Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Technical Reference Manual

WD Purple™ PR1334M

Surveillance Hard Drives

WD40PURX

WD40PURZ

WD40EVRX

Western Digital
3355 Michelson Drive, Suite 100
Irvine, California 92612

2679-800084-A04

Document Control Number Definition:

2679-800xxx-	**Axx-Px**	**NRD**
Doc Control No.	Doc Revision Level	Non-Released Document
	Axx = Released Version	
	Px = Review Cycle	

WD Purple PR1334M

Technical Reference Manual

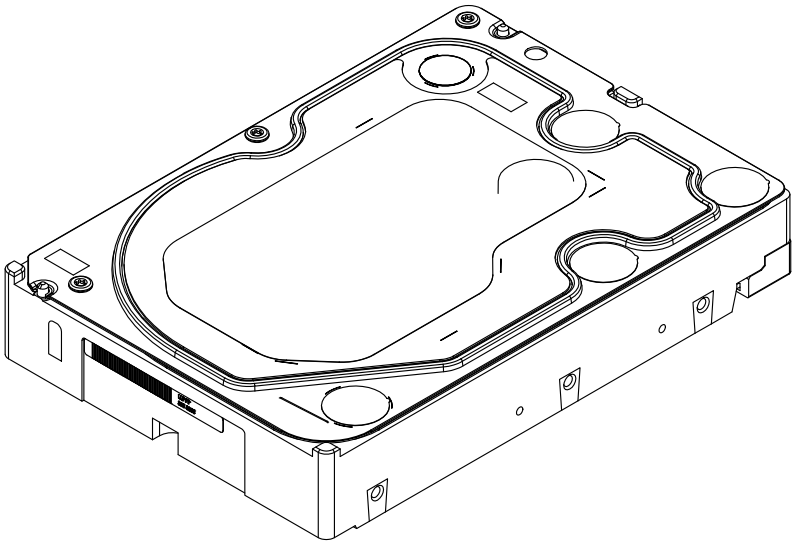


Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 Description and Features

1.1 General Description

WD Purple Surveillance Storage is built for 24/7 always-on surveillance in high-definition security systems that utilize higher hard drive bay counts and up to 64 cameras. Exclusive AllFrame 4K™ technology works with ATA streaming to reduce error pixilation and video interruptions that occur when desktop hard drives are incorrectly used as storage in security systems.

1.2 Product Features

- **Serial ATA (SATA) —** Serial ATA (SATA) is the industry standard bus interface for hard drives. It is designed to replace Parallel ATA, and has many advantages including increased transfer rate, improved signal integrity, enhanced data protection, and hot plug support.
- **AllFrame 4K™ —** All WD Purple™ drives are equipped with AllFrame 4K™ technology, which improves ATA streaming to help reduce frame loss, improve overall video playback, and increase the number of hard drive bays supported within a NVR. Help make your surveillance solution future-ready knowing that WD Purple™ drives are ready for ultra high definition cameras.
- **Premium Protection** – Designed with tarnish-resistant components, this WD Purple drive offers premium protection in harsh environments where surveillance systems may be installed.
- **IntelliSeek™** — Calculates optimum seek speeds to lower power consumption, noise, and vibration.
- **Dynamic Fly Height Control** — Designed to compensate for head/media separation changes due to temperature and altitude. This feature adds video quality margins across temperature and altitude changes.
- **Perpendicular Magnetic Recording (PMR)** — With PMR technology the magnetization of each data bit is aligned vertically to the spinning disk, rather than longitudinally as has been the case in hard drive technology for decades. This enables more data on a given disk than is possible with conventional longitudinal recording, and provides a platform for future expansion of hard drive densities.
- **NoTouch™ Ramp Load Technology** — The recording head never touches the disk media ensuring significantly less wear to the recording head and media as well as better drive protection in transit.
- **Dual Stage Actuator Technology** — A head positioning system with dual-stage actuators that improves positioning accuracy over the data track(s). The primary stage provides course displacement; the secondary stage uses piezo electric motion to fine tune the head positioning to a higher degree of precision.
- **Advanced Format (AF)** — Technology adopted by WD and other drive manufacturers as one of multiple ways to continue growing hard drive capacities. AF is a more efficient media format that enables increased areal densities.
- **Native Command Queuing (NCQ)** — Performance of a random I/O workload can be improved through intelligent re-ordering of the I/O requests so they read/write to and from the nearest available sectors and minimize the need for additional disk revolutions or head actuator movement. This improvement can be achieved though Native Command Queuing (NCQ), which is supported by these hard drives.

