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5 **Disk Drive Diagnostics Profile**

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Foreword

164 The *Disk Drive Diagnostics Profile* (DSP1113) was prepared by the Diagnostics Working Group of the
165 DMTF.

166 DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems
167 management and interoperability. For information about the DMTF, see <http://www.dmtf.org>.

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- 173 • Mike Walker – Storage Networking Industry Association
- 174 • Peter Lamanna – EMC Corporation

175

Introduction

176 A *profile* is a collection of Common Information Model (CIM) elements and behavior rules that represent a
177 specific area of management. The purpose of the profile is to ensure interoperability of web-based
178 enterprise management (WBEM) services for a specific subset of the CIM schema — in this case Disk
179 Drive diagnostics.

180 Diagnostics is a critical component of systems management. Diagnostic services are used in problem
181 containment to maintain availability, achieve fault isolation for system recovery, establish system integrity
182 during boot, increase system reliability, and perform routine proactive system verification. The goal of the
183 Common Diagnostic Model (CDM) is to define industry-standard building blocks, based on and consistent
184 with the DMTF CIM, which enables seamless integration of vendor-supplied diagnostic services into
185 system and SAN management frameworks.

186 The goal of the *Disk Drive Diagnostics Profile* is to define industry-standard building blocks that enable
187 seamless problem determination support for Disk Drives and to troubleshoot network problems involving
188 Disk Drives. The *Disk Drive Diagnostics Profile* extends the standard diagnostic profile by identifying a
189 base set of Disk Drive functions that should be diagnosed by provider implementations. Suppliers can
190 differentiate their diagnostic offering by providing this base set of diagnostics and developing diagnostics
191 to analyze proprietary features of the Disk Drive.

192 Document conventions

193 Typographical conventions

194 The following typographical conventions are used in this document:

- 195 • Document titles are marked in *italics*.
- 196 • Important terms that are used for the first time are marked in *italics*.

197 ABNF usage conventions

198 Format definitions in this document are specified using ABNF (see [RFC5234](#)), with the following
199 deviations:

- 200 • Literal strings are to be interpreted as case-sensitive Unicode characters, as opposed to the
201 definition in [RFC5234](#) that interprets literal strings as case-insensitive US-ASCII characters.
202

204

Disk Drive Diagnostics Profile

205 1 Scope

206 The *Disk Drive Diagnostics Profile* specializes the [Diagnostics Profile](#) by defining the set of classes,
207 properties, methods and default values needed to perform effective problem determination for Disk Drives
208 within a management domain.

209 The target audience for this specification includes implementers who are writing CIM-based Disk Drive
210 diagnostics or consumers of CIM-based diagnostics for the Disk Drive.

211 2 Normative references

212 The following referenced documents are indispensable for the application of this document. For dated or
213 versioned references, only the edition cited (including any corrigenda or DMTF update versions) applies.
214 For references without a date or version, the latest published edition of the referenced document
215 (including any corrigenda or DMTF update versions) applies.
216

217 DMTF DSP0004, *CIM Infrastructure Specification 2.6*,
218 http://dmtof.org/sites/default/files/standards/documents/DSP0004_2.6.pdf

219 DMTF DSP0200, *CIM Operations over HTTP 1.3*,
220 http://dmtof.org/sites/default/files/standards/documents/DSP0200_1.3.pdf

221 DMTF DSP1001, *Management Profile Specification Usage Guide 1.0*,
222 http://dmtof.org/sites/default/files/standards/documents/DSP1001_1.0.pdf

223 DMTF DSP1002, *Diagnostics Profile Specification 2.1*,
224 http://dmtof.org/sites/default/files/standards/documents/DSP1002_2.1.0a.pdf

225 DMTF DSP1033, *Profile Registration Profile 1.0*,
226 http://dmtof.org/sites/default/files/standards/documents/DSP1033_1.0.pdf

227 DMTF DSP1054, *Indications Profile 1.2*,
228 http://www.dmtf.org/sites/default/files/standards/documents/DSP1054_1.2.1.pdf

229 DMTF DSP1119, *Diagnostics Job Control Profile 1.0.0*,
230 http://www.dmtf.org/sites/default/files/standards/documents/DSP1119_1.0.0a.pdf

231 DMTF DSP8055, *Diagnostics Message Registry 1.0.0c*,
232 http://www.dmtf.org/sites/default/files/standards/documents/DSP8055_1.0.0c.xml

233 INCITS, Technical Committee T10, *Small Computer System Interface (SCSI)*,
234 <http://www.t10.org/>

235 INCITS, Technical Committee T13, *AT Attachment (ATA) Storage Interface*,
236 <http://www.t13.org/>

237 IETF RFC5234, *ABNF: Augmented BNF for Syntax Specifications, January 2008*,
238 <http://tools.ietf.org/html/rfc5234>

239 ISO/IEC Directives, Part 2, *Rules for the structure and drafting of International Standards*,
240 <http://isotc.iso.org/livelink/livelink.exe?func=ll&objId=4230456&objAction=browse&sort=subtype>

241 Serial ATA, *Serial ATA (SATA) Storage Interface*,
242 <https://www.sata-io.org/purchase-spec>

243 SMI-S 1.6 Disk Drive Lite Profile (in Block Book)
244 http://www.snia.org/sites/default/files/SMI-Sv1.6r4-Block.book_.pdf

245 **3 Terms and definitions**

246 In this document, some terms have a specific meaning beyond the normal English meaning. Those terms
247 are defined in this clause.

248 The terms "shall" ("required"), "shall not," "should" ("recommended"), "should not" ("not recommended"),
249 "may," "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described
250 in [ISO/IEC Directives, Part 2](#), Annex H. The terms in parenthesis are alternatives for the preceding term,
251 for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that in
252 [ISO/IEC Directives, Part 2](#), Annex H specifies additional alternatives. Occurrences of such additional
253 alternatives shall be interpreted in their normal English meaning.

254 The terms "clause," "subclause," "paragraph," and "annex" in this document are to be interpreted as
255 described in ISO/IEC Directives, Part 2, Clause 5.

256 The terms "normative" and "informative" in this document are to be interpreted as described in ISO/IEC
257 Directives, Part 2, Clause 3. In this document, clauses, subclauses, or annexes labeled "(informative)" do
258 not contain normative content. Notes and examples are always informative elements.

259 The terms defined in [DSP0004](#), [DSP0200](#), and [DSP1001](#) apply to this document.

260 **4 Symbols and abbreviated terms**

261 The following symbols and abbreviations are used in this document.

262 **4.1**

263 **ATA**

264 AT Attachment Storage Interface

265 **4.2**

266 **CDM**

267 Common Diagnostic Model

268 **4.3**

269 **CIM**

270 Common Information Model

271 **4.4**

272 **CIMOM**

273 CIM Object Manager

274 **4.5**

275 **CRU**

276 Customer Replaceable Unit

277	4.6
278	FRU
279	Field Replaceable Unit
280	4.7
281	HDD
282	Hard Disk Drive
283	4.8
284	LBA
285	Logical Block Addressing
286	4.9
287	ME
288	Managed Element
289	4.10
290	MOF
291	Managed Object Format
292	4.11
293	OS
294	Operating System
295	4.12
296	PD
297	Problem Determination
298	4.13
299	PFA
300	Predictive Failure Analysis
301	4.14
302	POST
303	Power-On Self-Test
304	4.15
305	QA
306	Quality Assurance
307	4.16
308	RAID
309	Redundant Array of Independent Disks
310	4.17
311	SAN
312	Storage Area Network
313	4.18
314	SATA
315	Serial Advanced Technology Attachment

- 316 **4.19**
 317 **SCSI**
 318 Small Computer System Interface
- 319 **4.20**
 320 **S.M.A.R.T.**
 321 Self-Monitoring, Analysis, and Reporting Technology
- 322 **4.21**
 323 **SSD**
 324 Solid State Drive
- 325 **4.22**
 326 **WBEM**
 327 Web-Based Enterprise Management

328 **5 Synopsis**

329 **Profile Name:** Disk Drive Diagnostics Profile

330 **Version:** 1.1.0a

331 **Organization:** DMTF

332 **CIM schema version:** 2.4

333 **Central Class:** CIM_DiskDriveDiagnosticTest

334 **Scoping Class:** CIM_ComputerSystem

335 The Disk Drive Diagnostics Profile extends the management capability of referencing profiles by adding
 336 common methods for determining that the Disk Drive is operating normally in a managed system.

337 CIM_DiagnosticTest shall be the Central Class of this profile. The instance of CIM_DiagnosticTest shall
 338 be the Central Instance of this profile. CIM_ComputerSystem shall be the Scoping Class of this profile.
 339 The instance of CIM_ComputerSystem with which the Central Instance is associated through an instance
 340 of CIM_HostedService shall be the Scoping Instance of this profile.

341 The CIM_ManagedElement is CIM_DiskDrive or a subclass of it.

342 **NOTE** When the physical drive is part of a RAID configuration, please refer to the RAID Controller Diagnostics
 343 Profile.

344 Table 1 identifies profiles on which this profile has a dependency.

345

Table 1 – Referenced profiles

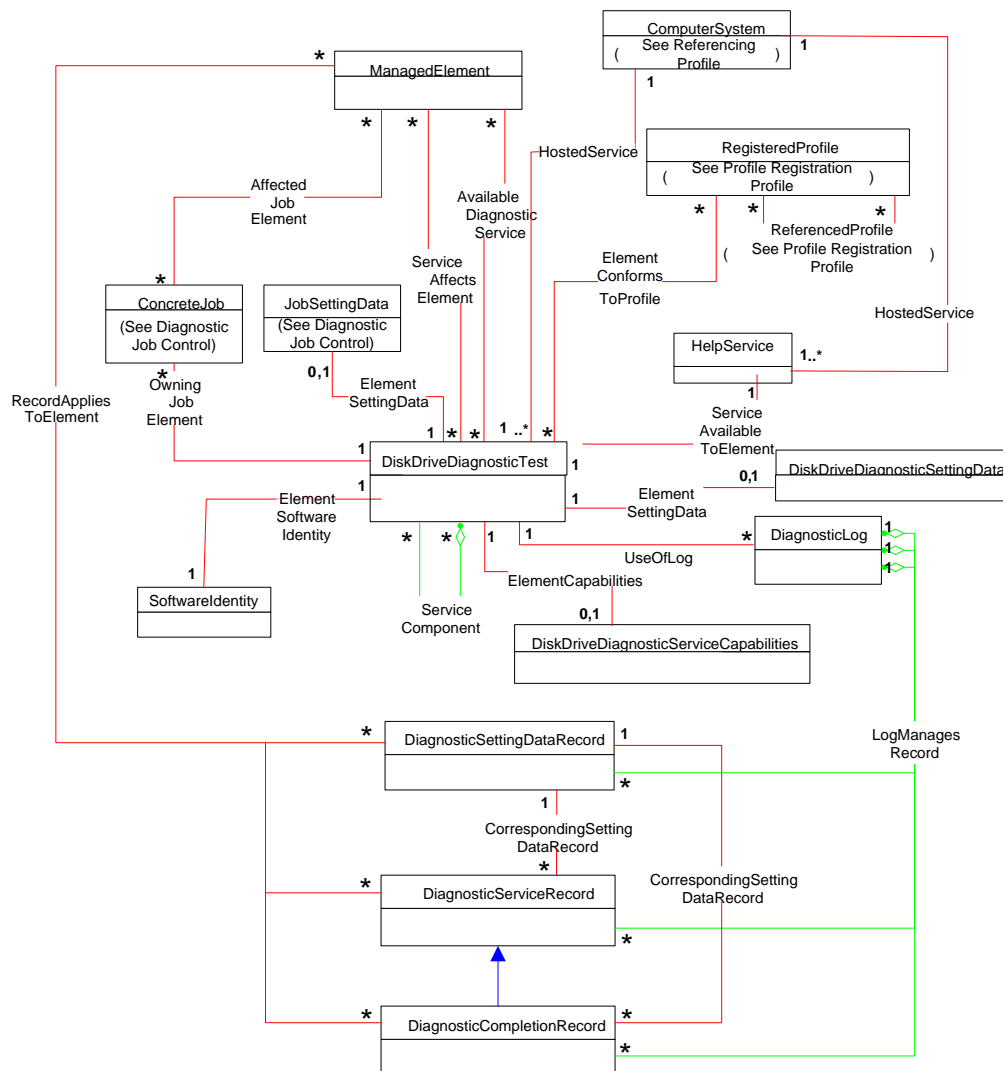
Profile name	Organization	Version	Description
Diagnostics	DMTF	2.1	Specializes
Profile Registration	DMTF	1.0	Mandatory
Disk Drive Lite	SNIA	1.6.0	Optional

346 **6 Description**

347 Diagnostic programs can be developed to verify that the Disk Drive is behaving properly, to identify its
 348 faulty components, or to diagnose any components. Such tests are run in two distinct environments: 1) at
 349 a vendor facility during development or manufacturing as part of their QA process, or 2) at an end-user
 350 location. In end-user environments, certain diagnostic tests will not be practical to run because they might
 351 modify or destroy data or they might take too long to run.

