

## Storage and Related Peripherals

This section presents the PC 98 requirements for storage and related peripherals, including DVD devices. Specific requirements for SCSI, IDE, and ATAPI peripherals are defined in the related chapters in Part 3 of this guide.

For specific information about implementation details related to storage devices under the Windows and Windows NT operating systems, see the articles at <http://www.microsoft.com/hwdev/devdes/>.

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## Storage Peripherals Basic Features

This section summarizes the hardware requirements for storage peripherals. For related acoustical requirements for storage devices, see the “Basic PC 98” chapter in Part 2 of this guide.

### 1. Storage device and controller support bus master capabilities

*Required*

Bus master capabilities must meet the related specification for the particular controller. For example, the programming register set for PCI IDE bus master DMA is defined in SFF 8038i.

Correctly implemented bus master support ensures improved performance and Windows-compatible device driver support.

**Note:** This requirement does not apply to legacy FDCs and will not become a requirement for legacy FDCs.

### 2. Removable media includes media status notification support

*Required*

The following list shows the required specifications for implementing media status notification, depending in device type.

Device type	Media status notification implementation
CD-ROM and DVD-ROM	Required. Comply with all provisions in the Media Event Status Notification subsection of SFF 8090 (Mt. Fuji specification), available at <a href="ftp://fission.dt.wdc.com/pub/standards/SFF/specs/">ftp://fission.dt.wdc.com/pub/standards/SFF/specs/</a> .
Other types of IDE/ATAPI removable storage devices	Required. Comply with <i>Media Status Notification Support, Version 1.03</i> or higher, available at <a href="http://www.microsoft.com/hwdev/specs/">http://www.microsoft.com/hwdev/specs/</a> .
ATAPI floppy drives	Required. Comply with media status notification as defined in SFF 8070.
Other ATAPI devices, including tape drives	Recommended. Comply with SFF 8090 (Mt. Fuji specification) if implemented.
Other types of SCSI removable devices	Not required. Comply with SFF 8090 (Mt. Fuji specification) if implemented.

### 3. Option ROMs support Int 13h Extensions

#### *Required*

The Int 13h Extensions ensure correct support for high-capacity drives, consistent drive-letter mapping between real mode and protected mode, and other capabilities for both Windows and Windows NT. Support for the fixed-disk access subset of Int 13h Extensions must be provided in the system BIOS and in any option ROMs for storage devices that include BIOS support. The Int 13h Extensions are defined in the “Layered Block Device Drivers” section of the Windows 98 DDK and in the Windows NT 5.0 DDK.

### 4. Device meets PC 98 general device requirements

#### *Required*

These include the PC 98 requirements for a Plug and Play device ID, automated software-only settings for device configuration, device drivers and Windows-based installation, and icons for external connectors. For more information, see the “Basic PC 98” chapter in Part 2 of this guide.

### 5. Device meets PC 98 requirements for ports or buses

#### *Required*

The device must meet all requirements for the port or bus to which it is attached. For example, a drive that uses the parallel port must meet all the requirements defined for legacy parallel peripherals (including requirements for ECP mode), as defined in the “I/O Ports and Devices” chapter in Part 4 of this guide. If the device uses a PCI, IDE, or SCSI connection, the device must meet the related requirements defined in Part 3 of this guide.

### 6. Device Bay storage device meets PC 98 requirements

#### *Required*

All Device Bay peripherals must meet the requirements defined in *Device Bay Interface Specification, Version 1.0*. Any storage device designed as a Device Bay peripheral must also interface with either the USB or IEEE 1394 bus, or both, and must support the *Universal Serial Bus Device Class Definition for Mass Storage Devices, Version 1.0* or higher, if it interfaces with USB.

### 7. IDE/ATAPI devices supported on IEEE 1394

#### *Recommended*

For PC 98 systems, IDE/ATAPI device support on IEEE 1394 is recommended. An interface device or dongle that allows all IDE/ATAPI devices to be connected to IEEE 1394 can be included with the system. If IDE/ATAPI support is included, the operating system must be able to boot from this device.