- **Pre-emptive Wear Leveling (PWL)** —This WD feature provides a solution for protecting the recording media against mechanical wear. In cases where the drive is so busy with incoming commands that it is forced to stay in a same cylinder position for a long time, the PWL control engine initiates forced seeks so that disk lubricant maintains an even distribution and does not become depleted. This feature ensures reliability for applications that perform a high incidence of read/write operations at the same physical location on the disk.
- **S.M.A.R.T. Command Transport (SCT)** — The SCT Command Transport feature set provides a method for a host to send commands and data to a device and for a device to send data and status to a host using log pages.
- **World Wide Name (WWN)** — The World Wide Name (WWN) defined in ATA/ATAPI-7 is a modification of the IEEE extended unique identifier 64 bit standard (EUI-64) and is comprised of three major components: naming authority, organizationally unique identifier (OUI) and serial number. WD's OUI is 0014EEh.
- **Reliability Features Set-Data Lifeguard™** — Representing WD's ongoing commitment to data protection, Data Lifeguard includes features that enhance the drives ability to prevent data loss. Data Lifeguard data protection utilities include thermal management, an environmental protection system, and embedded error detection and repair features that automatically detect, isolate, and repair problem areas that may develop over the extended use of the hard drive. With these enhanced data reliability features, the drive can perform more accurate monitoring, error repair, and deliver exceptional data security.
- **Hot Plug Support** — SATA supports hot plugging (also known as "hot swapping"), the ability to swap out a failed hard drive without having to power down the system or reboot. This capability contributes to both data availability and serviceability without any associated downtime, making it a critical feature for extending SATA into enterprise applications.
- **Active LED Status** — The drive supports external LED requirements. It provides an activity LED output which is ON during command execution and OFF otherwise.
- **Fluid Dynamic Bearings (FDB) —** Bearing design that incorporates a layer of high-viscosity lubricant instead of ball bearings in the hard drive spindle motor. As an alternative to conventional ball bearing technology, FDB designs provide increased non-operational shock resistance, speed control, and improved acoustics.
- **Staggered Spin-Up —** SATA 3 Gb/s feature that allows the system to control whether the drive will spin up immediately or wait until the interface is fully ready (available for specific OEM configurations).
- **CacheFlow™** —WD's unique, multi-generation caching algorithm evaluates the way data is read from and written to the drive and adapts "on-the-fly" to the optimum read and write caching methods. CacheFlow minimizes disk seek operations and overheads due to rotational latency. CacheFlow supports sequential and random write cache. With write cache and other CacheFlow features, the user can cache both read and write data. The cache can hold multiple writes and collectively write them to the hard disk.
- **48-bit Logical Block Addressing (LBA)** — WD SATA drives support both 48-bit and 28-bit LBA and CHS-based addressing. LBA is included in advanced BIOS and operating system device drivers and ensures high capacity disk integration.

- **Power Management** — The drive supports the ATA and SATA power management command set, allowing the host to reduce the power consumption of the drive by issuing a variety of power management commands.
- **Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.)** — S.M.A.R.T. enables a drives internal status to be monitored through diagnostic commands at the host level and during offline activities. S.M.A.R.T. devices employ data analysis algorithms that are used to predict the likelihood of some near-term degradation or fault conditions. When used with a S.M.A.R.T. application, the drive can alert the host system of a negative reliability status condition. The host system can then warn the user of the impending risk of data loss and recommend an appropriate action.
- **ATA Security** — The drive supports the ATA Security Mode Feature set. The ATA Security Mode feature set allows the user to create a device lock password that prevents unauthorized hard disk access even if the drive is removed from the host computer. The correct password must be supplied to the hard drive in order to access user data. Both the User and Master Password features are supported, along with the High and Maximum security modes. The Master Password Revision code is also supported. This feature varies by drive configuration and may not be available on all configurations.

