the product meets its regulatory and safety specifications, the use of foreign SCSI devices is not recommended.

Physical Characteristics

DIMENSIONS

Height:	370 mm (14.6 in.)
Width:	191 mm (7.5 in.)
Depth:	387 mm (15.25 in.)

WEIGHT

Net:	
Cabinet only:	12.9 kg (28.5 lb)
Each hard disk drive:	3.2 kg (7 lb)
Each DAT drive:	2.5 kg (5.5 lb)
Shipping:	
Cabinet package:	20 kg (44 lb)
Each hard disk drive:	5.5 kg (12 lb)
Each DAT drive:	5 kg (11 lb)

Operating Characteristics

HEAT DISSIPATION

Maximum:

Cabinet only:	30 W (102 Btu/hr; 26 kcals/hr)
Each hard disk drive:	60 W (205 Btu/hr; 52 kcals/hr)
Each DAT drive:	20 W (68 Btu/hr; 17 kcals/hr)

Typical:

Cabinet only:	30 W (102 Btu/hr; 26 kcals/hr)
Each hard disk drive:	40 W (136 Btu/hr; 34 kcals/hr)
Each DAT drive:	20 W (68 Btu/hr; 17 kcals/hr)

ELECTROMAGNETIC EMISSIONS

Radiated and conducted interference:

- For U.S.A., this equipment has been type tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Magnetic interference:

Magnetic operating:	<5 gauss on all surfaces
Magnetic nonoperating:	<2 milligauss at 2 m (7 ft) on all surfaces

POWER CHARACTERISTICS

Note

The power supply in your storage system has an automatic ranging power supply which adjusts itself to the input line voltage.



Voltages (true rms):

120 V:	100 V, 115 V, 120 V, single phase
240 V:	220 V, 240 V, single phase
Inclusive Ranges:	88 V to 135 V, 180 V to 269 V

Frequency: 47.5 to 63 Hz (single phase)

Maximum Power:

Cabinet only: 120 V; 30 W (120 V, 60 Hz)
240 V; 30 W (240 V, 50 Hz)

Each hard disk: 120 V; 60 W (120 V, 60 Hz)
240 V; 60 W (240 V, 50 Hz)

Each DAT: 120 V; 20 W (120 V, 60 Hz)
240 V; 20 W (240 V, 50 Hz)

Typical Power:

Cabinet only: 120 V; 30 W (120 V, 60 Hz)
240 V; 30 W (240 V, 50 Hz)

Each hard disk: 120 V; 40 W (120 V, 60 Hz)
240 V; 40 W (240 V, 50 Hz)

Each DAT: 120 V; 20 W (120 V, 60 Hz)
240 V; 20 W (240 V, 50 Hz)

C226XA-Series Network Mass Storage Systems

Maximum Current:

Cabinet only: 120 V; 0.5 A (true rms at 120 V, 60 Hz)
240 V; 0.3 A (true rms at 240 V, 50 Hz)

Each hard disk: 120 V; 0.7 A (true rms at 120 V, 60 Hz)
240 V; 0.3 A (true rms at 240 V, 50 Hz)

Each DAT: 120 V; 0.3 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Typical Current:

Cabinet only: 120 V; 0.5 A (true rms at 120 V, 60 Hz)
240 V; 0.3 A (true rms at 240 V, 50 Hz)

Each hard disk: 120 V; 0.5 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Each DAT: 120 V; 0.3 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Line Dropout:

No effect on performance; no operator intervention required for dropout equal to or less than 20 ms.

C226XA-Series Network Mass Storage Systems

HBA POWER CHARACTERISTICS

Operating voltage:	+5 V dc (± 0.25 V dc)
Maximum current:	ISA: 2.1 A MCA: 1.6 A

ACOUSTIC EMISSIONS

Typical sound power level (L_{wA}):	
With one hard disk drive	55 dB(A)
With three hard disk drives	57 dB(A)

SAFETY

- CSA certified to CSA 22.2 No. 950-M89.
- Meets all applicable safety standards of IEC 950.
- UL listed to UL 1950, First edition.

Environmental Requirements

Note



These specifications are the general environmental requirements for the network mass storage system, and include the specifications for the hard disk drive. Other individual mass storage devices have environmental requirements that are more stringent than those listed here. Consequently, the exact environmental requirements will be determined by the devices being used. Complete specifications for each device are included in this manual.