352 This specification attempts to cover a range of disk drive technologies and interfaces (for example, ATA,
 353 SATA, SCSI, SSD, etc.), although some defined tests may only apply to certain technologies. For
 354 example, the disk vendor industry has defined a set of tests for ATA interface drives called Self-
 355 Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.).

356



357

358 **Figure 1 – Disk Drive Diagnostics Profile: Profile class diagram**

359 The ManagedElement that is the UserOfService reference on the AvailableDiagnosticService association
 360 is a disk drive (as represented by the CIM_DiskDrive class). The ManagedElements that are
 361 AffectedElement references on the ServiceAffectsElement associations can be any element that is
 362 affected by the DiagnosticTest (for example, the disk enclosure, storage elements based on the disk drive

363 or the system that contains them). The ServiceAffectsElement has a broader scope than the
364 AvailableDiagnosticService association.

365 The ManagedElements of the AffectedJobElement association are any elements affected by the test job
366 (including the disk drive under test).

367 7 Implementation

368 This clause details the requirements related to the arrangement of instances and their properties for
369 implementations of this profile.

370 7.1 Disk drive test information

371 Table 2 provides general information for each test type.

372 **Table 2 – Test type information**

Test Name	Test Information	
Short Self-Test	Coverage Area	The diagnostic performs a small set of vendor-specific tests to verify that the disk is operating properly.
	Coverage Range	The entire disk drive is covered.
	User Control	None
	Execution Time	The diagnostic runs on order of seconds.
	Built into Device	Yes
	Details	For SCSI, a Self-Test is initiated using a Send Diagnostic command (operation code = 1D) while the results of the Self-Test are retrieved using a Receive Diagnostics Results command (operation code = 1C). A drive may support vendor-specific internal Self-Tests. The test results are written to a Self-Test log.
Extended Self-Test	Coverage Area	The diagnostic performs an extended set of vendor-specific tests to verify that the disk is operating properly.
	Coverage Range	The entire disk drive is covered.
	User Control	The user may also specify that the Extended Self-Test run for a specified period of time using CIM_DiskDriveDiagnosticSettingData.LoopControl = 4 (Timer) and CIM_DiskDriveDiagnosticSettingData.LoopControlParameter.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the capacity and disk speed.
	Built into Device	Yes
	Details	If a time duration is specified, the diagnostic simply stops at whatever test in the set of Self-Tests it happens to be running at the time.
Selected Self-Test	Coverage Area	The diagnostic performs an extended set of vendor-specific tests to verify that the disk is operating properly, but limited to a specific range of the disk.
	Coverage Range	The selected LBA range is covered.
	User Control	The user may specify a selected LBA range.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the region selected and disk speed.
	Built into Device	Yes

Test Name	Test Information	
	Details	All of the tests of the Extended Self-Test are run but only against the selected LBA range.
Conveyance Self-Test	Coverage Area	The diagnostic Self-Test routine is intended to identify damage incurred during transporting of the device.
	Coverage Range	The entire disk drive is covered.
	User Control	None
	Execution Time	This Self-Test routine should take on the order of minutes to complete.
	Built into Device	Yes
	Details	None
Sequential Read	Coverage Area	This diagnostic performs a read operation from disk sectors in sequential order for a selected LBA range
	Coverage Range	The selected LBA range is covered.
	User Control	The user may specify the LBA range and the size of data to be transferred for each read operation.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the region selected and disk speed.
	Built into Device	Yes
	Details	Data is transferred from disk to host.
Random Read	Coverage Area	This diagnostic performs a read operation from disk sectors in random order within a selected LBA range.
	Coverage Range	The selected LBA range is covered.
	User Control	The user may specify the seed to use and the size of data to be transferred for each read operation.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the region selected and disk speed.
	Built into Device	Yes
	Details	Data is transferred from disk to host.
Sequential Read-Write-Read Compare	Coverage Area	This diagnostic verifies that the read and write operations are performed properly for a selected LBA range. Disk sectors are tested in sequential order.
	Coverage Range	The selected LBA range is covered.
	User Control	The user may specify an LBA range to be tested and the size of the data to be transferred.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the selected LBA range, the size of I/O operations to perform, and disk speed.
	Built into Device	Yes
	Details	The diagnostic reads a block and then writes the read data back to the block. The diagnostic then reads data a second time and verifies that the data has not changed. Because data might be modified unintentionally by an errant write operation, CIM_DiskDriveDiagnosticTest.Characteristics shall include 5 (Is Risky). Data is transferred to/from host and disk.

Test Name	Test Information	
Random Read-Write-Read Compare	Coverage Area	This diagnostic verifies that read and write operations are performed properly for a selected LBA range. Disk sectors are tested in random order.
	Coverage Range	The selected LBA range is covered.
	User Control	The user may specify an LBA range, the data transfer size and the seed.
	Execution Time	The diagnostic runs on order of minutes to hours depending upon the region selected and disk speed.
	Built into Device	Yes
	Details	The diagnostic reads a block and then writes the read data back to the block. The diagnostic then reads data a second time and verifies that the data has not changed. Because data might be modified unintentionally by an errant write operation, DiagnosticTest.Characteristics shall include 5 (Is Risky). Data is transferred to/from host and disk.
Sequential Internal Verify	Coverage Area	This diagnostic verifies the ability to perform read and verify operations from track to track and head to head in sequential order.
	Coverage Range	The entire disk drive is covered.
	User Control	None
	Execution Time	The diagnostic runs on order of minutes to hours but depends upon disk capacity and disk speed.
	Built into Device	Yes
	Details	Data is not transferred from disk to host; that is, this test is internal to the disk.
Status	Coverage Area	This diagnostic returns information about the relative health of the disk drive based upon internal analysis of failure statistics.
	Coverage Range	The entire disk drive is covered.
	User Control	None
	Execution Time	The diagnostic returns immediately.
	Built into Device	Yes
	Details	Analysis of failure statistics is performed by the disk drive, not by the diagnostic test, which simply returns an overall status value.
Grown Defect	Coverage Area	The diagnostic retrieves statistics (such as the number of remapped sectors) collected by the disk drive regarding its sector remap mechanism.
	Coverage Range	The entire disk drive is covered.
	User Control	None
	Execution Time	The diagnostic returns immediately.
	Built into Device	Yes
	Details	For SCSI drives, the Read Defect Data command (B7) might be used. For SATA drives, the S.M.A.R.T. Reallocated Sector Count (ID = 5) command might be used.
4K Alignment	Coverage Area	For disk drives that support this feature, the diagnostic verifies that blocks can be properly aligned on 4K boundaries.
	Coverage Range	The entire disk drive is covered.

Test Name	Test Information	
	User Control	None
	Execution Time	The diagnostic runs on order of seconds.
	Built into Device	Yes
	Details	
Power Management	Coverage Area	The diagnostic verifies that disk power management features can be set and that they operate properly; for example, standby, sleep, lower power idle, etc.
	Coverage Range	The entire disk drive is covered.
	User Control	None.
	Execution Time	The diagnostic runs on order of minutes.
	Built into Device	Yes.
	Details	
Performance	Coverage Area	The diagnostic verifies that the disk operates within the vendor/product specific performance ranges for read operation transfer rates, sequential seek times, and random seek times.
	Coverage Range	The entire disk drive is covered.
	User Control	The user may select the data transfer size.
	Execution Time	The diagnostic runs on the order of hours depending upon the disk capacity and disk speed.
	Built into Device	Yes
	Details	

373 **7.2 CIM_DiskDriveDiagnosticTest**

374 The CIM_DiskDriveDiagnosticTest can be used for a variety of tests necessary for diagnosing Disk Drive
 375 issues. Table 3 defines the valid property values and whether or not the test is mandatory or optional. An
 376 implementation may extend this class and add vendor-defined tests using the vendor-defined range of the
 377 DiskDriveTestType valuemap.

378 The current values for TestType array property are: 0 (Unknown), 1 (Other), 2 (Functional), 3 (Stress), 4
 379 (Health Check), 5 (Access Test), 6 (Media Verify), 7 (DMTF Reserved), 8 (Vendor Reserved).

380 **Table 3 – CIM_DiskDriveDiagnosticTest property requirements**

Test Name	Criteria	ElementName *	DiskDriveTestType	TestType *
Short Self-Test	Mandatory	Disk Drive Short Self-Test	2	2 (Functional) 6 (Media Verify)
Extended Self-Test	Optional	Disk Drive Extended Self-Test	3	2 (Functional) 6 (Media Verify)
Selective Self-Test	Optional	Disk Drive Selective Self-Test	4	2 (Functional) 6 (Media Verify)
Conveyance Self-Test	Optional	Disk Drive Selective Self-Test	15	6 (Media Verify)
Sequential Read	Mandatory	Disk Drive Sequential Read	5	2 (Functional) 6 (Media Verify)

Test Name	Criteria	ElementName *	DiskDriveTestType	TestType *
Random Read	Optional	Disk Drive Random Read	6	2 (Functional) 6 (Media Verify)
Sequential Read-Write-Read Compare	Mandatory	Disk Drive Sequential Read-Write-Read Compare	7	2 (Functional) 6 (Media Verify)
Random Read-Write-Read Compare	Optional	Disk Drive Random Read-Write-Read Compare	8	2 (Functional) 6 (Media Verify)
Sequential Internal Verify	Optional	Disk Drive Sequential Internal Verify	9	2 (Functional) 6 (Media Verify)
Status	Mandatory	Disk Drive Status	10	4 (Health Check)
Grown Defects	Optional	Disk Drive Grown Defects	11	2 (Functional)
4K Alignment	Optional	Disk Drive 4K Alignment	12	2 (Functional)
Power Management	Optional	Disk Drive Power Management	13	2 (Functional)
Performance	Optional	Disk Drive Performance	14	2 (Functional) 6 (Stress)

381 An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticTest.

382 The current values for the Characteristics array property inherited from the CIM_DiagnosticTest parent
 383 class are: 0 (Unknown), 1 (Other), 2 (Is Exclusive), 3 (Is Interactive), 4 (Is Destructive), 5 (Is Risky), 6 (Is
 384 Package), 7 (Reserved), 8 (Is Synchronous), 9 (Media Required), 10 (Additional Hardware Required).
 385 The OtherCharacteristicsDescription property is used to provide additional information about the nature of
 386 the test. The content of the OtherCharacteristicsDescription property is vendor-specific.