2.0 Specifications

2.1 Performance Specifications

Performance Class	5400 RPM Class
Data Transfer Rate[1] - Buffer to Host - Host to/from Disk	 6 Gb/s maximum 175 MB/s sustained (typical)
Buffer Size	64 MB
Error Rate - Unrecoverable	<1 in 10^{14} bits read
Spindle Start Time - From Power-on to Drive Ready - From Power-on to Rotational Speed	 14.5s average 9s average
Spindle Stop Time	<15s average
Load/Unload Cycles (controlled unload at ambient condition)	300,000

[1] As used for buffer or cache, one megabyte (MB) = 1,048,576 bytes. As used for transfer rate or interface, megabyte per second (MB/s) = one million bytes per second, and gigabit per second (Gb/s) = one billion bits per second. Effective maximum SATA 6 Gb/s transfer rate calculated according to the Serial ATA specification published by the SATA-IO organization as of the date of this document. Visit www.sata-io.org for details.

2.2 Physical Specifications

Specifications represented are of a typical production drive and may be subject to change or variation without notice.

Physical Specifications[1]	WD40PURX/WD40PURZ/WD40EVRX
Capacity[2]	4 TB
Interface	SATA 6 Gb/s
Number of Disks	3
Data Surfaces	6
Number of Heads	6
Physical bytes per sector	4096
Host bytes per sector	512
User Sectors per Drive	7,814,037,168
Servo Type	Embedded
Recording Method	LDPC Target

[1] Specifications represented are of a typical production drive and may be subject to change or variation without notice.
[2] As used for storage capacity, one megabyte (MB) = one million bytes, one gigabyte (GB) = one billion bytes, and one terabyte (TB) = one trillion bytes. Total accessible capacity varies depending on operating environment. As used for buffer or cache, one megabyte (MB) = 1,048,576 bytes. As used for transfer rate or interface, megabyte per second (MB/s) = one million bytes per second, and gigabit per second (Gb/s) = one billion bits per second. Effective maximum SATA 3 Gb/s transfer rate calculated according to the Serial ATA specification published by the SATA-IO organization as of the date of this document. Visit www.sata-io.org for details.