The environmental specifications listed herein apply when this product is not connected to a Hewlett-Packard (HP) system. When this product is connected with HP systems, the more stringent environmental and performance specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

The following specifications were type-tested under controlled conditions. Hewlett-Packard maintains an active program of auditing production products to ensure these specifications remain true when products are again tested under the same conditions. The limits of these specifications do not represent the optimum for long, trouble-free operation and are specifically not recommended for maximum customer satisfaction. The recommended conditions are stated separately where appropriate.

C226XA-Series Network Mass Storage Systems

TEMPERATURE

Recommended operating range:	20°C to 25.5°C (68°F to 78°F)
Operating range:	0°C to 50°C (32°F to 122°F)
Nonoperating range:	-40°C to 65°C (-40°F to 149°F)
Maximum rate of change:	20°C (36°F) per hour

HUMIDITY

Operating :	8% to 80% relative humidity, noncondensing
Nonoperating:	5% to 80% relative humidity, noncondensing

COOLING REQUIREMENTS

Allow a minimum of 50 mm (2 in.) in front and behind the cabinet for adequate air flow.

RANDOM VIBRATION

Operating:
(See figure 2-3)

Random vibration with power spectral density (PSD) of $0.0001 \text{ g}^2/\text{Hz}$ from 5 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.00005 \text{ g}^2/\text{Hz}$ at 500 Hz at approximately 0.21 g rms.

Nonoperating:
(See figure 2-4)

Random vibration with power spectral density (PSD) of $0.015 \text{ g}^2/\text{Hz}$ from 5 to 100 Hz; -6 dB/octave from 100 to 137 Hz; PSD of $0.008 \text{ g}^2/\text{Hz}$ from 137 to 350 Hz; -6 dB/octave from 350 to 500 Hz; PSD of $0.0039 \text{ g}^2/\text{Hz}$ at 500 Hz at approximately 209 g rms swept sine from 5 to 500 Hz; 1 octave per minute, 5 minute dwell at 4 resonances per axis 0.5 g (0-peak).

SHOCK

Recommended operating range:
Operating (no data loss):
Nonoperating:

<1 g
3 g maximum at 11 ms, half sine waveform
24 g maximum at 11 ms, half sine waveform

ALTITUDE

Operating:

minimum -305 m (-1000 ft)
maximum 3 048 m (10,000 ft)

Nonoperating:

minimum -305 m (-1000 ft)
maximum 15 240 m (50,000 ft)

Maximum rate of change:

<1,524 m/minute (5000 ft/minute)

C226XA-Series Network Mass Storage Systems

ELECTROMAGNETIC SUSCEPTIBILITY OPERATING RANGE

Radiated (14 kHz to 1 GHz):

Recommended operating limit: 0.5 V/m
Operating limit: 3 V/m

Conducted (30 Hz to 50 kHz):

Recommended operating limit: 1 V rms
Operating limit: 3 V rms

Conducted (50 kHz to 400 MHz):

Recommended operating limit: 0.5 V rms
Operating limit: 1 V rms

Electrostatic Discharge:

Recommended operating limit: 5 kV
Operating limit: 15 kV

Magnetic:

<4 gauss, 47.5 to 198 Hz

Power line transients (oscillatory wave and unidirectional wave tests per IEEE Standard P587.1/F):

Oscillatory wave (100 kHz ringing wave):

Recommended operating limit: 500 V (open circuit voltage)
Operating limit: 3.0 kV (open circuit voltage)

Unidirectional wave (one 50 μ s wide pulse):

Recommended operating limit: 100 V (open circuit voltage)
Operating limit: 250 V (open circuit voltage)

Fast rise time transients:

Recommended operating limit: 500 V (into 50 ohm load)
Operating limit: 1 kV (into 50 ohm load)

POWER REQUIREMENTS

Voltages (true rms):	
120 V:	100 V, 115 V, 120 V, single phase
240 V:	220 V, 240 V, single phase
Inclusive Ranges:	88 V to 135 V, 180 V to 269 V
Frequency:	47.5 to 63 Hz (single phase)
Power:	For maximum and typical power values refer to the power characteristics included under Operating Characteristics.
Current:	For maximum and typical current values refer to the power characteristics included under Operating Characteristics.
Distortion:	<10% flat-topped harmonic distortion
Line Surge and Sag:	
Transparent surge:	120% nominal line voltage for 0.5 sec
Recoverable surge/sag:	120 V; 70% and 125% typical line voltage for 0.5 second (per MIL-T-28800)
Line Dropout:	Must not exceed 20 ms

TILT

The product shall meet all performance specifications when mounted in an upright orientation which maintains the horizontal plane of the device to within ± 15 degrees of parallel to the horizon.