387 **Table 4 – CIM_DiskDriveDiagnosticTest property requirements**

Test Name	Characteristics*	OtherCharacteristicsDescriptions*	Comment
Short Self-Test			
Extended Self-Test			
Selective Self-Test			
Conveyance Self-Test			
Sequential Read	5(Is Risky)		
Random Read	5(Is Risky)		
Sequential Read-Write-Read Compare	4 (Is Destructive) 5(Is Risky)		
Random Read-Write-Read Compare	4 (Is Destructive) 5(Is Risky)		
Sequential Internal Verify	4 (Is Destructive) 5(Is Risky)		
Status			
Grown Defects			
4K Alignment			

Test Name	Characteristics*	OtherCharacteristicsDescriptions*	Comment
Power Management			
Performance			

388 An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticTest.

389 7.3 CIM_DiskDriveDiagnosticSettingData

390 A diagnostic test may require parameters to run. Some parameters may affect how the test is run while
 391 other parameters provide the values to be used by the test.

392 CIM_DiagnosticSettingData contains properties that affect how a diagnostic test is run (for example,
 393 LoopControl, QuickMOde), how errors are handled (for example, HaltOnError), or how results are logged
 394 (for example, LogOptions). CIM_DiagnosticSettingData is an argument to the
 395 CIM_DiagnosticTest.RunDiagnosticService() extrinsic method. If additional properties are needed that
 396 control the behavior of the diagnostic test, they should be defined in a subclass of
 397 CIM_DiagnosticSettingData.

398 The CIM_DiskDriveDiagnosticSettingData class defines additional parameters that may be used by some
 399 of the disk drive tests. Table 5 lists these test parameters and shows which tests might use them. An
 400 implementation may extend this class and define additional parameters for any vendor-defined tests.

401 **Table 5 – CIM_DiskDriveDiagnosticSettingData property requirements**

Test Name	ElementName*	LBA Start	LBA End	Seed	Data Sizes	Data Patterns
Short Self-Test	Disk Drive Short Self					
Extended Self-Test	Disk Drive Extended Self					
Selective Self-Test	Disk Drive Region Self	Used	Used			
Conveyance Self-Test	Disk Drive Conveyance Self-Test					
Sequential Read	Disk Drive Sequential Read	Used	Used		Used	
Random Read	Disk Drive Random Read	Used	Used	Used	Used	
Sequential Read-Write-Read Compare	Disk Drive Sequential Read-Write-Read Compare	Used	Used		Used	Used
Random Read-Write-Read Compare	Disk Drive Random Read-Write-Read Compare	Used	Used	Used	Used	Used
Sequential Internal Verify	Disk Drive Sequential Internal Verify	Used	Used			
Status	Disk Drive Status					
Grown Defect	Disk Drive Grown Defect					
4K Alignment	Disk Drive 4K Alignment					
Power Management	Disk Drive Power Management					
Performance	Disk Drive Performance				Used	

402 An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticSettingData.

403 If any CIM_DiskDriveDiagnosticSettingData property does not have a value when passed as an argument
404 to the CIM_DiagnosticTest.RunDiagnosticService() extrinsic method, the default values for the test
405 arguments shall be used. The default values are defined by the test implementer.

406 **7.3.1 CIM_DiskDriveDiagnosticSettingData.LBAStart**

407 This property is used by a client to specify the start of a region to be test. If LBAStart is NULL, the default
408 value of 0 is used. To specify the entire disk, both LBAStart and LBAEnd shall be NULL.

409 **7.3.2 CIM_DiskDriveDiagnosticSettingData.LBAEnd**

410 This property is used by a client to specify the end of a region to be test. If LBAEnd is NULL, the default
411 value is the number of the last disk sector. To specify the entire disk, both LBAStart and LBAEnd shall be
412 NULL.

413 **7.3.3 CIM_DiskDriveDiagnosticSettingData.Seed**

414 This property is used by a client to specify the seed that initiates the random number sequence used by
415 the test. In order to replicate the same random number sequence for successive tests, one should use
416 the same seed value. If this property is NULL, the diagnostic randomly selects its own seed using a
417 vendor-specific algorithm.

418 **7.3.4 CIM_DiskDriveDiagnosticSettingData.DataSizes**

419 This array property is used by a client for the tests shown in Table 5 to specify the data buffer sizes to be
420 used for read or write operations by the diagnostic test. If this property is NULL, the default size of 512
421 bytes is used.

422 The vendor-defined default value(s) is optionally advertised by the provider using the default instance of
423 CIM_DiskDriveDiagnosticSettingData.

424 If both properties have values, they shall have the same number of values because the diagnostic test will
425 treat them as value pairs. That is, the test is run with the first value in DataSizes and the first value in
426 DataPatterns, and so on. Test behavior is illustrated by the following examples:

427 1) DataSizes = {1024,1024}, DataPatterns = {5555555555555555,AAAAAAAAAAAAAAAA}

428 2) DataSizes = {1024,2048}, DataPatterns = {AAAAAAAAAAAAAAAA,5555555555555555}

429 For the first data pair, the diagnostic test will run twice, first using DataSizes=1024 and
430 DataPatterns=5555555555555555 and then using DataSizes=1024 and
431 DataPatterns=AAAAAAAAAAAAAAAA.

432 For the second data pair, the diagnostic test will run twice, first using DataSizes=1024 and
433 DataPatterns=AAAAAAAAAAAAAAAA and then using DataSizes=2048 and
434 DataPatterns=5555555555555555.

435 NOTE If CIM_DiskDriveDiagnosticServiceCapabilities.DataSizes has values, a client can specify only one or more
436 of those values.

437 **7.3.5 CIM_DiskDriveDiagnosticSettingData.DataPatterns**

438 This array property is used by a client for the tests shown in Table 5 to specify the data pattern(s) to be
439 used for write operations by the diagnostic test. If this property is NULL, the vendor-specific data
440 pattern(s) is used.

441 The vendor-defined default value(s) is advertised by the provider using the default instance of
442 CIM_DiskDriveDiagnosticSettingData

443 A data pattern is a string interpreted as a 16-digit hex value. For example, a data pattern of all ones would
 444 be FFFFFFFFFFFFFFFF while alternating ones and zeros would be 5555555555555555 or
 445 AAAAAAAAAAAAAAAAAA. The pattern will be replicated as needed to fill the specified data size.

446 NOTE If CIM_DiskDriveDiagnosticServiceCapabilities.DataPatterns has values, the user can specify only one or
 447 more of those values.

448 **7.4 CIM_DiskDriveDiagnosticServiceCapabilities**

449 The SupportedLoopControl property is inherited from CIM_DiagnosticServiceCapabilities. It lists the loop
 450 controls that are supported by the Diagnostic Service. The values are: 0 (Unknown), 1 (Other), 2
 451 (Continuous), 3 (Count), 4 (Timer), 5 (ErrorCount), 0x8000 (No Loop Control). For all disk drive diagnostic
 452 tests, SupportedLoopControl has a value of 0x8000 (No Loop Control) except for the Extended Self-Test
 453 which has the value of 4 (Timer).

454 **Table 6 - CIM_DiskDriveDiagnosticServiceCapabilities property requirements**

Test Name	ElementName*	Region	Seed	DataSizes	DataPatterns
Short Self-Test	Disk Drive Short Self				
Extended Self-Test	Disk Drive Extended Self				
Selective Self-Test	Disk Drive Region Self	Used			
Conveyance Self-Test	Disk Drive Conveyance Self-Test				
Sequential Read	Disk Drive Sequential Read	Used		Used	
Random Read	Disk Drive Random Read	Used	Used	Used	
Sequential Read-Write-Read Compare	Disk Drive Sequential Read-Write-Read Compare	Used		Used	Used
Random Read-Write-Read Compare	Disk Drive Random Read-Write-Read Compare	Used	Used	Used	Used
Sequential Internal Verify	Disk Drive Sequential Internal Verify	Used			
Status	Disk Drive Status				
Grown Defect	Disk Drive Grown Defect				
4K Alignment	Disk Drive 4K Alignment				
Power Management	Disk Drive Power Management				
Performance	Disk Drive Performance			Used	

455 An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticServiceCapabilities

456 **7.4.1 CIM_DiskDriveDiagnosticServiceCapabilities.Region**

457 This property is used by a provider to define whether or not the client can specify start and end disk
 458 sectors for the region tests defined in Table 6.

459 If this property is TRUE, the client can use the values of CIM_DiskDriveDiagnosticSettingData.LBAStart
 460 and CIM_DiskDriveDiagnosticSettingData.LBAEnd to control which disk sectors are tested.

461 **7.4.2 CIM_DiskDriveDiagnosticServiceCapabilities.Seed**

462 This property is used by a provider to define whether or not the client can specify the seed for the tests
463 defined in Table 6 that generate a random number sequence for testing.

464 If this property is TRUE, the client can use the value of CIM_DiskDriveDiagnosticSettingData.Seed to
465 initiate the random number sequence generation.

466 **7.4.3 CIM_DiskDriveDiagnosticServiceCapabilities.DataSizes**

467 This array property is used by a provider for the tests shown in Table 6 to specify the list of data sizes
468 supported by the test.

469 **7.4.4 CIM_DiskDriveDiagnosticServiceCapabilities.DataPatterns**

470 This array property is used by a provider for the tests shown in Table 6 to specify the list of data patterns
471 supported by the test.

472 A data pattern is a string interpreted as a 16-digit hex value. For example, a data pattern of all ones would
473 be FFFFFFFFFFFFFFFFFF while alternating ones and zeros would be 5555555555555555 or
474 AAAAAAAAAAAAAAAAAA. The pattern will be repeated as necessary to fill the specified data size.

475 **7.5 Disk Drive Diagnostics Profile indications support**

476 The *Disk Drive Diagnostics Profile* constrains certain elements in its support for the *DMTF Indications*
477 *Profile*. This subclause identifies those constraints.

478 **7.5.1 CIM_IndicationFilter (StaticIndicationFilter)**

479 The *Disk Drive Diagnostics Profile* constrains some of the properties of the StaticIndicationFilter version
480 of the CIM_IndicationFilter class and makes the class mandatory. The class is mandatory because some
481 of the alert indication filters are mandatory and the *Disk Drive Diagnostics Profile* requires that static
482 versions of mandatory indication filters be populated.

483 **7.5.1.1 CIM_IndicationFilter.Name**

484 The *Disk Drive Diagnostics Profile* constrains names of the profile-defined alert indication filters as
485 prescribed by [DSP1054](#). The names for the indication filters are identified in the entries for the indications
486 in Table 13. The Name shall be formatted as defined by the following ABNF rule:

487 "DMTF:Disk Drive Diagnostics:" MessageID

488 The MessageID shall have the same value of the MessageID in the Query for the filter.

489 **7.5.1.2 CIM_IndicationFilter.Query**

490 The *Disk Drive Diagnostics Profile* constrains the Query properties of the profile-defined alert indication
491 filters as prescribed by [DSP1054](#). The Query properties for the indication filters are identified in the
492 entries for the indications in Table 8.

493 **7.5.1.3 CIM_IndicationFilter.QueryLanguage**

494 The *Disk Drive Diagnostics Profile* constrains the QueryLanguage properties of the profile-defined alert
495 indication filters as prescribed by [DSP1054](#). The QueryLanguage properties for the indication filters are
496 identified in the entries for the indications in Table 8.

497 **7.5.2 CIM_FilterCollection (ProfileSpecificFilterCollection)**

498 The *Disk Drive Diagnostics Profile* constrains the CollectionName property of the
499 ProfileSpecificFilterCollection version of the CIM_FilterCollection class.