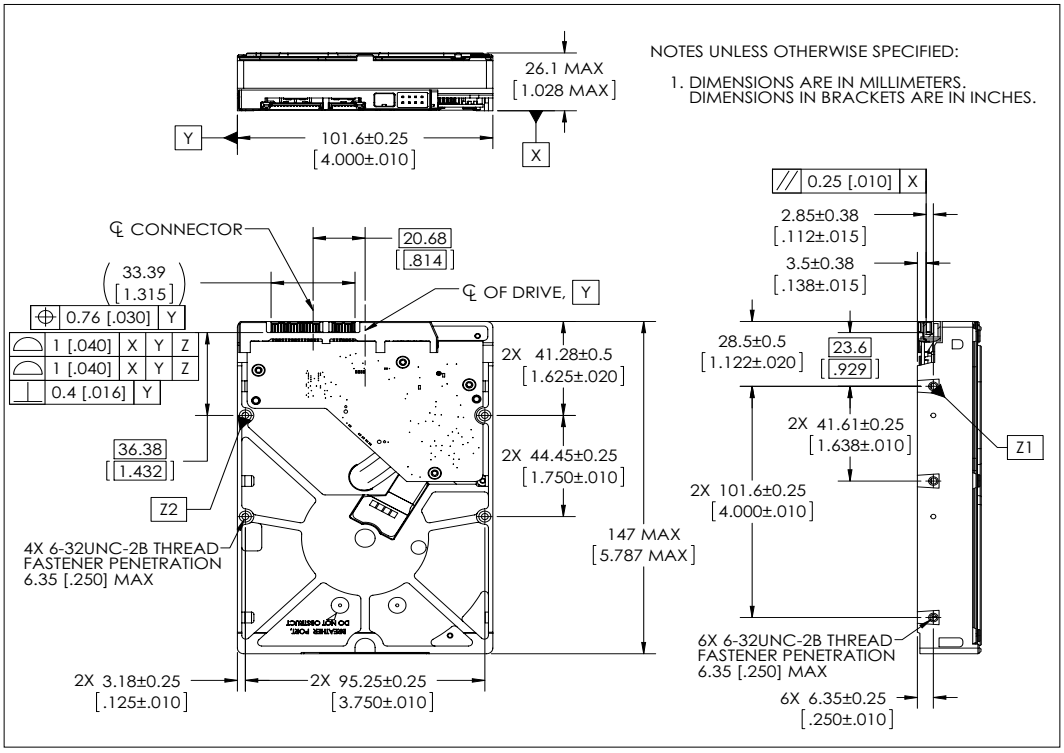
2.2.1 Physical Dimensions

	English		Metric	
	Dimension	**Tolerance**	**Dimension**	**Tolerance**
Height	1.028 inches	MAX	26.1 mm	MAX
Length	5.787 inches	MAX	147.0 mm	MAX
Width	4.00 inches	±0.01 inch	101.6 mm	±0.25 mm
Weight	1.40 pounds	±10%	0.635 kg	±10%

2.3 Mechanical Specifications

Figure 2-1 shows the mounting dimensions and locations of the screw holes for the drive.

Figure 1. Mounting Dimensions



2.4 Electrical Specifications

2.4.1 Current Requirements and Power Dissipation

All values are typical (25°C, 5.0V, and 12V input). 3.3V Serial ATA power not utilized in this product.

Operating Mode	Mean Current		Power, Average
	12 VDC	5 VDC	
Spinup (max)	1.75 A	–	24.5 W
Read/Write	235 mA	335 mA	4.5 W
Seek	260 mA	300 mA	4.6 W

POWER MANAGEMENT COMMANDS			
Operating Mode	Mean Current		Power, Average
	12 VDC	5 VDC	
Idle	230 mA	260 mA	4.1 W
Standby	7 mA	70 mA	0.4 W
Sleep	7 mA	70 mA	0.4 W

2.4.2 Input Voltage Requirements

The input voltage requirements are +5.0V ± 5% and +12.0V ± 10%.

2.4.3 Ripple

	+12 VDC	+5 VDC
Maximum Frequency	200 mV (peak-to-peak) 0-30 MHz	100 mV (peak-to-peak) 0-30 MHz

2.4.4 Power Connectors and Cables

SATA Connectors

For information on SATA data connectors, refer to the Serial ATA 1.0 specification available for download at *www.serialata.org*.

At the time of this printing, there are no published standards for SATA power/mating connectors or power/data cable wire gauges.

Cabling Requirements for SATA

The SATA cable consists of four conductors in two differential pairs. The cable may also include drain wires to be terminated to the ground pins in the SATA cable receptacle connectors. See the SATA 1.0 specification for cable specifications. The cable's maximum length is one meter.

2.5 Environmental Specifications

2.5.1 Shock and Vibration

Table 1. Shock and Vibration

Shock						
Operating	30G, 2 ms (read/write)					
	65G, 2 ms (read)					
Non-operating (2 ms)	250G					
Note: Half-sine wave, measured without shock isolation and without non-recoverable errors.						
Vibration						
Operating	Linear: 20-300 Hz, 0.75G (0 to peak)					
	Random: 0.004 g^2 /Hz (10-300 Hz)					
Non-operating	Linear: 20-500 Hz, 4.0G (0 to peak)					
	Random: 0.05 g^2 /Hz (10-300 Hz)					
Sweep Rate	0.5 octave/minute minimum					
Rotational Vibration						
12.5 rad/sec^2 based on the following PSD profile maintaining < 20% degradation:						
Frequency (Hz)	20	200	300	900	1400	1500
(Rad/sec^2)^2/Hz	0.035	0.035	0.2	0.2	0.002	0.002
Drive Generated Vibration						
Operating	0.2 gm-mm average with the drive in an unconstrained condition					
Rotational Shock Non-Operating						
Amplitude	20K rad/sec^2					
Duration	2 ms					

Operating Vibration

Drives are tested by applying a random excitation in each linear axis, one axis at a time. The drive incurs no physical damage and no hard errors while subjected to continuous vibration not exceeding the level listed in Table 1. Operating performance may degrade during periods of exposure to continuous vibration.