HP C222XA-Series Hard Disk Drives Specifications

Note



The following specifications apply when this product is installed and operated within the environmental limits specified in the *HP Network Mass Storage System User's Manual*, part number C2261-90901.

Operating Specifications

HARD DISK DRIVE PERFORMANCE

	C2220A/C2221A	C2222A
Rotational speed ($\pm 0.05\%$):	4,002 rpm	4,002 rpm
Average seek time:	16.5 ms	17.5 ms
Average rotational delay ($\pm 0.5\%$):	7.5 ms	7.5 ms
Average time to transfer 1 kilobyte:	0.7 ms	0.7 ms
Average controller overhead time:	~1 ms	~1 ms
Total average transaction time:	26 ms	27 ms
Disk performance index: (in I/Os per second ¹)	38.5	37

¹ *Maximum disk transactions per second, for 1 kilobyte transfers, less system overhead. Refers to fundamental disk performance; true I/O rates are application dependent and must take into account system overhead, including the individual host computer system configuration specifications.*

HARD DISK DRIVE TRANSFER RATE

Data transfer rate (synchronous burst): 5.0 Megabytes per second
 Data transfer rate (asynchronous burst): 1.5 Megabytes per second

HARD DISK DRIVE FUNCTIONAL CHARACTERISTICS

Average spin-up time
 (from start of spin-up to ready for access): 19 seconds

HARD DISK DRIVE FORMATTED CAPACITY

Item	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Sector	512			
Track:				
C2220A/C2221A	28,672	56		
C2222A	32,768	64		
Surface:				
C2220A/C2221A	41,488,384	81,032	1,447	1
C2222A	62,849,024	122,752	1,918	1
C2220A	331,907,072	648,256	11,576	8
C2221A	663,814,144	1,296,512	23,152	16
C2222A	1,005,584,384	1,964,032	30,688	16

C222XA-Series Hard Disk Drives

Operating Characteristics

HEAT DISSIPATION

Maximum: 60 W (205 Btu/hr; 52 kcals/hr)
Typical: 40 W (136 Btu/hr; 34 kcals/hr)

POWER CHARACTERISTICS

Maximum Power: 120 V; 60 W (120 V, 60 Hz)
240 V; 60 W (240 V, 50 Hz)

Typical Power: 120 V; 40 W (120 V, 60 Hz)
240 V; 40 W (240 V, 50 Hz)

Maximum Current: 120 V; 0.7 A (true rms at 120 V, 60 Hz)
240 V; 0.3 A (true rms at 240 V, 50 Hz)

Typical Current: 120 V; 0.5 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Environmental Requirements

Because the hard disk drive is a component of the C226XA-series storage system product, the environmental specifications for the storage system apply to the hard disk drive as well. For a complete list of technical specifications for your storage system, refer to the *HP Network Mass Storage System User's Manual*, part number C2261-90901.

HP C2224A DDS-Format DAT Drive Specifications

Note  The following information stipulates the specifications and characteristics of this product when installed and operated within the specified environmental limits.