500 **7.5.2.1 CIM_FilterCollection.CollectionName**

501 The *Disk Drive Diagnostics Profile* constrains the CollectionName of the profile-defined
502 ProfileSpecificFilterCollection filter collection as prescribed by [DSP1054](#). The CollectionName for the filter
503 collection shall be formatted as defined by the following ABNF rule:

504 "DMTF:Disk Drive Diagnostics:ProfileSpecifiedAlertIndicationFilterCollection"

505 **7.5.3 CIM_MemberOfCollection (IndicationFilterInFilterCollection)**

506 **7.5.3.1 CIM_MemberOfCollection.Collection**

507 The *Disk Drive Diagnostics Profile* constrains the Collection property to be the reference to the
508 ProfileSpecificFilterCollection filter collection.

509 **7.5.3.2 CIM_MemberOfCollection.Member**

510 The *Disk Drive Diagnostics Profile* constrains the Member property to be a reference to one of the
511 profile-defined alert indication filters.

512 **7.5.4 CIM_OwningCollectionElement (IndicationServiceOfFilterCollection)**

513 **7.5.4.1 CIM_OwningCollectionElement.OwnedElement**

514 The *Disk Drive Diagnostics Profile* constrains the OwnedElement property to be the reference to the
515 ProfileSpecifiedFilterCollection filter collection.

516 **7.6 Diagnostics alert indications and standard messages**

517 **7.6.1 DIAG501 - The selected disk drive is not present.**

518 The test did not run to completion because the specified disk drive was not present.

519 This alert would only be sent if the test discovers that the disk drive specified does not exist.

520 The variables in this message are:

521 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
522 property of the DiagnosticTest instance.

523 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

524 This could be one of the following names:

525 – The Object path of the CIM_DiskDrive instance

526 – The ElementName of the CIM_DiskDrive

527 – A unique, user friendly name not in the model (such as, asset name)

528 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
529 consistently for all disk drives within the scoping profile.

530 With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType should be set to “Disk
531 Drive Missing”.

532 With this alert, the PerceivedSeverity shall have one of the values of 5 (Major).

533 **7.6.2 DIAG502 - The selected disk drive is offline.**

534 The test did not run to completion because the disk drive was offline.

535 This alert would only be sent if the disk drive in question was to be exercised by the test and the
536 OperationalStatus of the disk drive in question shall be 10 (Stopped). The alert will cause the test to fail to
537 execute to completion.

538 The variables in this message are:

539 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
540 property of the DiagnosticTest instance.

541 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

542 This could be one of the following names:

543 – The Object path of the CIM_DiskDrive

544 – The ElementName of the CIM_DiskDrive

545 – A unique, user friendly name not in the model (such as, asset name)

546 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
547 consistently for all disk drives within the scoping profile.

548 With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType shall be set to “Disk
549 Drive Offline”.

550 With this alert, the PerceivedSeverity shall have the value 5 (Major).

551 **7.6.3 DIAG503 - The selected disk drive is disabled by the user.**

552 The test did not run to completion because the disk drive was disabled by the user.

553 This alert is only sent if the disk drive in question was to be exercised by the test and the provider can
554 determine that the disk drive was disabled by user action. As with the offline case, the OperationalStatus
555 of the disk drive in question shall be 10 (Stopped). If the provider cannot determine that the disk drive was
556 disabled by the user, DIAG502 should be used. The alert will cause the test to fail to execute to
557 completion.

558 The variables in this message are:

- 559 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
560 property of the DiagnosticTest instance.
- 561 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

562 This could be one of the following names:

- 563 – The Object path of the CIM_DiskDrive instance
- 564 – The ElementName of the CIM_DiskDrive instance
- 565 – A unique, user friendly name not in the model (such as, asset name)

566 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
567 consistently for all disk drives within the scoping profile.

568 With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType shall be set to “Disk
569 Drive Disabled by User”.

570 With this alert, the PerceivedSeverity shall have the value 5 (Major).

571 **7.6.4 DIAG512 - Disk drive in error**

572 The test may or may not have run to completion because disk drive was in error.

573 This alert is only sent if the disk drive in question was to be exercised by the test and the drive is in error
574 (usually reported in OperationalStatus of the disk drive as ? (Error)). The test itself may have caused the
575 state to change to an error state. If there are multiple errors and HaltOnError is FALSE, there may be
576 multiple DIAG512 messages (one for each error). If HaltOnError is TRUE, this error will prevent the test
577 from being completed. This would typically be used if a more specific error alert does not exist.

578 The variables in this message are:

- 579 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
580 property of the DiagnosticTest instance.
- 581 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

582 This could be one of the following names:

- 583 – The Object path of the CIM_DiskDrive
- 584 – The ElementName of the CIM_DiskDrive
- 585 – A unique, user friendly name not in the model (such as, asset name)

586 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
587 consistently for all disk drives within the scoping profile.

- 588 • Error Designation – Identifies a vendor specified error code for the disk drive error.

589 With this alert, the AlertType shall have the value 5 (Device Alert).

590 With this alert, the PerceivedSeverity shall have the value 5 (Major), 6 (Critical) or
591 7 (Fatal/Nonrecoverable).

592 **7.6.5 DIAG513 - The disk drive has an unrecognized state**

593 The disk drive has an unrecognized state. The test shall continue to run.

594 This alert is only sent if the disk drive in question was to be exercised by the test and some state property
595 (such as OperationalStatus) was not in a recognized state. This state may influence the execution or
596 results of the test. The state may ultimately cause the test to fail to execute to completion or it may

597 influence the outcome of the test. However the test shall attempt to run to completion. If the test fails to
598 run to completion, a separate alert will indicate what caused the failure.

599 The variables in this message are:

600 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
601 property of the DiagnosticTest instance.

602 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

603 This could be one of the following names:

604 – The Object path of the CIM_DiskDrive

605 – The ElementName of the CIM_DiskDrive

606 – A unique, user friendly name not in the model (such as, asset name)

607 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
608 consistently for all disk drives within the scoping profile.

609 • State Property – Identifies the named property that represents the state. This could be a
610 CIM_DiskDrive property name or a SMART property name.

611 • Disk Drive State – Identifies property value for the disk drive that is in an unrecognized state

612 • Preferred States – Identifies the list of states that the test recognizes and will not inhibit the test.

613 With this alert, the AlertType shall have the value 1 (Other).. A “1” indicates that a disk drive is in an
614 unrecognized state (the OtherAlertType should be set to “Disk Drive in Unrecognized State”).

615 With this alert, the PerceivedSeverity shall have the value 3 (Warning).

616 **7.6.6 DIAG514 - The disk drive is in a predictive failure state**

617 The test ran to completion, but the specified disk drive indicates a predictive failure, based on a threshold
618 defined for the drive.

619 This alert is only sent if the disk drive in question was to be exercised by the test and the test discovers
620 that a threshold has been crossed. If multiple thresholds have been crossed then multiple DIAG514
621 messages will be sent. The execution of the test may trigger the change of OperationalStatus to
622 Predictive Failure from OK, or it may simply report the thresholds that have been crossed that caused the
623 drive to be in the Predictive Failure state.

624 The variables in this message are:

625 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
626 property of the DiagnosticTest instance.

627 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

628 This could be one of the following names:

629 – The Object path of the CIM_DiskDrive

630 – The ElementName of the CIM_DiskDrive

631 – A unique, user friendly name not in the model (such as, asset name)

632 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
633 consistently for all disk drives within the scoping profile.

634 • Threshold Name – Identifies the (SMART) name of the threshold.

635 • Threshold Value – The value established for indicating a predictive failure situation.

636 • Current Value – The current value of the named threshold property.

637 With this alert, the AlertType shall have the value 5 (Device Alert).

638 With this alert, the PerceivedSeverity shall have the value 5 (Major) or 6 (Critical).

639 **7.6.7 DIAG515 - The disk drive is in a predictive failure state for unknown reason**

640 The test ran to completion, but the specified disk drive indicates a predictive failure for unknown reasons.

641 This alert is only sent if the disk drive in question was to be exercised by the test and the drive is in a
642 predictive failure state, but the SMART test does not indicate any thresholds have been crossed. If there
643 was SMART information available, DIAG514 would have been sent. This alert should not cause the test
644 to fail to execute to completion.

645 The variables in this message are:

646 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
647 property of the DiagnosticTest instance.

648 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

649 This could be one of the following names:

- 650 – The Object path of the CIM_DiskDrive
- 651 – The ElementName of the CIM_DiskDrive
- 652 – A unique, user friendly name not in the model (such as, asset name)

653 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
654 consistently for all disk drives within the scoping profile.

655 With this alert, the AlertType shall have the value 5 (Device Alert).

656 With this alert, the PerceivedSeverity shall have the value 5 (Major) or 6 (Critical).

657 **7.6.8 DIAG516 – Drive has an interface CRC error**

658 The test may or may not have run to completion, but the specified disk drive indicates an interface CRC
659 error. An Ultra DMA data may be applicable to Multiword DMA and PIO data transfers. When the
660 Interface CRC is message is sent, the DIAG36 or 37 may also be sent if the test does not run to
661 completion.

662 This alert is only sent if the disk drive in question was to be exercised by the test and an interface CRC
663 error was encountered. This error may cause the test to fail to execute to completion.

664 The variables in this message are:

665 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
666 property of the DiagnosticTest instance.

667 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

668 This could be one of the following names:

- 669 – The Object path of the CIM_DiskDrive
- 670 – The ElementName of the CIM_DiskDrive
- 671 – A unique, user friendly name not in the model (such as, asset name)

672 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
673 consistently for all disk drives within the scoping profile.

674 • Error Code – Identifies the SMART error code for the interface CRC error.

675 With this alert, the AlertType shall have the value 5 (Device Alert).

676 With this alert, the PerceivedSeverity shall have the value 5 (Major), 6 (Critical) or
677 7 (Fatal/Nonrecoverable). If the test runs to completion, the value should be 5 (Major). If the test is
678 aborted, the value should be 6 (Critical) or 7 (Fatal/Nonrecoverable). And the OperationalStatus for the
679 drive should be set to 3 (Degraded) or 6 (Error).

680 **7.6.9 DIAG517 – Drive has a media error**

681 The test should have run to completion, but the specified disk drive indicates a media error was found.

682 This alert is only sent if the disk drive in question was to be exercised by the test and a media error was
683 found. This indicates there are one or more bad sectors. If a predictive failure threshold is crossed due to
684 the bad sector, then a DIAG514 message will also be sent.

685 The variables in this message are:

686 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
687 property of the DiagnosticTest instance.

688 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

689 This could be one of the following names:

- 690 – The Object path of the CIM_DiskDrive
- 691 – The ElementName of the CIM_DiskDrive
- 692 – A unique, user friendly name not in the model (such as, asset name)

693 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
694 consistently for all disk drives within the scoping profile.

695 With this alert, the AlertType shall have the value 5 (Device Alert).

696 With this alert, the PerceivedSeverity shall have the value 5 (Major), 6 (Critical) or
697 7 (Fatal/Nonrecoverable). This should only be reported as a fatal error if there are no spare sectors that
698 can be used (and you need one). This should be reported as 6 (Critical) if a spare sector can be used, but
699 this exhausts the spare sectors. This should be reported as 5 (Major) if there are additional spare sectors
700 available.

701 **7.6.10 DIAG518 – Data contains an uncorrectable error**

702 The test may or may not have run to completion, but the specified disk drive indicates a uncorrectable
703 error has occurred.

704 This alert is only sent if the disk drive in question was to be exercised by the test and an uncorrectable
705 error occurs. This error may cause the test to fail to execute to completion.

706 The variables in this message are:

707 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
708 property of the DiagnosticTest instance.

709 • Disk Drive Moniker – Identifies a unique name for the disk drive under test that was specified.