Non-Operating Vibration

Note: This specification applies to handling and transportation of unmounted drives.

Drives are tested by applying a random excitation in each linear axis, one axis at a time. The drive incurs no physical damage when subjected to continuous vibration not exceeding the level listed in Table 1.

Packaged Shock and Vibration

The shipping packaging is designed to meet the National/International Safe Transit Association (N/ISTA) standards for packaged products. The drive incurs no physical damage when subjected to the N/ISTA standards.

2.5.2 Temperature and Humidity

The system environment must allow sufficient air flow to limit maximum surface temperatures as defined. AFR can be affected by workload and operating temperature. See Section 2.6 on page 11 for further details.

Operation	
Min-Max Base Casting Temperature[1]	0°C to 65°C (32°F to 149°F)
Humidity	5-95% RH non-condensing 37.7°C (maximum wet bulb)
Thermal Gradient	20°C/hour (maximum)
Humidity Gradient	20%/hour (maximum)
Non-Operation	
Temperature	-40°C to 70°C (-40°F to 158°F)
Humidity	5-95% RH non-condensing 35°C (maximum wet bulb)
Thermal Gradient	30°C/hour (maximum)
Humidity Gradient	20%/hour (maximum)

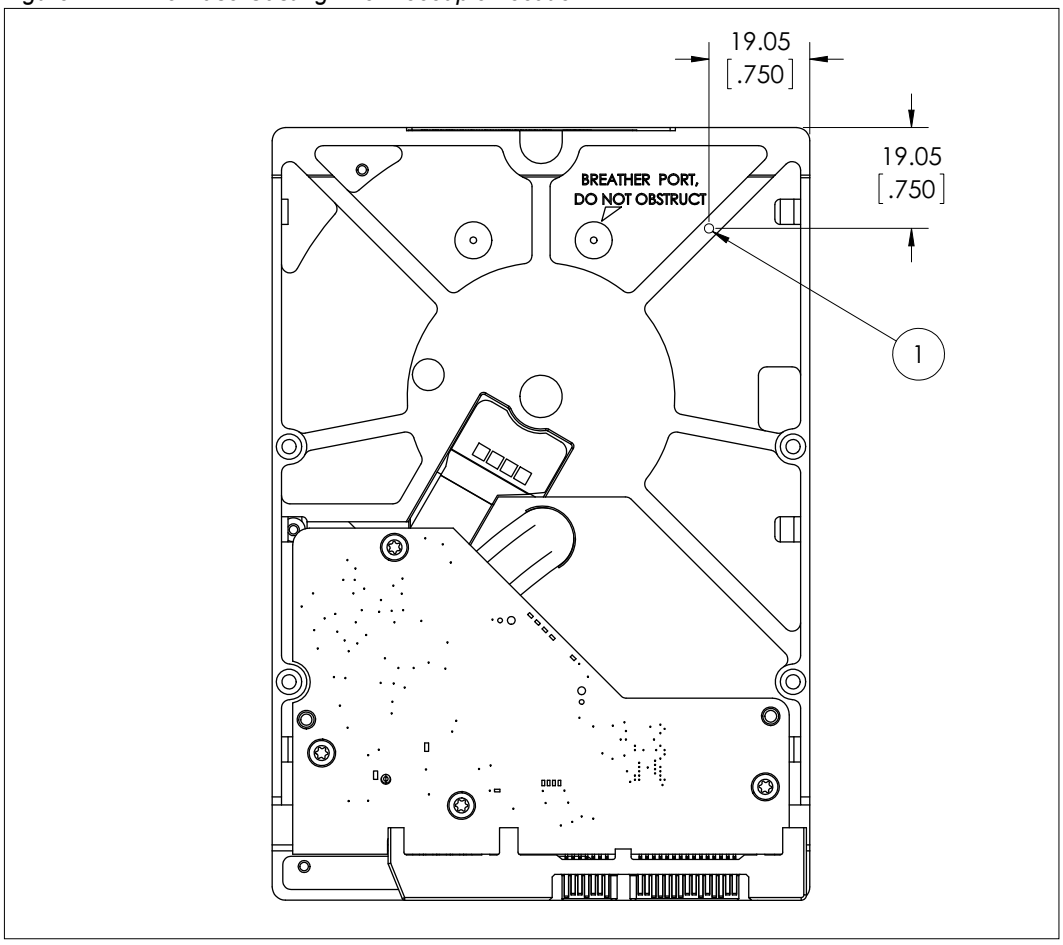
[1] Operating at elevated base casting temperatures will result in a higher AFR. See Section 2.6 on page 11 for further details.