Operating Specifications

PERFORMANCE

Data transfer rate (asynchronous)

Maximum sustained:	183 kilobytes per second
Maximum burst:	1.5 megabytes per second

Access time

Average random:	20 seconds ¹
-----------------	-------------------------

¹ *Average random access for any part of a 1.3 gigabyte DDS-format DAT cassette.*

FUNCTIONAL

Load time:	25 seconds (from cassette inserted until ready to perform first command)
Unload time:	10 seconds (wind tape to BOT, unthread, and eject cassette)

MEDIA

Type:	60 meter (120-minute) DDS-format DAT
Format:	helical-scan DDS-format digital audio tape
Data capacity:	1.3 gigabytes
Record size:	512 bytes

C2224A DDS-Format DAT Drive

Operating Characteristics

HEAT DISSIPATION

Maximum: 20 W (68 Btu/hr; 17 kcals/hr)
Typical: 20 W (68 Btu/hr; 17 kcals/hr)

POWER CHARACTERISTICS

Maximum Power: 120 V; 20 W (120 V, 60 Hz)
240 V; 20 W (240 V, 50 Hz)

Typical Power: 120 V; 20 W (120 V, 60 Hz)
240 V; 20 W (240 V, 50 Hz)

Maximum Current: 120 V; 0.3 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Typical Current: 120 V; 0.3 A (true rms at 120 V, 60 Hz)
240 V; 0.2 A (true rms at 240 V, 50 Hz)

Environmental Requirements

Note

Because the DAT drive is a component of the C226XA-series storage system product, most of the environmental specifications for the storage system apply to the DAT drive as well. However, because the DAT drive is a tape device, it has more stringent limits for several of the environmental parameters. The requirements listed here are specific to the DAT drive and are used to supplement the general environmental requirements for the storage system.

For a complete list of technical specifications for your storage system, refer to the *HP Network Mass Storage System User's Manual*, part number C2261-90901.

TEMPERATUREOperating¹:5°C to 40°C (41°F to
104°F)

¹ *DDS-format DAT cassettes should only be used at temperatures between 5°C (40°F) and 45°C (113°F). Also, do not transfer data to or from the cassette if the temperature is changing more than 10°C per hour. However, cassettes can be stored at temperatures down to -40°C (-40°F).*