710 This could be one of the following names:

- 711 – The Object path of the CIM_DiskDrive
- 712 – The ElementName of the CIM_DiskDrive
- 713 – A unique, user friendly name not in the model (such as, asset name)

714 The Disk Drive Moniker can be any of these, but whichever one is used shall be used
715 consistently for all disk drives within the scoping profile.

- 716 • Error Code – The SMART error code for the uncorrectable error.

717 With this alert, the AlertType shall have the value 5 (Device Alert).

718 With this alert, the PerceivedSeverity shall have the value 7 (Fatal/Nonrecoverable).

719 **7.6.11 DIAG551 – Test aborted due an invalid DiagnosticSettings value**

720 The test did not run because the requested DiagnosticSettings property parameter of the
721 RunDiagnosticService method is not valid.

722 This alert would be sent if a DiagnosticSettings property requested in the RunDiagnosticService extrinsic
723 method is not valid and could not be used. If there are multiple properties that are invalid, multiple
724 DIAG551 messages will be sent.

725 The variables in this message are:

- 726 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
727 property of the DiagnosticTest instance.
- 728 • Element Moniker – Identifies a unique name for the disk drive under test that was specified.

729 This could be one of the following:

- 730 – The Object Path of the disk drive
- 731 – The ElementName of the disk drive
- 732 – A unique, user friendly name not in the model (such as, asset name)

733 The Element Moniker can be any of these, but whichever one is used shall be used consistently
734 for all managed elements of the same type within the scoping profile (such as, all disk drives in
735 a system).

- 736 • DiagnosticSettings Property – Identifies the DiskDriveDiagnosticSettingData property by
737 property name.
- 738 • DiagnosticSettings Value – Identifies the value requested (the invalid value).

739 With this alert, the AlertType shall have the value 4 (Processing Error).

740 With this alert, the PerceivedSeverity shall have the value 5 (Major). The client should set the value to a
741 supported value and rerun the test.

742 **7.6.12 DIAG51 – Test aborted due an invalid DiagnosticSettings value**

743 The test did not run because the requested DiagnosticSettings property parameter of the
744 RunDiagnosticService method is not valid.

745 This alert would be sent if a DiagnosticSettings property requested in the RunDiagnosticService extrinsic
746 method is not valid and could not be used. If there are multiple properties that are invalid, multiple
747 DIAG51 messages will be sent.

748 The variables in this message are:

- 749 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
750 property of the DiagnosticTest instance.
- 751 • Element Moniker – Identifies a unique name for the element under test (such as, Disk Drive)
752 that was specified.

753 This could be one of the following:

- 754 – The Object Path of the element
- 755 – The ElementName of the element
- 756 – A unique, user friendly name not in the model (such as, asset name)

757 The Element Moniker can be any of these, but whichever one is used shall be used consistently
758 for all managed elements of the same type within the scoping profile (such as, all disk drives in
759 a system).

- 760 • DiagnosticSettings Property – Identifies the DiagnosticSettings property by property name.
- 761 • DiagnosticSettings Value – Identifies the value requested (the invalid value).

762 With this alert, the AlertType shall have the value 4 (Processing Error).

763 With this alert, the PerceivedSeverity shall have the value 5 (Major). The client should set the value to a
764 supported value and rerun the test.

765 7.6.13 Disk drive alerts using common messages

766 In addition to the alert standard messages that are unique to the disk drives, the *Disk Drive Diagnostics*
767 *Profile* may also generate common diagnostic messages (including diagnostic job control messages). Of
768 specific note, the *Disk Drive Diagnostics Profile* may generate completion status messages (such as
769 DIAG0, DIAG3 or DIAG4) and job-related standard messages (such as DIAG19 or DIAG20).

770 In addition, the implementation may generate DIAG43, DIAG50 or DIAG51 to cover capabilities or
771 settings alerts.

772 7.6.13.1 Common completion status messages

773 The *Disk Drive Diagnostics Profile* should generate completion status messages to reflect the completion
774 of the test (see [DSP1002](#)). These messages would include:

- 775 • DIAG0 - The test passed.
- 776 • DIAG3 - The device test failed.
- 777 • DIAG4 - The test was completed with warnings.
- 778 • DIAG44 - The test did not start.
- 779 • DIAG45 - The test aborted.

780 7.6.13.2 Diagnostic Job Control messages

781 The *Disk Drive Diagnostics Profile* should generate messages associated with the Diagnostic Job Control
782 Profile (see [DSP1119](#)). The messages would include:

- 783 • DIAG9 - Test continued after last interactive timeout using Default Values.
- 784 • DIAG12 - Job could not be started.
- 785 • DIAG19 - Test killed by client.
- 786 • DIAG20 - Test terminated by client.
- 787 • DIAG21 - Test suspended by client.
- 788 • DIAG34 - Request for Inputs

- 789 • DIAG35 - Request for action
- 790 • DIAG36 - Test killed by test.
- 791 • DIAG37 - Test terminated by test.
- 792 • DIAG38 - Test resumed by client.
- 793 • DIAG39 - JobSetting reset.
- 794 • DIAG40 - JobSetting defaults not used.
- 795 • DIAG48 - Test continued after an interim interactive timeout.
- 796 • DIAG49 - Test terminated after an interactive timeout.

797 7.6.13.3 Settings alert messages

798 Errors in values supplied in the DiagnosticSettings parameter (an embedded instance of
799 DiskDriveDiagnosticSettingData) of the RunDiagnosticService method would be reported by using
800 DIAG43 (The Requested DiagnosticSettings is not supported) or DIAG51 (Test aborted due an invalid
801 DiagnosticSettings value).

802 The DIAG43 message has the following format:

803 The <Diagnostic Test Name> test on the selected Element to test <Element Moniker> ran but the
804 requested DiagnosticSettings property <DiagnosticSettings Property> of <DiagnosticSettings Value>
805 is not supported. The value <DiagnosticSettings Used> was used instead.

806 The Element Moniker would be the disk drive moniker. The <DiagnosticSettings Property> could be any
807 one of the DiskDriveDiagnosticSettingData properties, including DataPatterns.

808 The <DiagnosticSettings Value> would be the value supplied for the property. It is the value that is not
809 supported. The <DiagnosticSettings Used> would be the value that the test used instead of the value that
810 was supplied.

811 The DIAG51 message has the following format:

812 The <Diagnostic Test Name> test on the selected Element to test <Element Moniker> did not run
813 because the requested DiagnosticSettings property <DiagnosticSettings Property> of
814 <DiagnosticSettings Value> is not valid.

815 The Element Moniker would be the disk drive moniker. The <DiagnosticSettings Property> could be any
816 one of the DiskDriveDiagnosticSettingData properties, including LBASStart, LBAEnd, Seed or DataSizes.

817 The <DiagnosticSettings Value> would be the value supplied for the property. It is the value that is invalid.

818 7.6.13.4 Capabilities alert messages

819 Errors in properties supplied in the DiagnosticSettings parameter (an embedded instance of
820 DiskDriveDiagnosticSettingData) of the RunDiagnosticService method would be reported by using
821 DIAG50 (Capability to set the DiagnosticSettings parameter not supported for test).

822 The DIAG50 message has the following format:

823 The <Diagnostic Test Name> test on the selected element to test <Element Moniker> ran, but
824 DiagnosticSettings parameter requested <Diag Setting Property> is not a supported capability and
825 was ignored.

826 The Element Moniker would be the disk drive moniker. <Diag Setting Property> could be any one of the
827 DiskDriveDiagnosticSettingData, including LBASStart, LBAEnd, Seed, DataSizes or DataPatterns. The
828 message means that the parameter (property) is not applicable to the test and was ignored.

829 7.6.13.5 Other common messages

830 In addition, the *Disk Drive Diagnostics Profile* may also generate other common messages (see
831 [DSP1002](#)). For example, these messages might include common messages for general capabilities and
832 settings errors, such as LoopControl or LogOption errors.

833 8 Methods

834 This clause details the requirements for supporting intrinsic operations and extrinsic methods for the CIM
835 elements defined by this profile.

836 8.1 CIM_DiagnosticTest.RunDiagnosticService()

837 The RunDiagnosticService() method shall return one of the return code values defined in “Table 2 –
838 RunDiagnosticsService() Method: Return Code Values” of [DSP1002](#).

839 When failures occur during the execution of a diagnostic test, the failure shall be recorded in the instance
840 of CIM_DiagnosticServiceRecord associated with the test. The reason for the failure shall be recorded in
841 CIM_DiagnosticServiceRecord.ErrorCode[] and the corresponding
842 CIM_DiagnosticServiceRecord.ErrorCount[] shall be incremented. Other occurrences of the same failure
843 during the same test shall not create additional entries in CIM_DiagnosticServiceRecord.ErrorCode[], but
844 they shall cause the corresponding CIM_DiagnosticServiceRecord.ErrorCount[] to be incremented.
845 Profile Conventions for Operations.

846 Support for operations for each profile class (including associations) shall be as mandated in [DSP1002](#),
847 clauses 8.5 through 8.29.

848 8.1.1 CIM_DiskDriveDiagnosticTest

849 All operations are supported as for CIM_DiagnosticTest in [DSP1002](#).

850 8.1.2 CIM_DiskDriveDiagnosticSettingData

851 All operations are supported as for CIM_DiagnosticSettingData in [DSP1002](#).

852 8.1.3 CIM_DiskDriveDiagnosticServiceCapabilities

853 All operations are supported as for CIM_DiagnosticServiceCapabilities in [DSP1002](#).

854 8.2 Profile conventions for operations

855 Support for operations for each profile class (including associations) shall be as mandated in [DSP1002](#),
856 clauses 8.5 through 8.24.

857 9 Use cases

858 This clause contains use cases for the *Disk Drive Diagnostics Profile*.

859 How to discover, configure, and run the individual diagnostic tests is detailed in [DSP1002](#). This clause
860 focuses on how to use the Disk Drive diagnostic tests to diagnose common SAN issues.

861 **9.1 Use case summary**

862 Table 7 summarizes the use cases that are described in this clause. The use cases are categorized and
 863 named, and references are provided to the body of the test that describes the use case.

864 NOTE Although use case names follow the convention for naming classes, properties and methods in the
 865 schema, this naming was done for readability only and does not imply any functionality attached to the name.

866 The CIM_ prefix has been omitted from the class names in the use cases for readability.

867 **Table 7 – Disk Drive Diagnostics Profile use cases**

Category	Tests	Description
Core device verification		Provides quick device verification with minimal to no user interaction required. See 9.2
Full functional verification		Verifies complete functionality in a running environment. May require some user interaction, but should also provide default values to adequately diagnose the device under test. See 9.3
Full functional verification (preboot)		Provides a more complete functional verification allowed by the pre-boot environment. See 9.4
Stress test		Stresses the device for a user-defined amount of time or iterations in an attempt to expose failures during heavy use. See 9.5

868 Before performing the use cases in this profile, it is assumed that a client has already utilized the use
 869 case methodology defined in [DSP1002](#) to discover the following instances:

- 870 • ManagedSystemElement (that is, disk drive instance(s) to be tested
- 871 • DiskDriveDiagnosticTest instance(s) to be used by this profile
- 872 • DiskDriveDiagnosticSettingData instance(s) to be used by this profile that will be passed to the
 873 DiskDriveDiagnosticTest.RunDiagnosticService() extrinsic method

874 **9.2 Core device verification**

875 To quickly verify that the disk is operating at a minimal functional level on a running system, a client
 876 performs the following steps:

- 877 1) Select the ManagedSystemElement instance to be tested.
- 878 2) Initialize the property values of DiagnosticSettingData as desired (for example, HaltOnError,
 879 LogOptions, etc.).
- 880 3) Initialize the DiskDriveDiagnosticTest instance to select the test to run (for example,
 881 DiskDriveTestType = 1 (Stress).
- 882 4) Invoke the DiskDriveDiagnosticTest.RunDiagnosticService() extrinsic method using the
 883 instances from steps 1 and 2 as arguments.
- 884 5) Repeat steps 2, 3 and 4 for running other tests.