2.5.3 Thermocouple Location

Component	Location
Drive base casting	#1, Figure 2

The system environment must allow sufficient air flow to limit maximum base casting temperatures as defined in Figure 2 below.

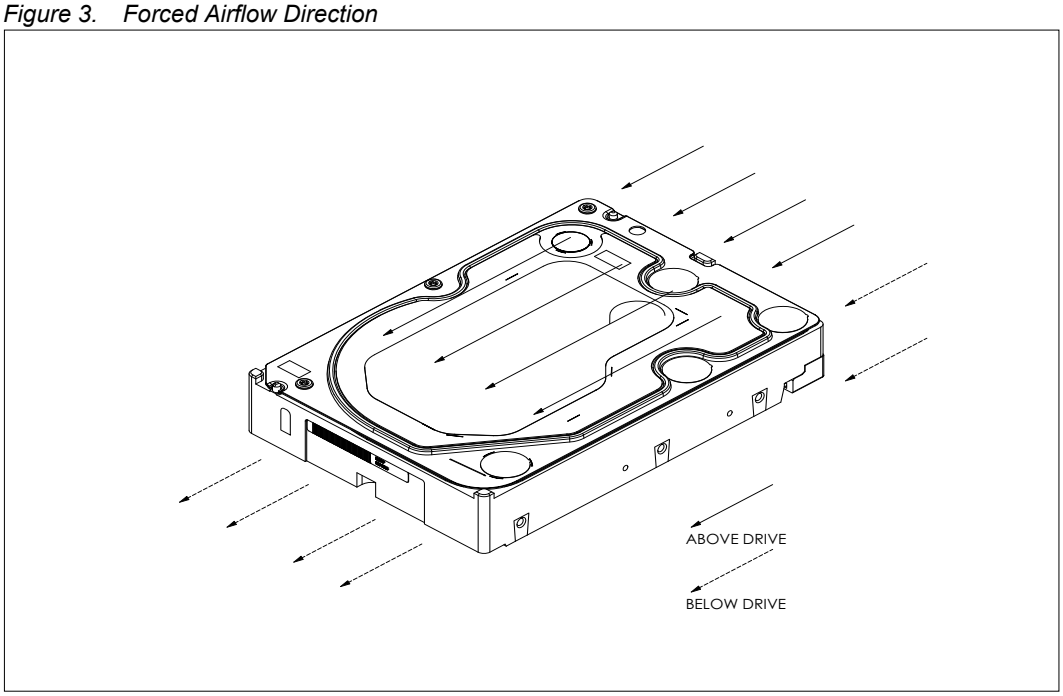
Figure 2. Drive Base Casting Thermocouple Location



2.5.4 Cooling

If forced air cooling is required, the drive must be positioned to receive airflow from one or more fans as indicated in Figure 3.

Figure 3. Forced Airflow Direction



2.5.5 Atmospheric Pressure

Altitude	
Operating	-1,000 feet to 10,000 feet (-305M to 3,050M)
Non-operating	-1,000 feet to 40,000 feet (-305M to 12,200M)

2.5.6 Acoustics

TYPICAL SOUND POWER LEVEL Measured per ECMA-74/ISO 7779	
Idle Mode (average dBA, no audible pure tones)	23
Seek Mode (average dBA)	24

2.5.7 RoHS (Restriction of Hazardous Substances)

WD complies with the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU of the European Parliament, which is effective in the EU beginning July 8, 2011. RoHS aims to protect human health and the environment by restricting the use of certain hazardous substances in new equipment, and consists of restrictions on lead, mercury, cadmium, and other substances.