This recommended support is defined in relation to the emerging Device Bay standard. For more information about PC 98 recommendations and requirements for Device Bay, see the “Basic PC 98” chapter in Part 2 of this guide.

**8. IDE/ATAPI devices and controllers support Ultra DMA/33***Required*

Ultra DMA/33 (also known as Ultra-ATA) is required to avoid the bottleneck created by the current 16.6 Mb/s limit on disk transfer. Ultra DMA/33 also provides error checking for improved robustness over previous IDE implementations. This is a requirement for all IDE/ATAPI controllers and devices.

PCI chip sets must implement DMA as defined in SFF 8020i and must implement Ultra DMA/33 as defined in the specification submitted by Quantum Corporation for inclusion in the ATA-4 specification.

**9. USB-based mass storage device meets PC 98 requirements for USB***Required*

If a USB-based mass-storage device (including tape and CD-ROM) is implemented in a PC 98 system, it must meet the requirements defined in the “USB” chapter in Part 3 of this guide. It must also meet the requirements defined in *Universal Serial Bus Device Class Definition for Mass Storage Devices, Version 1.0* or higher.

**10. System BIOS or option ROM supports El Torito No Emulation mode***Required*

For PC systems that include CD-ROM or DVD-ROM devices, the system BIOS or option ROM must support the No Emulation mode defined in the specification *El Torito—Bootable CD-ROM Format Specification, Version 1.0*, published by IBM and Phoenix.

## Floppy Disk Controller

This section describes the specific requirements for any FDC provided with a PC 98 system. The device must also meet the general requirements defined in the “Storage Peripherals Basic Features” section earlier in this chapter and the “PC 98 Design for Storage Components” section later in this chapter.

PC 98 does not require an FDC. Although most systems include some form of floppy disk drive, some Office PC 98 systems might not need one.

**11. Floppy disk capabilities provided through expansion card or external bus***Recommended*

To support migration away from legacy devices, it is recommended that support for floppy disk drives be provided by a solution based on an external bus, such as USB or PC Card, or an expansion card for SCSI or IDE.

**12. IDE floppy drive complies with SFF 8070***Required*

The SFF 8070 specification defines the required implementation supported by the Windows operating system, including support for ATA floptical drives.

**13. Legacy FDC built into system***Optional*

Including a legacy FDC on a PC 98 system is optional. However, if a legacy FDC is included, it must meet the requirements listed in this section.

**14. Legacy FDC device meets resource configuration requirements***Required*

The following resource requirements must be met for each FDC device on the system (not shared among devices of the same type):

- Use static I/O addresses 3F2h, 3F4h, and 3F5h. Additional addresses can be provided in the event of conflict.
- Use IRQ 6.
- Use DMA Channel 2 if FDC supports block data transfers to memory using DMA controllers.

**15. System supports conflict resolution and dynamic disable capabilities for legacy FDC***Required*

The FDC must be capable of being disabled. For example, if the FDC is located on the system board and an adapter card that includes an FDC is added to the system, the system-board FDC must be capable of being disabled to prevent conflicts with the new card. If the FDC is located on an expansion card, the expansion card must allow independent dynamic disabling of the FDC and the hard disk controller. In this case, the adapter will continue to function if the FDC is disabled because of conflicts, and vice versa.

## Hard Disk Drives

This section summarizes specific requirements for hard disk drives. The device must also meet the general requirements defined in the “Storage Peripherals Basic Features” and “PC 98 Design for Storage Components” sections in this chapter.

**Note:** In the “IDE and ATAPI” chapter in Part 3 of this guide, BIOS support is required for an LBA scheme compatible with the BIOS/CMOS and IDE register-set constraints. This enables support for IDE disk drives larger than 528 MB.

**16. IDE hard drive is SMART-compliant and uses SMART IOCTL API***Required*

The Self-Monitoring, Analysis, and Reporting Technology system (SMART) is an industry term used to describe technology that monitors and predicts device performance.