885 **9.3 Full functional verification**

886 The use cases in this clause describe how the client can use the diagnostic tests to verify the health of
887 Disk Drives and to locate them. The CIM_ prefix has been omitted from the class names in the use cases
888 for readability.

889 To more completely verify the proper operation of a disk on a running system, a client performs the
890 following steps:

- 891 1) Select the ManagedSystemElement instance to be tested.
- 892 2) Initialize the property values of DiagnosticSettingData as desired (for example, HaltOnError,
893 LogOptions, etc.).
- 894 3) Initialize the DiskDriveDiagnosticTest instance to select the test to run (for example,
895 DiskDriveTestType = 1 (Stress).
- 896 4) Invoke the DiskDriveDiagnosticTest.RunDiagnosticService() extrinsic method using the
897 instances from steps 1 and 2 as arguments.
- 898 5) Repeat steps 2, 3 and 4 for running other tests..

899 **9.4 Full functional verification (preboot)**

900 To more completely verify the proper operation of a disk, a client performs the following steps before the
901 system is booted:

- 902 1) Select the ManagedSystemElement instance to be tested.
- 903 2) Initialize the property values of DiagnosticSettingData as desired (for example, HaltOnError,
904 LogOptions, etc.).
- 905 3) Select the DiskDriveDiagnosticTest instance that tests the Instruction set, (for example,
906 DiskDriveTestType = 1 (Stress).
- 907 4) Invoke the DiskDriveDiagnosticTest.RunDiagnosticService() extrinsic method using the
908 instances from steps 1 and 2 as arguments.
- 909 5) Repeat steps 2, 3 and 4 for running other tests.

910 **9.5 Stress test**

911 To more completely verify the proper operation of a disk, a client performs the following steps before the
912 system is booted:

- 913 1) Select the ManagedSystemElement instance to be tested.
- 914 2) Initialize the property values of DiagnosticSettingData as desired (for example, HaltOnError,
915 LogOptions, etc.).
- 916 3) Select the DiskDriveDiagnosticTest instance that tests the Instruction set, for example
917 DiskDriveTestType = 1 (Stress).
- 918 4) Invoke the DiskDriveDiagnosticTest.RunDiagnosticService() extrinsic method using the
919 instances from steps 1 and 2 as arguments.
- 920 5) Repeat steps 2, 3 and 4 for running other tests.

921 **10 CIM elements**

922 Table 8 shows the instances of CIM elements for this profile. Instances of the CIM elements shall be
 923 implemented as described in Table 8. Clause 7 (“Implementation”) and Clause 8 (“Methods”) may impose
 924 additional requirements on these elements.

925 **Table 8 – CIM elements: Disk Drive Diagnostics Profile**

Element name	Requirement	Description
Classes		
CIM_DiskDriveDiagnosticTest	Mandatory	See 10.1.
CIM_DiskDriveDiagnosticSettingData	Optional	See 10.2.
CIM_DiskDriveDiagnosticServiceCapabilities	Optional	See 10.3.
CIM_RegisteredProfile	Mandatory	See 10.4.
CIM_AffectedJobElement	Optional	See 10.5.
CIM_AvailableDiagnosticService	Mandatory	See 10.6.
CIM_ElementCapabilities	Optional	See 10.7.
CIM_ElementSettingData (DiagnosticSettingData)	Optional	See 10.8.
CIM_ElementSettingData (JobSettingData)	Optional	See 10.9.
CIM_ElementSoftwareIdentity	Mandatory	See 10.10.
CIM_HostedService	Mandatory	See 10.11.
CIM_OwningJobElement	Mandatory	See 10.12.
CIM_RecordAppliesToElement	Optional	See 10.13.
CIM_ServiceAffectsElement	Mandatory	See 10.14.
CIM_ServiceAvailableToElement	Optional	See 10.15.
CIM_ServiceComponent	Optional	See 10.16.
CIM_UseOfLog	Mandatory	See 10.17.
CIM_FilterCollection	Optional	See 10.18.
CIM_IndicationFilter	Mandatory	See 10.19.
CIM_MemberOfCollection	Optional	See 10.20.
CIM_OwningCollectionElement	Optional	See 10.21.
Indications		
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG501"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG501" See 7.6.1.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG502"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG502" See 7.6.2.

Element name	Requirement	Description
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG503"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG503" See 7.6.3.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG512"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG512" See 7.6.4.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG513"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG513" See 7.6.5.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG514"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG514" See 7.6.6.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG515"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG515" See 7.6.7.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG516"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG516" See 7.6.8.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG517"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG517" See 7.6.9.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG518"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG518" See 7.6.10.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG551"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Disk Drive Diagnostics:DIAG551" See 7.6.11.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG51"	Optional	Query Language = "DMTF:CQL" Name = "DMTF: Diagnostics:DIAG51" See 7.6.12.

926 10.1 CIM_DiskDriveDiagnosticTest (specializes CIM_DiagnosticTest)

927 CIM_DiskDriveDiagnosticTest is used to represent the Diagnostic Testing for a Disk Drive. This class
 928 specializes CIM_DiagnosticTest as defined in the *Diagnostics Profile* ([DSP1002](#)). The constraints listed in
 929 Table 9 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory elements that
 930 must be implemented.

931

Table 9 – Class: CIM_DiskDriveDiagnosticTest

Elements	Requirement	Notes
ElementName	Mandatory	See 7.2.
Characteristics	Mandatory	See 7.2.
OtherCharacteristicsDescriptions	Conditional	If Characteristics includes the value of 1 (Other), this property is Mandatory.
DiskDriveTestType	Mandatory	See 7.2.
OtherDiskDriveTestTypeDescription	Conditional	If DiskDriveTestType has a value of 1 (Other), this property is Mandatory.

932 **10.2 CIM_DiskDriveDiagnosticSettingData (specializes**
 933 **CIM_DiagnosticSettingData)**

934 CIM_DiskDriveDiagnosticSettingData is used to pass in test parameters and to specify other test control
 935 parameters. This class specializes CIM_DiagnosticSettingData as defined in [DSP1002](#). The constraints
 936 listed in Table 10 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory
 937 elements that must be implemented.

938

Table 10 – Class: CIM_DiskDriveDiagnosticSettingData

Elements	Requirement	Notes
ElementName	Mandatory	See 7.3.
LBASStart	Optional	See 7.3.1.
LBAEnd	Optional	See 7.3.2.
Seed	Optional	See 7.3.3.
DataSizes	Optional	See 7.3.4.
DataPatterns	Optional	See 7.3.5.

939 **10.3 CIM_DiskDriveDiagnosticServiceCapabilities (specializes**
 940 **CIM_DiagnosticServiceCapabilities)**

941 CIM_DiskDriveDiagnosticServiceCapabilities is used to provide information on the capabilities for the Disk
 942 Drive Diagnostic Service. This class specializes CIM_DiagnosticServiceCapabilities as defined in
 943 [DSP1002](#). The constraints listed in Table 11 are in addition to those specified in [DSP1002](#). See [DSP1002](#)
 944 for other mandatory elements that must be implemented.

945

Table 11 – Class: CIM_DiskDriveDiagnosticServiceCapabilities

Elements	Requirement	Notes
ElementName	Mandatory	See 7.4.
Region	Optional	See 7.4.1.
Seed	Optional	See 7.4.2.
DataSizes	Optional	See 7.4.3.
DataPatterns	Optional	See 7.4.4.

946 **10.4 CIM_RegisteredProfile**

947 The CIM_RegisteredProfile class is defined by the *Profile Registration Profile* ([DSP1033](#)). The
 948 requirements denoted in Table 12 are in addition to those mandated by [DSP1033](#). See [DSP1033](#) for the
 949 other mandatory elements that must be implemented.

950 **Table 12 – Class: CIM_RegisteredProfile**

Elements	Requirement	Notes
RegisteredName	Mandatory	This property shall be “Disk Drive Diagnostics”.
RegisteredVersion	Mandatory	This property shall be “1.0.0”.
RegisteredOrganization	Mandatory	This property shall be 2 (DMTF).

951 **10.5 CIM_AffectedJobElement**

952 Although defined in [DSP1002](#), the CIM_AffectedJobElement class is listed here because the
 953 AffectedElement reference is scoped down to a subclass of CIM_ManagedElement as specified in clause
 954 5. The constraints listed in Table 13 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for
 955 other mandatory properties of CIM_AffectedJobElement that must be implemented.

956 **Table 13 – Class: CIM_AffectedJobElement**

Properties	Requirement	Notes
AffectedElement (overridden)	Mandatory	This property shall be a reference to an instance of the CIM_ManagedElement subclass specified in clause 5.
AffectingElement	Mandatory	This property shall be a reference to an instance of CIM_ConcreteJob.

957 **10.6 CIM_AvailableDiagnosticService**

958 Although defined in [DSP1002](#), the CIM_AvailableDiagnosticService class is listed here because the
 959 ServiceProvided reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 960 CIM_DiagnosticTest, and the UserOfService reference is scoped down to a subclass of
 961 CIM_ManagedElement as specified in clause 5. The constraints listed in Table 14 are in addition to those
 962 specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_AvailableDiagnosticService
 963 that must be implemented.

964 **Table 14 – Class: CIM_AvailableDiagnosticService**

Properties	Requirement	Notes
ServiceProvided (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
UserOfService (overridden)	Mandatory	This property shall be a reference to an instance of the CIM_ManagedElement subclass specified in clause 5.

965 **10.7 CIM_ElementCapabilities**

966 Although defined in [DSP1002](#), the CIM_ElementCapabilities class is listed here because the
 967 ManagedElement reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of

968 CIM_DiagnosticTest, and the Capabilities reference is scoped down to
 969 CIM_DiskDriveDiagnosticServiceCapabilities, which is a subclass of CIM_DiagnosticServiceCapabilities.
 970 The constraints listed in Table 15 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other
 971 mandatory properties of CIM_ElementCapabilities that must be implemented.

972 **Table 15 – Class: CIM_ElementCapabilities**

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
Capabilities (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticServiceCapabilities.

973 **10.8 CIM_ElementSettingData (DiagnosticSettingData)**

974 Although defined in [DSP1002](#), the CIM_ElementSettingData class is listed here because the
 975 ManagedElement reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 976 CIM_DiagnosticTest, and the SettingData reference is scoped down to
 977 CIM_DiskDriveDiagnosticSettingData, which is a subclass of CIM_DiagnosticSettingData. The constraints
 978 listed in Table 16 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory
 979 properties of CIM_ElementSettingData that must be implemented.

980 **Table 16 – Class: CIM_ElementSettingData**

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
SettingData (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticSettingData.
IsDefault	Mandatory	If the instance of CIM_DiskDriveDiagnosticSettingData is the default setting, this property shall have the value of TRUE.

981 **10.9 CIM_ElementSettingData (JobSettingData)**

982 Although defined in [DSP1002](#), the CIM_ElementSettingData class is listed here because the Dependent
 983 reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of CIM_DiagnosticTest,
 984 and the SettingData reference is scoped down to CIM_JobSettingData, which is a subclass of
 985 CIM_SettingData. The constraints listed in Table 17 are in addition to those specified in [DSP1002](#). See
 986 [DSP1002](#) for other mandatory properties of CIM_ElementSettingData that must be implemented.

987 **Table 17 – Class: CIM_ElementSettingData**

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
SettingData (overridden)	Mandatory	This property shall be a reference to an instance of CIM_JobSettingData.
IsDefault	Mandatory	If the instance of CIM_JobSettingData is the default setting, this property shall have the value of TRUE.