2.6 Reliability Specifications and Characteristics

The average Annualized Failure Rate (AFR) calculations assumes operation at nominal voltages, a base casting temperature of 40°C, and the workload usage of a typical surveillance environment. Workload is defined as the number of bytes transferred by the user to/from the drive. If the system(s) that the drive is installed in are not capable of meeting the characteristics listed below, please use a WD drive that matches your system(s)' capability. Operating drives outside any of the reliability characteristics listed below will result in a higher AFR.

Reliability Specification	
Average AFR over the Limited Warranty Period	0.88%
Reliability Characteristics	
Base Casting Temperature	40 C
Annual Power on Hours (POH)	<=8760
Annualized Workload Rate[1]	<=180 TB/Year

[1] Annualized Workload Rate = TB transferred x (8760/recorded power-on hours)

2.7 Device Plug Connector Pin Definitions

For information on SATA data connectors, including the pin definitions of the SATA connectors and

the corresponding signal names and signal functions, refer to the latest SATA specification available for

download at *www.serialata.org*.

2.8 Agency Approvals

PR1334M Regulatory Number (R/N): 800055

These drives meet the standards of the following regulatory agencies:

- **Underwriters Laboratories:** Bi-National UL Standard CAN/CSA-C22.2 No. 60950/ UL 60950-1. Standard for Safety of Information Technology Equipment, including Electrical Business Equipment (File E101559).
- **TUV NORD CERT GmbH**: IEC 60950-1 per EN 60950-1, Standard for Safety of Information Technology Equipment, including Electrical Business Equipment. IEC 60065. Standard of Safety for Audio, Video, and Similar Electronic Apparatus.
- **CE Compliance for Europe**: Complies with EN 55022: 2010 RF/ Conducted Emissions and EN 55024: 2010 Immunity requirements. Including EU Directive 2011/ 65/EU RoHS II requirements.
- **RCM Compliance for Australia and New Zealand**: Verified to comply with AS/NZS CISPR 22 for RF Emissions as required by the Australian Communications Authority.
- **Korean KC Mark**: Registered as a Class-B product with the South Korean Ministry of Information and Communication.
- **Taiwan BSMI EMI Certification**: Certified as a Class-B product with the Bureau of Standards Metrology and Inspection (BSMI).

2.9 Full Model Number Specification

Table 4 below provides a summary specification of the model number suffix for this product platform.

Table 4. Full Model Number Description

Model Number Format	ID	Product Brand	Description
WD40PURX-xx**NZ6**Y0	**NZ6**	WD Purple	PR1334M-4TB Surveillance 64 MB SATA 6 Gb/s AF
WD40PURX-xxN96Y0	**N96**	WD Purple	PR1334M-4TB Surveillance 64 MB SATA 6 Gb/s AF
WD40PURZ-xxTTDY0	**TTD**	WD Purple	PR1334M-4TB Surveillance 64 MB SATA 6 Gb/s AF
WD40EVRX-xxB9FY0	**B9F**	WD Purple	PR1334M-4TB Surveillance 64 MB SATA 6 Gb/s AF

3.0 Product Features

- SATA 6 Gb/s
- AllFrame 4k™ Technology
- IntelliSeek™
- Dynamic Fly Height Control
- Perpendicular Magnetic Recording (PMR)
- NoTouch™
- Dual Stage Actuator Technology
- Advanced Format
- Native Command Queuing (NCQ)
- Pre-Emptive Wear Leveling (PWL)
- S.M.A.R.T. Command Transport (SCT)
- World Wide Name (WWN)
- Reliability Features Set—Data Lifeguard™
- Hot Plug Support
- Active LED Status
- Fluid Dynamic Bearings (FDB)
- Staggered Spin-Up and Activity Indication (SATA Power Pin 11)
- CacheFlow™
- 48-bit Logical Block Addressing (LBA)
- Power Management
- Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.)
- Security Mode