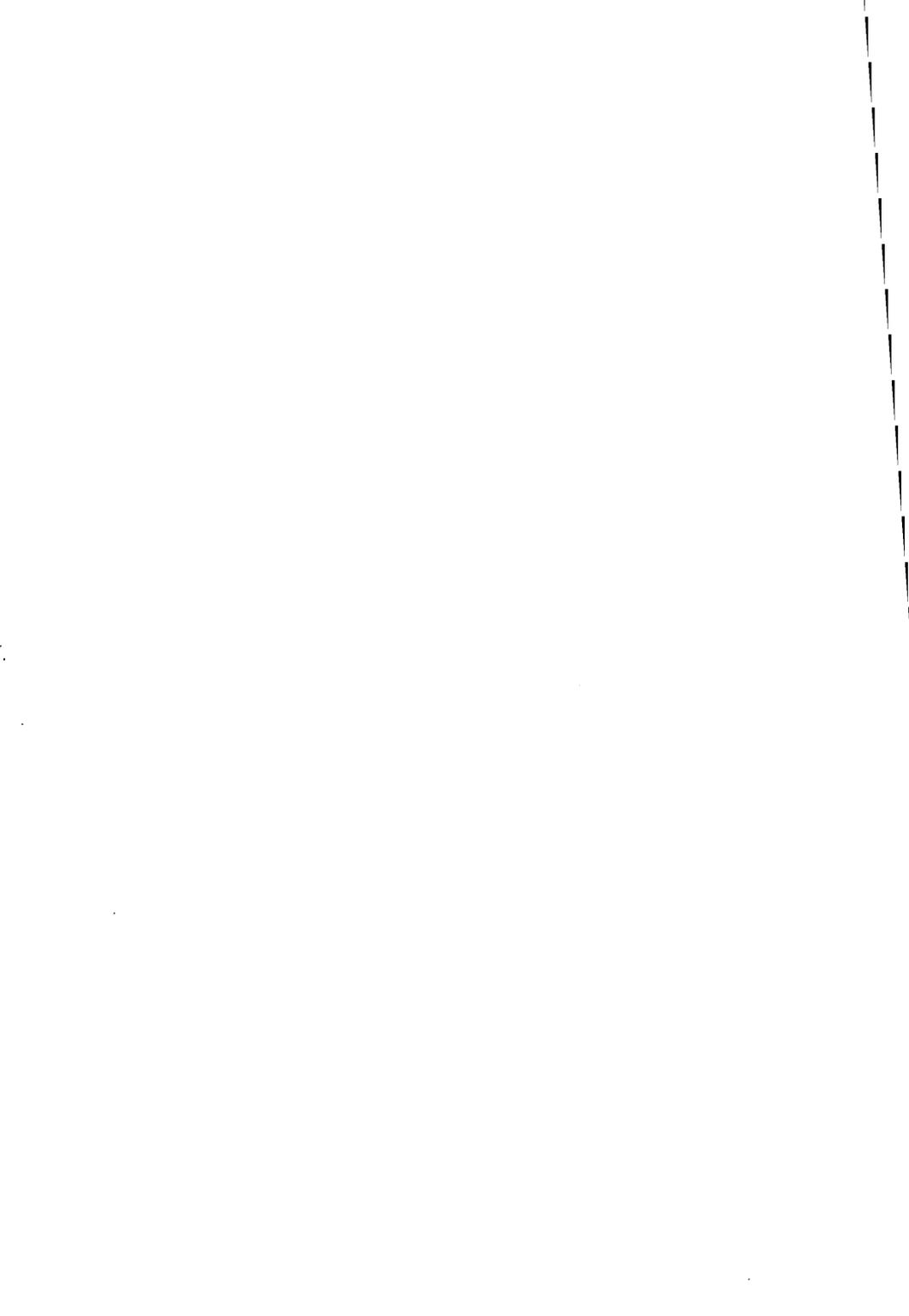
C2224A DDS-Format DAT Drive

ALTITUDE

Operating:	minimum 0 m (0 ft) maximum 4,600 m (15,000 ft)
Nonoperating:	minimum 0 m (0 ft) maximum 15,240 m (50,000 ft)

HUMIDITY

Operating:	20% to 80% RH (noncondensing)
Nonoperating:	5% to 95% RH (noncondensing)
Maximum wetbulb temperature:	26°C (79°F)



Typical Current Usage for Products No Longer In Production

INTRODUCTION

The typical current usage for products no longer in production is listed in Table B-1. These products are not included in Appendix A.

Table B-1. Typical Current For Products No Longer In Production

PRODUCT TYPE	100 V 50Hz/60Hz	120 V 50Hz/60Hz	208 V 50Hz/60Hz	220 V 50Hz/60Hz	240 V 50Hz/60Hz
7906	9.4A/8.7A	8.1A/7.5A	4.3A/4.3A	4.5A/4.2A	2.5A/3.9A
7920	7.7A/8.6A	6.6A/7.5A	3.3A/3.2A	3.7A/4.3A	3.4A/4.0A
7925	8.4A/7.8A	7.2A/6.6A		3.9A/3.8A	3.6A/3.5A

Environmental Requirements for Products No Longer In Production

INTRODUCTION

The environmental requirements for products no longer in production are condensed in Table C-1. These products are not included in Appendix A.

**Table C-1.
Environmental Requirements For Products No Longer In
Production**

	7906	7920	7925	7908	7910
TEMPERATURE					
Recommended limit:	20 - 25.5°C 68 - 78°F				
Operating limit:	10 - 40°C 50 - 104°F	0 - 45°C 50 - 113°F			
HUMIDITY² (%)					
Recommended limit:	NS ¹	NS	NS	NS	NS
Operating limit:	8 - 80	8 - 80	8 - 80	20 - 80	8 - 80
TILT					
Recommended limit:	NS	NS	NS	NS	NS
Operating limit:	± 20°	NS	NS	<30°	NS
SHOCK					
Recommended limit:	<0.5 g	<0.5 g	<0.5 g	<0.67 g	<0.5 g
Operating limit:	NS	NS	NS	1 g	NS
VIBRATION					
Recommended limit:	See below ³	See below ³	See below ³	<0.05 g rms	NS
Operating limit:	NS	NS	NS	<0.1 g rms	NS
AC POWER					
Recommended limit:	See below ⁴	See below ⁴	See below ⁴	NS	NS
Operating limit:	+5%, -10%	+5%, -10%	+5%, -10%	NS	+5%, -10%
EMI⁵					
Recommended limit:	<0.1 V/m	<0.1 V/m	<0.1 V/m	<0.2 V/m	<0.1 V/m
Operating limit:	<0.5 V/m	NS	NS	<1 V/m	NS
ESD					
Recommended limit:	<500 V				
Operating limit:	<12.5 kV	NS	NS	<12.5 kV	NS
¹ NS means Not Specified. ² Humidity is noncondensing. ³ PSD of 0.000004 g ² /Hz from 5 - 2500 Hz. ⁴ AC power daily average not to vary more than ±2% from nominal value. ⁵ EMI denotes radiated susceptibility.					