988 **10.10 CIM_ElementSoftwareIdentity**

989 Although defined in [DSP1002](#), the CIM_ElementSoftwareIdentity class is listed here because the
 990 Dependent reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 991 CIM_DiagnosticTest. The constraints listed in Table 18 are in addition to those specified in [DSP1002](#).
 992 See [DSP1002](#) for other mandatory properties of CIM_ElementSoftwareIdentity that must be implemented.

993 **Table 18 – Class: CIM_ElementSoftwareIdentity**

Properties	Requirement	Notes
Antecedent	Mandatory	This property shall be a reference to an instance of CIM_SoftwareIdentity.
Dependent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

994 **10.11 CIM_HostedService**

995 Although defined in [DSP1002](#), the CIM_HostedService class is listed here because the Dependent
 996 reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of CIM_DiagnosticTest.
 997 The constraints listed in Table 19 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other
 998 mandatory properties of CIM_HostedService that must be implemented.

999 **Table 19 – Class: CIM_HostedService**

Properties	Requirement	Notes
Antecedent	Mandatory	This property shall be a reference to an instance of CIM_ComputerSystem.
Dependent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1000 **10.12 CIM_OwningJobElement**

1001 Although defined in [DSP1002](#), the CIM_OwningJobElement class is listed here because the
 1002 OwningElement reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 1003 CIM_DiagnosticTest. The constraints listed in Table 20 are in addition to those specified in [DSP1002](#).
 1004 See [DSP1002](#) for other mandatory properties of CIM_OwningJobElement that must be implemented.

1005 **Table 20 – Class: CIM_OwningJobElement**

Properties	Requirement	Notes
OwningElement (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
OwnedElement	Mandatory	This property shall be a reference to an instance of CIM_ConcreteJob.

1006 **10.13 CIM_RecordAppliesToElement**

1007 Although defined in [DSP1002](#), the CIM_RecordAppliesToElement class is listed here because the
 1008 Dependent reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 1009 CIM_DiagnosticTest. The constraints listed in Table 21 are in addition to those specified in [DSP1002](#).
 1010 See [DSP1002](#) for other mandatory properties of CIM_RecordAppliesToElement that must be
 1011 implemented.

1012

Table 21 – Class: CIM_RecordAppliesToElement

Properties	Requirement	Notes
Antecedent	Mandatory	This property shall be a reference to an instance of CIM_RecordForLog.
Dependent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1013

10.14 CIM_ServiceAffectsElement

1014 Although defined in [DSP1002](#), the CIM_ServiceAffectsElement class is listed here because the
 1015 AffectedElement reference is scoped down to a subclass of CIM_ManagedElement as specified in clause
 1016 5, and the AffectingElement reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a
 1017 subclass of CIM_DiagnosticTest. The constraints listed in Table 22 are in addition to those specified in
 1018 [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ServiceAffectsElement that must be
 1019 implemented.

1020

Table 22 – Class: CIM_ServiceAffectsElement

Properties	Requirement	Notes
AffectedElement (overridden)	Mandatory	This property shall be a reference to an instance of the CIM_ManagedElement subclass specified in clause 5.
AffectingElement (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1021

10.15 CIM_ServiceAvailableToElement

1022 Although defined in [DSP1002](#), the CIM_ServiceAvailableToElement class is listed here because the
 1023 UsersOfService reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 1024 CIM_DiagnosticTest. The constraints listed in Table 23 are in addition to those specified in [DSP1002](#).
 1025 See [DSP1002](#) for other mandatory properties of CIM_ServiceAvailableToElement that must be
 1026 implemented.

1027

Table 23 – Class: CIM_ServiceAvailableToElement

Properties	Requirement	Notes
ServiceProvided	Mandatory	This property shall be a reference to an instance of CIM_HelpService.
UsersOfService (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1028

10.16 CIM_ServiceComponent

1029 Although defined in [DSP1002](#), the CIM_ServiceComponent class is listed here because the
 1030 GroupComponent reference is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of
 1031 CIM_DiagnosticTest, and the PartComponent reference is scoped down to CIM_DiskDriveDiagnosticTest,
 1032 which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 24 are in addition to those
 1033 specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ServiceComponent that
 1034 must be implemented.

1035

Table 24 – Class: CIM_ServiceComponent

Properties	Requirement	Notes
GroupComponent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.
PartComponent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1036 **10.17 CIM_UseOfLog**

1037 Although defined in [DSP1002](#), the CIM_UseOfLog class is listed here because the Dependent reference
 1038 is scoped down to CIM_DiskDriveDiagnosticTest, which is a subclass of CIM_DiagnosticTest. The
 1039 constraints listed in Table 25 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other
 1040 mandatory properties of CIM_UseOfLog that must be implemented.

1041

Table 25 – Class: CIM_UseOfLog

Properties	Requirement	Notes
Antecedent	Mandatory	This property shall be a reference to an instance of CIM_DiagnosticLog.
Dependent (overridden)	Mandatory	This property shall be a reference to an instance of CIM_DiskDriveDiagnosticTest.

1042

1043 **10.18 CIM_FilterCollection**

1044 CIM_FilterCollection represents a ProfileSpecificFilterCollection as defined in [DSP1054](#). It defines the
 1045 collection of all the alert indications of the *Disk Drive Diagnostics Profile*. Table 26 contains the
 1046 requirements for elements of this class.

1047

Table 26 – Class: CIM_FilterCollection

Properties	Requirement	Notes
InstanceID	Mandatory	Key: See DSP1054 .
CollectionName	Mandatory	The property shall be “DMTF:Disk Drive Diagnostics: ProfileSpecifiedAlertIndicationFilterCollection”.

1048

1049 **10.19 CIM_IndicationFilter**

1050 CIM_IndicationFilter represents a StaticIndicationFilter as defined in [DSP1054](#). It defines the format of all
 1051 the alert indication filters of the *Disk Drive Diagnostics Profile*. Table 27 contains the requirements for
 1052 elements of this class.

1053

Table 27 – Class: CIM_IndicationFilter

Properties	Requirement	Notes
Name	Mandatory	Key: See the Name values as identified in Table 8.
CreationClassName	Mandatory	Key: See DSP1054 .
SystemName	Mandatory	Key: See DSP1054 .
SystemCreationClassName	Mandatory	Key: See DSP1054 .
SourceNamespaces[]	Mandatory	See DSP1054 .
IndividualSubscriptionSupported	Mandatory	See DSP1054 .
Query	Mandatory	See the Query values as identified in Table 8.
QueryLanguage	Mandatory	See the QueryLanguage values as identified in Table 8.

1054

1055 **10.20 CIM_MemberOfCollection**

1056 CIM_MemberOfCollection represents an association between the profile specific FilterCollection and the
 1057 CIM_IndicationFilters for the alert indications. Table 28 contains the requirements for elements of this
 1058 class.

1059

Table 28 – Class: CIM_MemberOfCollection

Properties	Requirement	Notes
Collection	Mandatory	Key: Value shall reference the profile specific FilterCollection instance representing a filter collection containing the alert indication filters.
Member	Mandatory	Key: Value shall reference an Alert IndicationFilter instance representing a contained alert indication filter.

1060 **10.21 CIM_OwningCollectionElement**

1061 CIM_OwningCollectionElement represents an association between the IndicationService that controls the
 1062 profile specific FilterCollection and the profile specific CIM_FilterCollection for the alert indication filters.
 1063 Table 29 contains the requirements for elements of this class.

1064

Table 29 – Class: CIM_OwningCollectionElement

Properties	Requirement	Notes
OwningElement	Mandatory	Key: See DSP1054 .
OwnedElement	Mandatory	Key: Value shall reference the profile specific Alert Indication FilterCollection instance.

1065

1066

ANNEX A (informative)

1067
1068

1069 **A.1 S.M.A.R.T. Tests**

1070 S.M.A.R.T. includes disk diagnostic tests and attributes that can be used to monitor disk drive status,
1071 collect statistics, test components or subsystems and predict upcoming failures. S.M.A.R.T. support is
1072 available for many platforms (Linux, Windows, etc.). Many motherboard and disk drive vendors provide
1073 S.M.A.R.T. utilities customized for the tests and attributes supported by their product.

1074 S.M.A.R.T. defines a list of attributes identified by an ID number. The list of attributes can be categorized
1075 into several functional groups. Some are counters for particular error conditions. Others are simply usage
1076 counters that are not necessarily indicative of aberrant behavior.

1077 A disk drive vendor may support one or more attributes. The disk will update the raw value of each
1078 supported attribute. Each disk drive vendor defines their own alert threshold for each supported attribute.

1079 Since implementations may use S.M.A.R.T. technology to perform some of the diagnostic tests,
1080 information regarding S.M.A.R.T. is provided for convenience.

1081 **A.2 Self Test**

1082 S.M.A.R.T. defines a generic Self test that verifies that the disk is operating properly. The specific tests
1083 performed by a Self test are dependent upon the vendor and individual product features. Typically, a user
1084 may specify a short Self test that runs several minutes or an extended Self test that may run much longer.
1085 Self tests may be run online or offline.

1086 **A.3 Cache Test**

1087 A Cache diagnostic verifies that the cache subsystem is operating properly. Typically, disks have
1088 separate read-ahead cache and write cache. A user may choose to test either or both. S.M.A.R.T. defines
1089 a cache related attribute called End-to-End Error (ID = 184). This error counter is incremented whenever
1090 the disk detects that parity has changed after data has been transferred between the host and disk
1091 through a cache.

1092 **A.4 Seek Tests**

1093 A Seek diagnostic verifies that all read and write heads of a disk can seek to all cylinders on their platter.
1094 A user may choose to have the heads seek to cylinders in a sequential or random manner. A user may
1095 also select a subset of disk sectors by specifying a starting and ending LBA.

1096 S.M.A.R.T. defines an attribute, called Seek Error Rate (ID = 7), that monitors the frequency of head
1097 positioning errors. A rising rate may indicate upcoming disk failure.

1098 **A.5 Sector Remap Tests**

1099 Over time, a percentage of physical disk sectors become unusable. A disk reserves a number of spare
1100 sectors that can be used to dynamically replace permanently damaged sectors. When a disk detects a
1101 permanent sector failure, it automatically remaps the logical sector from the failed physical sector to a
1102 spare physical sector.

1103 Additionally, some disk sectors cannot be used to store user data because they are reserved for use by
1104 the operating system or other purpose.

- 1105 S.M.A.R.T. defines several attributes related to bad block mapping. They are
- 1106 • Reallocated Sector Count (ID = 5) – The count of reallocated sectors.
 - 1107 • Reallocation Event Count (ID = 196) – The count of sector remap operations
 - 1108 • Current Pending Sector Count (ID = 197) – The number of "unstable" sectors (waiting to be
1109 remapped because of read errors).
 - 1110 • Uncorrectable Sector Count (ID = 198) – The number of unusable sectors.

1111 **A.6 Read Tests**

1112 A read diagnostic verifies that all read heads of a disk can read all disk sectors. A user may choose to
1113 read sectors in a sequential or random manner. A user may also select a subset of disk sectors by
1114 specifying a starting and ending LBA.

1115 S.M.A.R.T. defines several attributes related to read operations. They are

- 1116 • Raw Read Error Rate (ID = 1) – The frequency of errors occurred while reading raw data
- 1117 • Soft Read Error Rate (ID = 13) – The number of uncorrected read errors reported to the OS
- 1118 • TA Counter Detected (ID = 201) – The count of off-track errors
- 1119 • Read Error Retry Rate (ID = 205) – The number of retries of read operations

1120 **A.7 Write Tests**

1121 A write diagnostic verifies that all write heads of a disk can write to all disk sectors. A user may choose to
1122 write to sectors in a sequential or random manner. A user may also select a subset of disk sectors by
1123 specifying a starting and ending LBA.