The *SMART IOCTL API Specification, Version 1.1* or higher, published by Compaq Computer Corporation and Microsoft Corporation, describes the API used by an application to issue SMART commands to an IDE drive under Microsoft Windows 98. In Windows, the API is implemented in a vendor-specific driver: Smartvsd.vxd.

For all PC 98 systems, the hard drive must be SMART-compliant.

**17. IDE hard drive spin-up time supports OnNow capabilities***Recommended*

The hard disk drive should spin up and be able to complete a Read operation within 6 seconds of applying power and within 5 seconds of leaving the ATA STANDBY mode and transitioning to ATA ACTIVE, as specified in *Storage Device Class Power Management Reference Specification, Version 1.0* or higher.

This recommendation supports the OnNow design initiative goals for a system that is “instantly” available when power is applied.

## CD-ROM Peripherals

This section summarizes the requirements for CD-ROM peripherals and the specific features for PC 98. The device must also meet the general requirements defined in the “Storage Peripherals Basic Features” and “PC 98 Design for Storage Components” sections in this chapter, including the requirement for bus mastering.

**18. CD-ROM drive provides 8x or higher performance***Required*

The CD-ROM drive must support 1200K per second average throughput or higher performance when running in the fully on power state.

**19. CD-ROM drive is CD-Enhanced compatible***Required*

For PC 98, the CD-ROM drive must be able to mount multisession CD-ROM discs, even if track 1 is Red Book audio. Microsoft recommends use of the Sony ReadTOC method for SCSI-2 multisession support as noted in SFF 8020i, Version 2.5.

CD-Enhanced support must be Blue Book compliant, as defined in *Enhanced Music CD Specification, Version 1.0*.

**20. CD-ROM drive supports specified logical and physical CD formats***Required*

At a minimum, the CD-ROM device must be compatible with the following formats to ensure cross-media compatibility:

- Logical formats: CD Red Book, Yellow Book, White Book, and Blue Book
- Physical formats: CD-ROM and CD-Audio

CD-E and CD-R (Orange Book format) can be implemented; however, there are no PC 98 requirements or recommendations for this format.

**Note:** Any ATAPI CD-ROM drive designed to play back CD-I content must return a minimum of two track entries for the READ\_TOC (0x43) command. These two track entries must be a track 01 entry and a track 0xAA entry for the lead-out address. Drives that do not comply with this minimum requirement cannot play back CD-I movies.

**21. IDE/ATAPI CD-ROM drive complies with SFF 8020i, Version 1.2***Required*

CD-ROM drives attached to the system must support the hardware and protocols documented in *ATA Packet Interface for CD-ROMs, Version 1.2* or higher.

**Note:** For PC 98, support for the READ CD-DA command as defined in SFF 8020i, Version 1.2, is recommended. This might become a requirement in future versions of these guidelines.

For DVD drives, see the “DVD device meets SFF 8090 specification” requirement later in this chapter.

**22. CD-ROM drive supports multisession and compatibility forms of the READ\_TOC command***Required*

Both multisession forms (01b and 10b) as well as the compatibility form (00b) of the READ\_TOC command must be implemented. This ensures complete support for CD-ROM multisession capabilities.

**Note:** Any ATAPI CD-ROM drive designed to play back CD-I content must return a minimum of two track entries for the READ\_TOC (0x43) command. These two track entries must be a track 01 entry and a track 0xAA entry for the lead-out address. Drives that do not comply with this minimum requirement cannot play back CD-I movies.

**23. IDE/ATAPI CD changer meets SFF 8070 specification***Required*

If an ATAPI-compatible CD changer is present that has a capacity for seven or fewer discs, the device must comply with SFF 8070.

## Rewritable ATAPI Devices

This section summarizes specific requirements for optical storage devices. The device must also meet the general requirements defined in the “Storage Peripherals Basic Features” and “PC 98 Design for Storage Components” sections in this chapter.