**C-2 Environmental Requirements for Products
No Longer in Production**

Power Cord Options

Introduction

Refer to the figure D-1 and table D-1 for all power cord options.

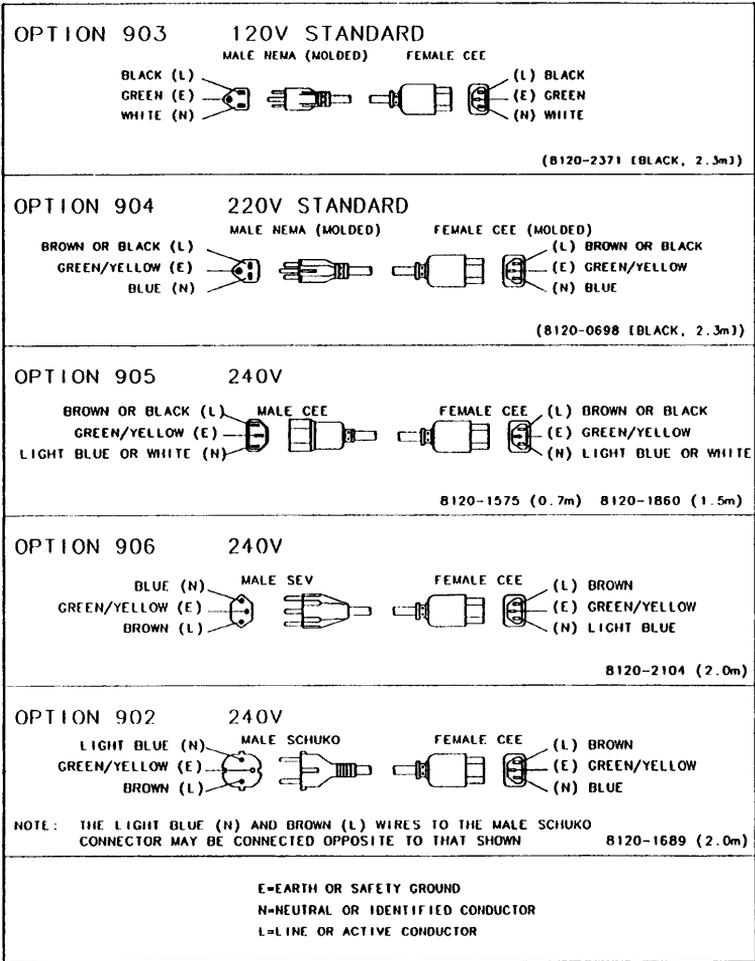


Figure D-1. Power Cord Options

D-2 Power Cord Options

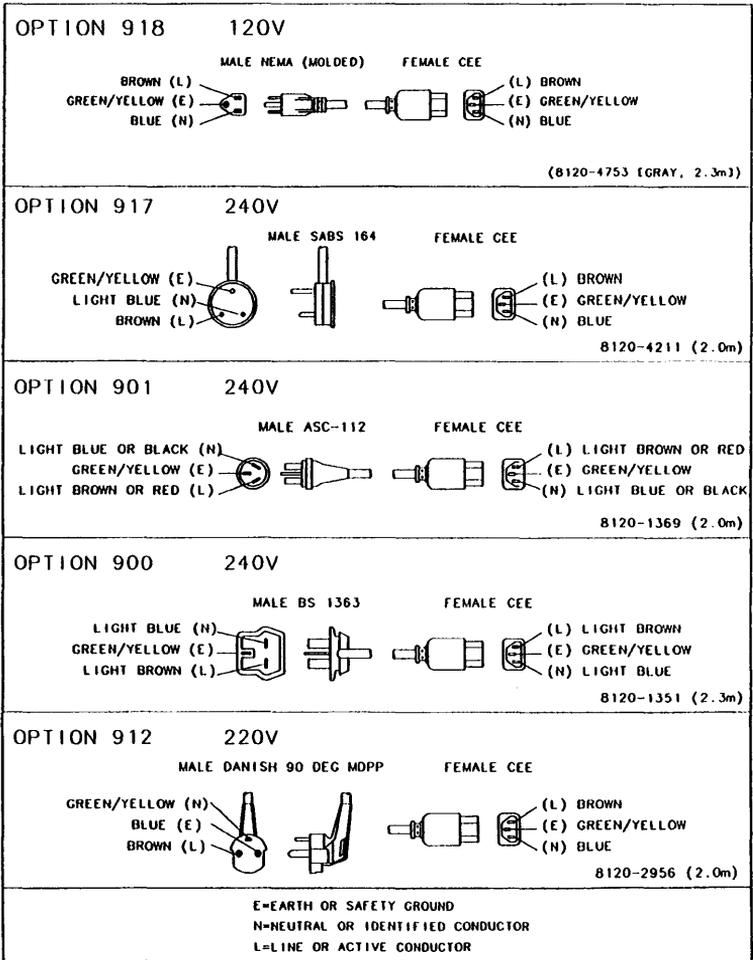


Figure D-1. Power Cord Options (continued)

Table D-1. Power Cord Options By Country

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
531	Afghanistan	902	220	50
481	Albania	902	220	50
721	Algeria	902	220	50
951	American Samoa	903	120	50
762	Angola	902	220	50
357	Argentina	901	220	50
602	Australia	901	240	50
433	Austria	902	220	50
467	Azores	902	220	50
236	Bahamas	903	120	60
525	Bahrain	900	240	50
538	Bangladesh	902	240	50
272	Barbados	900	240	50
423	Belgium	902	220	50
208	Belize (Br. Honduras)	903	120	60
761	Benin (Dahomey)	902	220	50
232	Bermuda	903	120	60
335	Bolivia	902	220	50
793	Botswana	900	240	50
351	Brazil	903	120	60
781	Br. Indian Ocean Terr.	900	240	50
561	Brunei	900	240	50
487	Bulgaria	902	220	50
546	Burma	902	240	50
767	Burundi	902	220	50
243	Caicos	903	120	60
742	Cameroon	902	220	50
122	Canada	903	120	60
733	Canary Islands	902	220	50
941	Canton	900	240	50

D-4 Power Cord Options

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
244	Cayman Island	903	120	60
754	Central African Republic	902	220	50
756	Chad	902	220	50
337	Chile	902	220	50
570	China (Mainland)	901	220	50
583	China (Taiwan)	903	120	60