1124 S.M.A.R.T. defines several attributes related to read operations. They are

- 1125 • Write Error Rate (ID = 200) – The number of write errors

1126 **A.8 Disk Information**

1127 Disks may support the capability to return device and product information such as

- 1128 • Device Model
- 1129 • Serial Number
- 1130 • Firmware Version
- 1131 • Capacity
- 1132 • Interface type (for example, SCSI, SATA, PATA, etc.)

1133 A Disk Information diagnostic verifies that such data can be retrieved and that the retrieved data is
1134 accurate.

1135 **A.9 Environmental Sensor Tests**

1136 A disk must operate properly within a specified range of environmental parameters. Disks may have
1137 sensors that monitor certain environmental conditions. An Environmental Sensor test verifies that these
1138 sensors are operating properly.

1139 S.M.A.R.T. defines several attributes related to environmental sensors built into the disk. They are

- 1140 • InducedOp-Vibration Detection (ID = 186)
- 1141 • Airflow Temperature (ID = 190) – Current airflow temperature
- 1142 • Disk Temperature (ID = 194) – Current disk temperature
- 1143 • Thermal Asperity Count (ID = 205) – The number of errors caused by high temperature
- 1144 • Vibration During Write (ID = 211)
- 1145 • Shock During Write (ID = 212)
- 1146 • G-Sense Error Rate (ID = 221) – The number of errors caused by external shock or vibration
- 1147 • Free Fall Event Count (ID = 254) – The number of “free fall” (drops) suffered by the disk

1148

1149 Other environmental factors that may be tested are

- 1150 • Altitude – that the disk properly operates at certain atmospheric pressures
- 1151 • Electromagnetic Immunity – that the disk properly operates when subject to certain strengths of
1152 electromagnetic fields
- 1153 • Humidity – that the disk properly operates at certain levels of relative humidity

1154 **A.10 Operation Sensor Tests**

1155 A disk consists of many moving components (for example heads, platters, etc.) that must operate within a
1156 specified range of speed and motion. Most disks have sensors that monitor certain operating conditions
1157 to detect when potentially harmful situations occur. An Operation Sensor test verifies that these sensors
1158 are operating properly.

1159 S.M.A.R.T. defines several attributes related to operation sensors built into the disk. They are

- 1160 • Head stability (ID = 185)
- 1161 • High Fly Writes (ID = 189) – The number of unsafe write operations outside the normal head
1162 flying range
- 1163 • Flying Height (ID = 206) – Current head flying height
- 1164 • Spin High Current (ID = 207) – Amount of current used to spin up the drive
- 1165 • Load Friction (ID = 224) – Resistance caused by friction of mechanical parts of magnetic head
1166 armature
- 1167 • Disk Shift (ID = 220) – Distance the disk has shifted relative to the spindle

1168 **A.11 Power Management Tests**

1169 Disks provide support for different power consumption modes such as

- 1170 • Active
- 1171 • Active Idle
- 1172 • Low Power Idle
- 1173 • Standby
- 1174 • Sleep/Hibernate

1175 A Power Management diagnostic verifies that the disk can enter and return from each supported power
1176 consumption mode.

1177 **A.12 Malfunction Indicator Tests**

1178 Disks collect data and statistics that can be used to alert the user of rising error rates or levels that may
1179 indicate upcoming disk failure or degraded operation. The Malfunction Indicator test verifies that the disk
1180 can accurately collect these statistics and data and return them upon request.

1181 S.M.A.R.T. defines several attributes related to malfunction indicators. They are

- 1182 • Read Channel Margin (ID = 6) – The number of read operations that occur in the read channel
1183 margin
- 1184 • Spin Retry Count (ID = 10) – The number of retries of spin start attempts
- 1185 • Drive Recalibration Retry Count (ID = 11) – The number of attempts to recalibrate the drive
- 1186 • Spin Buzz (ID = 208) – The number of buzz routines needed to spin up the drive due to
1187 insufficient power
- 1188 • Torque Amplification Count (ID = 227) – The number of attempts to compensate for platter
1189 speed variations
- 1190 • GMR Head Amplitude (ID = 230) – The amplitude of “thrashing” (distance of repetitive
1191 forward/reverse head motion)

1192 **A.13 Performance**

1193 Disks collect performance data on various aspects of their operation that can be used to alert the user of
1194 degrading performance that may indicate upcoming disk failure. The Performance test verifies that the
1195 disk can accurately collect performance data and return them upon request.

1196 S.M.A.R.T. defines several attributes related to performance measurement. They are

- 1197 • Throughput performance (ID = 2) – General throughput performance. Degrading performance
1198 may indicate upcoming motor, servo or bearing failure.
- 1199 • Spin-Up Time (ID = 3) – Time needed by spindle to spin up to full RPMs. Degrading
1200 performance may indicate upcoming motor or bearing failure.
- 1201 • Seek Time Performance (ID = 8) – Average time of seek operations. Degrading performance
1202 may indicate upcoming servo failure.
- 1203 • Offline Seek Performance (ID = 209) – Drive performance as measured during a Self test

1204 **A.14 Usage Meters**

1205 Disks maintain counters that monitor the overall usage of the drive. These counters measure how often a
1206 particular operation or event has occurred but do not necessarily indicated any error condition. The
1207 Usage Meters test verifies that these counters are operating properly.

1208 S.M.A.R.T. defines attributes related usage meters. They are

- 1209 • Start/Stop Count (ID = 4) – The number of spindle start/stop cycles.
- 1210 • Power-On Hours (ID = 9) – The amount of time the drive is powered on
- 1211 • Power Cycle Count (ID = 12) – The number of power on/off cycles
- 1212 • Power Off Retract Count (ID = 192) – The number of times when the heads are unloaded from
1213 the media for a power off operation

- 1214 • Load Cycle Count (ID = 193) – The number of time the head are moved to a landing zone
- 1215 position
- 1216 • Loaded Hours (ID = 222) – The amount of time the disk where the magnetic head armature is
- 1217 active
- 1218 • Load/Unload Retry Count (ID = 223) – The number of times read/write heads enter/exit a data
- 1219 zone
- 1220 • Load/Unload Cycle Count (ID = 225) – The number of load/unload cycles
- 1221 • Load-In Time (ID = 226) – The amount of time read/write heads are in a data zone
- 1222 • Power-Off Retract Cycle (ID = 228) – The number of times that the magnetic armature was
- 1223 retracted automatically because power was turned off
- 1224 • Head Flying Hours (ID = 240) – The total amount of time spent to position a head
- 1225 • Total LBAs Written (ID = 241)
- 1226 • Total LBAs Read (ID = 242)

1227 **A.15 Error Counters**

1228 Disks maintain counters for a set of detected errors. The Error Counters test verifies that these counters
1229 are operating properly.

1230 S.M.A.R.T. defines attributes related to monitor errors, some of which are included in other diagnostic
1231 tests. These remaining error attributes are

- 1232 • SATA Downshift Error Count (ID = 183)
- 1233 • Reported Uncorrectable Errors (ID = 187) – The number of errors that could not be corrected
- 1234 using hardware ECC
- 1235 • Command Timeout (ID = 188) – The number of aborted operations caused by disk command
- 1236 timeout
- 1237 • UltraDMA CRC Error Count (ID = 199) – The number of detected data transfer errors across the
- 1238 interface cable
- 1239 • Data Address Mark Errors (ID = 202)
- 1240 • Run Out Cancel (ID = 203) – The number of errors that were corrected using hardware ECC
- 1241 • Soft ECC Correction (ID = 204) – The number of errors that were corrected using software ECC
- 1242 • Transfer Error Rate (ID = 240) – The number of data transfer errors caused by a link reset

1243 The following table represents the list of tests that are used by one disk drive vendor.

Test Name	Description
Device Information	This provides information about the HDD (model string, serial #, capacity, config verification, firmware revision)(can possibly get device info even though drive cannot perform I/O)(no user controls).

Test Name	Description
SMART Short Self-Test	<p>This executes the SMART (Self-Monitoring, Analysis, and Reporting Technology) drive Self-Test routine. This test runs only on SATA and SCSI drives that support off-line data collection or Self-Test. (runs just a subset, returns success/failure status only, no user control, a few minutes).</p> <p>For SCSI, a Self-Test is initiated using a Send Diagnostic command (operation code = 1D) while the results of the Self-Test are retrieved using a Receive Diagnostics Results command (operation code = 1C).</p>
SMART Status Test	<p>This checks the status of predictive failures for SATA and SCSI hard disk drives that support SMART. (examines error/failure statistics collected by drive, no user control, immediate return).</p>
SMART Extended Self-Test	<p>This test runs the drive's SMART Extended Self-Test for hard disk drives that support SMART technology (no user control, longer than short Self-Test, maybe an hour to run, full set of implemented tests).</p>
SMART Selective (LBA) Self-Test	<p>This test runs the drive's SMART Extended Self-Test selectively - only for the specified Spans. There are 3 expected supported spans: Span1 is at the start of the drive, Span2 is in the middle of the drive and Span3 is at the end of the drive. This is for hard disk drives that support SMART technology (user selects the LBA range but not the tests to run).</p>
SMART Timed Self-Test	<p>This test runs the drive's SMART Extended Self-Test only for the specified time. This is for hard disk drives that support SMART technology (runs through ordered list of tests and stops after a period of time at whatever test it is running).</p>
Performance/Speed Test	<p>Determines the data transfer rate, the sequential seek time, and the random seek time based on transfer size, seek count, and data transferred.</p>
Sequential Read Test	<p>This test checks the drive head's ability to read from sector to sector in a straight line, beginning from the first sector and continuing sequentially to the last sector. (user can specify LBA range, size of data transferred)(data is transferred to host).</p>
Sequential Read-Write-Read-Compare	<p>This test checks the drive head's ability to sequentially read specified range of blocks (start, end, and skip blocks) and writes the read data back. The test then reads the data a second time and compares it with the data that was originally read. (user specified LBA range and size of data transferred, data is not actually changed intentionally, is Risky, bad sector remap is transparent to this test).</p>
Sequential Verify Test	<p>This test verifies the drive's ability to read and verify sequentially from track to track and head to head. (uses ATA command)(no SCSI equivalent?)(data is not transferred to the host, internal verify).</p>
Random Read Test	<p>This test verifies the drive's ability to read data randomly from block to block. (user control by LBA range and size of data transferred, maybe random seed?).</p>

Test Name	Description
Random Read-Write-Read-Compare	This test checks the drive head's ability to randomly read a specified range of blocks (begin, end, and skip blocks) and writes the read data back. The test then reads the data a second time and compares it with the data that was originally read. (user specified LBA range and size of data transferred and maybe random seed(?), data is not actually changed intentionally, is Risky, bad sector remap is transparent to this test).
Region Test	The test performs reads a block of data, saves the data into a buffer, if read call passes, writes a specific pattern to that block, if write call passes, it reads it back, compares the data. Then, restores the original data. (is Risky, is Destructive, user specified LBA range and size of data transferred).
Grown Defects Test (B)	This test will find the number of grown defects on the drive. For ATA use ATA command. For SCSI use SCSI command.

1244
1245**ANNEX B**
Change log

Version	Date	Description
0.1.0	2010-05-10	Initial Version
0.2.0	2010-08-24	Updated to be consistent with latest specification template
1.0.0a	2010-10-26	Updated to reflect Work In Progress and associated data (updated version number, notice of expiration, updated footers)
1.0.0	2011-02-16	Draft Standard
1.0.0	2011-06-13	Revised Draft Standard
1.1.0a	2014-5-22	Upgraded the profile for DSP1002 v2.1.0 - Added Alerts and Standard Messages - Adapted the profile for DSP1119 (Diagnostic Job Control)

1246