### **24. ATAPI rewritable device meets SFF 8070i specification**

*Required*

The SFF 8070i specification defines the requirements for ATAPI rewritable devices, including specifications for logical unit number (LUN) implementation, media status notification, and device write protection. This also includes required support for the Read Format Capacities command.

## DVD Devices

This section summarizes specific requirements for DVD devices. The device also must meet the general requirements defined in the “Storage Peripherals Basic Features” and “PC 98 Design for Storage Components” sections in this chapter.

For information about the PC 98 requirements for DVD-Video and MPEG-2 playback performance, see the “Video and Broadcast Components” chapter in Part 4 of this guide.

For more information about DVD support under Windows and Windows NT, see the articles at <http://www.microsoft.com/hwdev/devdes/>.

### **25. DVD drive supports bus master DMA transfers**

*Required*

Hardware decoders must support byte-aligned, multisegment, bus master DMA transfers. The drive must function without corrupting data in DMA mode.

ATAPI DVD drives and IDE system-board implementations must support DMA as specified in SFF 8090 (Mt. Fuji specification). DMA must be enabled by default.

### **26. DVD drive meets minimum compatibility requirements**

*Required*

At a minimum, the DVD device must be compatible with the following formats to ensure that the DVD device can read earlier media:

- Logical formats: CD Red Book, Yellow Book, White Book, and Blue Book
- Physical formats: CD-ROM, CD-Audio, DVD-ROM, and DVD-RAM 1.0

The device must also be able to mount multisession CD-ROM discs, as described in the “CD-ROM drive is CD-Enhanced-compatible” requirement earlier in this chapter. However, there is no DVD drive support for CD-E and CD-R.



## 27. Device and driver support DVD command sets

*Required*

The device and driver must support the command set defined in SFF 8090 (Mt. Fuji specification). Specifically, the device and driver must support the commands in the following list.

Code	Command name	Code	Command name
12h	Inquiry	42h	Read sub-channel
00h	Test unit ready	Beh	Read CD
03h	Request sense	B9h	Read CD MSF
55h	Mode select (10)	45h	Play audio (10)
5Ah	Mode sense (10)	47h	Play audio MSF
BDh	Mechanism status	4Bh	Pause/resume
25h	Read C/DVD capacity	4Eh	Stop play/scan
23h	Read formatted capacities	BAh	Scan
Adh	Read DVD structure	28h	Read (10)
A8h	Read (12)	08h	ATAPI soft reset
A7h	Set read ahead	E5h	Check power mode
1Bh	Start/stop unit	90h	Execute drive diagnostic
1Eh	Prevent/allow medium removal	E1h	Idle immediately
2Bh	Seek	00h	NOP
4Ah	Get event status notification	A0h	ATAPI packet
A4h	Report key	A1h	ATAPI identify device
A3h	Send key	Efh	Set features
43h	Read TOC	E6h	Sleep
44h	Read header	E0h	Standby immediate

## 28. DVD device meets SFF 8090 specification

*Required*

SFF 8090 (Mt. Fuji specification) defines the implementation requirements that the Windows operating system supports. For PC 98, a DVD device must comply with the following portions of SFF 8090:

- Media Event Status Notification
- Power management
- DMA implementation

**29. DVD device uses high-speed expansion bus***Required*

The DVD hardware must use a bus that supports high-speed transfer of multiple data types. Any DVD controller must be capable of sustained rates of 12 Mb/s minimum.

**30. DVD drive supports UDF***Required*

The drive must support UDF as defined in *Universal Disk Format Specification, Version 1.02* or higher, available from the Optical Storage Technology Association at <http://www.osta.org>.

**31. DVD device uses push-to-close design***Recommended*

A motorized design is not required, but if it is implemented, the device must be designed so the user has three options for closing the device when inserting a disc:

- Physically pushing on the bay.
- Physically pushing the close button on the bay housing.
- Selecting a software-supported option to close the device.

**32. DVD device supports defect management***Required*

The drive must support defect management that is transparent to the operating system, according to industry standards. Defect management is defined in *DVD Specification, Book A: Physical Specifications*, published by Toshiba Corporation.