301	Columbia	903	120	60
789	Comoros	902	220	50
763	Congo (Brazzaville)	902	220	50
223	Costa Rica	903	120	60
239	Cuba	903	120	60
491	Cyprus	900	240	50
435	Czechoslovakia	902	220	50
409	Denmark	912	220	50
777	Djibouti	902	220	50
247	Dominican Republic	903	120	60
331	Ecuador	903	120	60
729	Egypt	902	220	50
211	El Salvador	903	120	60
941	Enderbury Island	900	240	50
738	Equatorial Guinea	900	240	50
447	Estonia	902	220	50
774	Ethiopia	902	220	50
372	Falkland Isl. (Is. Malvinas)	900	240	50
405	Finland	902	220	50
427	France	902	220	50
317	French Guiana	902	220	50
790	French Indian Ocean Areas	902	220	50
641	French Pacific Islands	902	220	50
283	French West Indies	903	120	50

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
755	Gabon	902	220	50
750	The Gambia	900	240	50
512	Gaza Strip	902	220	50
429	Germany, Demo. Rep. (E)	902	220	50
428	Germany, Fed. Rep. (W)	902	220	50
749	Ghana	900	240	50
472	Gibraltar	900	240	50
473	Gozo	902	220	50
484	Greece	902	220	50
101	Greenland	912	220	50
935	Guam	903	120	60
205	Guatemala	903	120	60
746	Guinea	900	240	50
312	Guyana	903	120	60
245	Haiti	903	120	60
215	Honduras	903	120	60
582	Hong Kong	900	220	50
437	Hungary	902	220	50
400	Iceland	902	220	50
533	India	902	240	50
560	Indonesia	902	220	50
507	Iran	902	220	50
505	Iraq	902	220	50
419	Ireland	900	240	50
508	Israel	903	220	50
475	Italy	902	220	50
748	Ivory Coast	902	220	50
241	Jamaica	903	120	50
588	Japan	918	100	50
511	Jordan	902	220	50