**33. DVD device supports copyright protection***Required*

The drive must support a licensed CSS copyright-protection scheme and support CSS-protected discs to ensure proper protection for all content produced in accordance with CSS, as defined in the DVD specification.

Software is provided as part of the Windows and Windows NT operating system support for DVD in order to facilitate the authentication process required by this scheme. This allows a DVD-ROM drive to authenticate and transfer keys with a CSS decrypter. Windows and Windows NT operating system software will act as the agent to allow either hardware or software decrypters to be authenticated.

For information, see the related articles on DVD support under Windows and Windows NT at <http://www.microsoft.com/hwdev/devdes/>.

## PC 98 Design for Storage Components

This section summarizes requirements related to Plug and Play and other bus-related and resource-related design issues for storage devices.

### Plug and Play and Bus Design for Storage Components

The items in this section are requirements for Plug and Play capabilities.

#### **34. Each device has a Plug and Play device ID**

*Required*

For each device, there must be a device-specific ID. Each device must provide Plug and Play device IDs in the manner required for the bus it uses as defined in Part 3 of this guide. For example, a PCI add-on device must comply with PCI 2.1 requirements and also must provide a Subsystem ID and Subsystem Vendor ID, as defined in the “PCI” chapter in Part 3 of this guide.

#### **35. Conflict resolution and dynamic disable capabilities supported for all devices**

*Required*

To ensure conflict resolution for resource allocation, the device must conform to the Plug and Play specifications for the bus it uses as described in Part 3 of this guide. The system must have a method for automatically disabling or relocating the resources used by the device if conflicts occur when an expansion card is added to the system.

Devices must be capable of being disabled with software settings only, that is, without requiring rebooting or jumper setting changes. Disabling the device must result in freeing all its resources for use by other devices. DIP switches on boot devices can be used for an initial power-on default state or for non-Plug and Play system compatibility, but must be able to be overridden by software configuration after system power up.

The primary hard disk controller is not required to support dynamic disable capabilities.

**Note:** This requirement does not apply to jumper settings used by the OEM to make basic system-related settings in the factory. This requirement applies only to settings that the end user must make to configure the hardware.

**36. 3F7h and 377h are unclaimed by devices***Required*

To avoid having two devices in the system claim 3F7h and 377h, these addresses should not be claimed as resources in device registers, especially by IDE devices.

It is recognized that some FDC devices claim this range. Such devices can be implemented in a PC 98 system; however, the system manufacturer must ensure that only a single device in the system claims this range.

**37. Physical security is provided for storage devices***Consumer PC 98**Office PC 98**Entertainment PC 98**Recommended**Recommended**Recommended*

External drive devices should have locking capabilities. This is recommended for PC 98 systems and required for Net PC hardware. Each removable media device should be capable of being locked to prevent unauthorized access to data. This means that the device is rendered useless, either electronically or mechanically.

## Power Management for Storage Components

This section summarizes specific power management requirements for storage devices.

**38. Device and controller comply with device class power management reference specification***Required*

The *Storage Device Class Power Management Reference Specification, Version 1.0* or higher, provides definitions of the OnNow device power states (D0–D3) for these devices. The specification also covers device functionality expected in each power state and possible wake-up event definitions for the class. Power states D0, D1, and D3 are PC 98 requirements for hard disks, CD-ROM drives, and other mass storage devices. Support for the D1 state is not required for floppy disk devices.

**39. Device supports wake-up events***Optional*

For PC 98, the ability to cause a wake-up event as defined in the *Storage Device Class Power Management Reference Specification, Version 1.0* or higher, is an optional feature.

## Device Drivers and Installation for Storage

This section summarizes the basic requirements for device drivers and installation procedures for storage devices.

### **40. Device drivers and installation meet PC 98 requirements**

*Required*

The manufacturer does not need to supply a driver if a PC 98-compliant driver provided with the operating system can be used. If the manufacturer supplies a driver, the requirements for the device drivers and installation are defined in the “Basic PC 98” chapter in Part 2 of this guide. The basic requirements include driver support for unattended installation and Help file support if special driver parameters are used.

Ease-of-use requirements for installation and configuration are defined for SCSI peripherals and for IDE and ATAPI devices in Part 3 of this guide. For information about WDM support for devices that use a USB or IEEE 1394 bus, see the Windows NT 5.0 DDK. See also the related articles on the web site at <http://www.microsoft.com/hwdev/pcfuture/>.

### **41. Device and file system run in protected mode following installation**

*Required*

The device driver and the file system must be running in 32-bit protected mode (not compatibility mode) immediately following installation.

**Note:** Although it is strongly preferred that a system reboot not be required as part of device installation, it is recognized that installation of boot devices presents a special situation. For PC 98, it is acceptable that installation includes restarting the system during installation of a boot device.

### **42. Applications provided with the device meet Win32 requirements**

*Required*

Any Windows-based applications provided with the device must meet Microsoft requirements for software compatibility as defined in the Win32 SDK. However, any software applications included with the device can be installed using an alternate Windows-based installation method as defined in the Win32 SDK.

### **43. Driver for partitioned media supports all Windows and Windows NT partition types**

*Required*

Device drivers that support partitioned media must support all Windows and Windows NT partition types, which include but are not limited to FAT16, FAT32, NTFS, and UDF.

#### **44. Driver for block-mode device supports extended BPBs**

##### *Required*

Storage subsystems that include an MS-DOS–based block-mode device driver (for example, *Aspidisk.sys*) must support Extended BIOS Parameter Blocks (BPBs) in the Build BPB device driver function call, and must support `category=48` in the generic IOCTL device driver interface calls, as specified in the 1996 update to the Windows DDK.

## Storage References and Resources

This section lists resources for building storage hardware that works with the Windows and Windows NT operating systems.

*ATA-2 [X3T9.2 948D], ATA Packet Interface for CD-ROMs, SFF 8020i,*  
and other SFF Committee publications

<ftp://fission.dt.wdc.com/pub/standards/SFF/specs/>

*Device Bay Interface Specification, Version 1.0*

<http://www.device-bay.org>

Device driver support for storage devices and DVD white papers

<http://www.microsoft.com/hwdev/devdes/>

*DVD Specification, Book A: Physical Specifications, Toshiba Corporation.*

<http://www.toshiba.com>

*El Torito—Bootable CD-ROM Format Specification, Version 1.0*

<http://www.ptltd.com/techs/specs.html>

FAT32 partition device driver support

<http://www.microsoft.com/hwdev/devdes/>

## IDE and SCSI specifications

SFF Committee publications

FaxAccess: (408) 741-1600 (fax-back)

Fax: (408) 867-2115

Global Engineering Documents

Phone: (800) 854-7179 (US)

(613) 237-4250 (Canada)

(303) 792-2181 (Outside North America)

Fax: (303) 397-2740

<ftp://ftp.symbios.com/pub/standards/io/>*Media Status Notification Support Specification, Version 1.03*

Plug and Play specifications

*SMART IOCTL API Specification, Version 1.1*<http://www.microsoft.com/hwdev/specs/>*Multisession Compact Disc Specification**Enhanced Music CD Specification, Version 1.0*

Philips Consumer Electronics B.V.

Coordination Office Optical-Magnetic Media Systems

Building SWA-109, PO Box 80002

5600 JB Eindhoven, The Netherlands

Fax: (31) (40) 732113

Sony/Philips CD-ROM hardware logo program:

Bert Gall, Philips Consumer Electronics

Philips Consumer Electronics B.V.

*Storage Device Class Power Management Reference Specification, Version 1.0*<http://www.microsoft.com/hwdev/onnow.htm>*Universal Disk Format Specification, Version 1.02*<http://www.osta.org>*Universal Serial Bus Device Class Definition for Mass Storage Devices,  
Version 1.0*

Phone: (503) 264-0590

Fax: (503) 693-7975

<http://www.usb.org>

WDM device driver support white papers

<http://www.microsoft.com/hwdev/pcfuture/>

Windows DDK, Windows NT DDK, and Win32 SDK

MSDN Professional membership

(The Windows DDK includes information about the Int 13h Extensions API.)