D-6 Power Cord Options

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
555	Kampuchea	903	120	50
779	Kenya	900	240	50
580	Korea, Republic of	903	100	60
513	Kuwait	902	240	50
553	Laos	903	220	50
449	Latvia	902	220	50
504	Lebanon	902	240	50
248	Leeward & Windward Isl.	903	120	50
799	Lesotho	900	240	50
765	Liberia	903	120	60
725	Libya	902	240	50
451	Lithuania	902	220	50
423	Luxembourg	902	220	50
566	Macao	900	240	50
759	Madeira Islands	902	220	50
788	Malagasy Republic	902	220	50
797	Malawi	900	240	50
557	Malaysia	900	240	50
745	Mali	902	220	50
473	Malta	902	220	50
741	Mauritania	902	220	50
785	Mauritius	900	240	50
201	Mexico	903	120	60
931	Midway Islands	903	120	60
161	Miquelon	902	220	60
574	Mongolia	902	220	50
714	Morocco	902	220	50
787	Mozambique	902	220	50
792	Namibia	902	240	50

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
536	Nepal	902	240	50
277	Netherlands Antilles	902	220	50
421	Netherlands (Holland)	902	220	50
614	New Zealand	901	220	50
219	Nicaragua	903	220	50
751	Niger	902	240	50
753	Nigeria	900	240	50
579	North Korea	902	100	60
403	Norway	902	220	50
523	Oman	902	240	50
686	Other Pacific Isl.	903	120	60
535	Pakistan	902	240	50
225	Panama	903	120	60
604	Papua New Guinea	901	220	50
353	Paraguay	902	220	50
333	Peru	903	220	60
565	Phillippines	903	120	60
455	Poland	902	220	50
471	Portugal	902	220	50
903	Puerto Rico	903	120	60
518	Qatar	900	240	50
791	Republic of So. Africa	902	240	50
485	Romania	902	220	50
769	Rwanda	902	220	50
758	St. Helena	900	240	50
161	St. Pierre Islands	902	220	60
417	Saudi Arabia	902	220	50
744	Senegal	902	220	50
780	Seychelles	900	240	50
747	Sierra Leone	900	240	50

D-8 Power Cord Options

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES		HP OPTION	VOLTS	HERTZ
	COUNTRY			
559	Singapore	900	240	50
770	Somalia	902	220	50
568	Southern Asia	900	240	50
622	Southern Pacific Isl.	900	240	50
469	Spain	902	220	50
735	Spanish Africa	902	220	50
542	Sri Lanka (Ceylon)	902	240	50
732	Sudan	900	240	50
315	Suriname	903	120	60
795	Swaziland	900	240	50
401	Sweden	902	220	50
441	Switzerland	906	220	50
502	Syria	902	220	50
783	Tanzania	900	240	50
549	Thailand	903	220	50
274	Tobago	903	120	60
752	Togo	902	220	50
274	Trinidad	903	120	60
684	Trust Terr. of Pacific Isl.	903	120	60
723	Tunisia	902	220	50
489	Turkey	902	220	50
243	Turks Isl.	903	120	60
778	Uganda	900	240	50
520	United Arab Emirates	900	240	50
412	United Kingdom	900	240	50
760	Upper Volta	902	220	50
355	Uruguay	901	220	50
000	U.S.A.	903	120	60
461	USSR	902	220	50
307	Venezuela	903	120	60

Table D-1. Power Cord Options By Country (continued)

CTRY. CODES	COUNTRY	HP OPTION	VOLTS	HERTZ
552	Vietnam	903	120	50
911	Virgin Islands	903	120	60
933	Wake Island	903	120	60
764	Western Africa	902	220	50
737	Western Sahara	902	220	50
615	Western Samoa	901	240	50
522	Yemen (Aden)	900	240	50
521	Yemen (Sana)	900	240	50
479	Yugoslavia	902	220	50
766	Zaire	902	220	50
794	Zambia	900	240	50
796	Zimbabwe	900	240	50

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