## Checklist for Storage and Related Peripherals

If a recommended feature is implemented, it must meet the PC 98 requirements for that feature as defined in this document.

<b>Consumer PC 98</b>	<b>Office PC 98</b>	<b>Entertainment PC 98</b>
1. Storage device and controller support bus master capabilities <i>Required</i>		
2. Removable media includes media status notification support <i>Required</i>		
3. Option ROMs support Int 13h Extensions <i>Required</i>		
4. Device meets PC 98 general device requirements <i>Required</i>		
5. Device meets PC 98 requirements for ports or buses <i>Required</i>		
6. Device Bay storage device meets PC 98 requirements <i>Required</i>		
7. IDE/ATAPI devices supported on IEEE 1394 <i>Recommended</i>		
8. IDE/ATAPI devices and controllers support Ultra DMA/33 <i>Required</i>		
9. USB-based mass storage device meets PC 98 requirements for USB <i>Required</i>		
10. System BIOS or option ROM supports El Torito No Emulation mode <i>Required</i>		
11. Floppy disk capabilities provided through expansion card or external bus <i>Recommended</i>		
12. IDE floppy drive complies with SFF 8070 <i>Required</i>		
13. Legacy FDC built into system <i>Optional</i>		
14. Legacy FDC device meets resource configuration requirements <i>Required</i>		
15. System supports conflict resolution and dynamic disable capabilities for legacy FDC <i>Required</i>		
16. IDE hard drive is SMART-compliant and uses SMART IOCTL API <i>Required</i>		
17. IDE hard drive spin-up time supports OnNow capabilities <i>Recommended</i>		
18. CD-ROM drive provides 8x or higher performance <i>Required</i>		



Consumer PC 98	Office PC 98	Entertainment PC 98
19. CD-ROM drive is CD-Enhanced compatible <i>Required</i>		
20. CD-ROM drive supports specified logical and physical CD formats <i>Required</i>		
21. IDE/ATAPI CD-ROM drive complies with SFF 8020i, Version 1.2 <i>Required</i>		
22. CD-ROM drive supports multisession and compatibility forms of the READ_TOC command <i>Required</i>		
23. IDE/ATAPI CD changer meets SFF 8070 specification <i>Required</i>		
24. ATAPI rewritable device meets SFF 8070i specification <i>Required</i>		
25. DVD drive supports bus master DMA transfers <i>Required</i>		
26. DVD drive meets minimum compatibility requirements <i>Required</i>		
27. Device and driver support DVD command sets <i>Required</i>		
28. DVD device meets SFF 8090 specification <i>Required</i>		
29. DVD device uses high-speed expansion bus <i>Required</i>		
30. DVD drive supports UDF <i>Required</i>		
31. DVD device uses push-to-close design <i>Recommended</i>		
32. DVD device supports defect management <i>Required</i>		
33. DVD device supports copyright protection <i>Required</i>		
34. Each device has a Plug and Play device ID <i>Required</i>		
35. Conflict resolution and dynamic disable capabilities supported for all devices <i>Required</i>		
36. 3F7h and 377h are unclaimed by devices <i>Required</i>		
37. Physical security is provided for storage devices <i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>
38. Device and controller comply with device class power management reference specification <i>Required</i>		

<b>Consumer PC 98</b>	<b>Office PC 98</b>	<b>Entertainment PC 98</b>
39. Device supports wake-up events <i>Optional</i>		
40. Device drivers and installation meet PC 98 requirements <i>Required</i>		
41. Device and file system run in protected mode following installation <i>Required</i>		
42. Applications provided with the device meet Win32 requirements <i>Required</i>		
43. Driver for partitioned media supports all Windows and Windows NT partition types <i>Required</i>		
44. Driver for block-mode device supports extended BPBs <i>Required</i>		