

# ISO/IEC 30193:2021-12 (E)

## Information technology - Digitally recorded media for information interchange and storage - 120 mm triple layer (100,0 Gbytes per disk) BD rewritable disk

---

<b>Contents</b>		<b>Page</b>
Foreword.....		ix
Introduction.....		x
<b>1</b>	<b>Scope</b> .....	<b>1</b>
<b>2</b>	<b>Normative references</b> .....	<b>1</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>1</b>
<b>4</b>	<b>Symbols and abbreviated terms</b> .....	<b>6</b>
<b>5</b>	<b>Conformance</b> .....	<b>8</b>
5.1	Optical disk.....	8
5.2	Generating system.....	8
5.3	Receiving system.....	8
5.4	Compatibility statement.....	8
<b>6</b>	<b>Conventions and notations</b> .....	<b>8</b>
6.1	Levels of grouping.....	8
6.2	Representation of numbers.....	8
6.3	Integer calculus.....	10
<b>7</b>	<b>General description of disk</b> .....	<b>10</b>
<b>8</b>	<b>General requirements</b> .....	<b>11</b>
8.1	Environments.....	11
8.1.1	Test environment.....	11
8.1.2	Operating environment.....	12
8.1.3	Storage environment.....	13
8.1.4	Transportation.....	14
8.2	Safety requirements.....	14
8.3	Flammability.....	14
<b>9</b>	<b>Reference drive</b> .....	<b>15</b>
9.1	General.....	15
9.2	Measurement conditions.....	15
9.3	Optical system.....	15
9.4	Optical beam.....	16
9.5	HF read channel.....	16
9.6	Radial PP read channel.....	17
9.7	Disk clamping.....	17
9.8	Rotation of disk and measurement velocity.....	17
9.9	Normalized servo transfer function.....	18
9.10	Measurement velocities and reference servos for axial tracking.....	18
9.10.1	General.....	18
9.10.2	Reference servo for axial tracking for 1x measurement velocity.....	19
9.10.3	Reference servo for axial tracking for 2x measurement velocity.....	20
9.11	Measurement velocities and reference servos for radial tracking.....	21
9.11.1	General.....	21
9.11.2	Reference servo for radial tracking for 1x measurement velocity.....	21
9.11.3	Reference servo for radial tracking for 2x measurement velocity.....	23
<b>10</b>	<b>Dimensional characteristics</b> .....	<b>24</b>
10.1	General.....	24

10.2	Disk reference planes and reference axis.....	24
10.3	Overall dimensions.....	26
10.4	First transition area.....	26
10.5	Protection ring.....	26
10.6	Clamping zone.....	26
10.7	Second transition area.....	27
10.8	Information area.....	27
	10.8.1 General.....	27
	10.8.2 Subdivision of information zone on TL disk.....	28
10.9	Rim area.....	29
<b>11</b>	<b>Mechanical characteristics.....</b>	<b>29</b>
11.1	Mass.....	29
11.2	Moment of inertia.....	29
11.3	Dynamic imbalance.....	29
11.4	Axial runout.....	29
	11.4.1 General.....	29
	11.4.2 Residual axial tracking error for 1x measurement velocity.....	30
	11.4.3 Residual axial tracking error for 2x measurement velocity.....	30
11.5	Radial runout.....	30
	11.5.1 General.....	30
	11.5.2 Residual radial tracking error for 1x measurement velocity.....	31
	11.5.3 Residual radial tracking error for 2x measurement velocity.....	31
11.6	Durability of cover layer.....	31
	11.6.1 Impact resistance of cover layer.....	31
	11.6.2 Scratch resistance of cover layer.....	32
	11.6.3 Repulsion of fingerprints by cover layer.....	32
<b>12</b>	<b>Optical characteristics in information area.....</b>	<b>32</b>
12.1	General.....	32
12.2	Refractive index of transmission stacks (TS).....	32
12.3	Thickness of transmission stacks (TS).....	32
12.4	Example of target thickness of spacer layers for TL disks.....	33
12.5	Reflectivity of recording layers.....	35
12.6	Birefringence.....	36
12.7	Angular deviation.....	36
<b>13</b>	<b>Data format.....</b>	<b>37</b>
13.1	General.....	37
13.2	Data frame.....	39
13.3	Error-detection code (EDC).....	39
13.4	Scrambled data frame.....	40
13.5	Data block.....	40
13.6	LDC block.....	41
13.7	LDC code words.....	42
13.8	LDC cluster.....	43
	13.8.1 General.....	43
	13.8.2 First interleaving step.....	43
	13.8.3 Second interleaving step.....	43
13.9	Addressing and control data.....	45
	13.9.1 General.....	45
	13.9.2 Address units.....	45
	13.9.3 User control data.....	49
	13.9.4 Byte/Bit assignment for user control data.....	50
13.10	Access block.....	52
13.11	BIS block.....	52
13.12	BIS code words.....	53
13.13	BIS cluster.....	54
13.14	ECC cluster.....	57
13.15	Recording frames.....	58
13.16	Physical cluster.....	59
13.17	17PP modulation for recordable data.....	59
	13.17.1 General.....	59
	13.17.2 Bit conversion rules.....	59
	13.17.3 dc-control procedure.....	60
	13.17.4 Frame sync.....	60

13.18	Modulation and NRZI conversion.....	62
<b>14</b>	<b>Physical data allocating and linking.....</b>	<b>62</b>
14.1	General.....	62
14.2	Recording-unit block (RUB).....	63
14.2.1	General.....	63
14.2.2	Data run-in.....	63
14.2.3	Data run-out.....	64
14.2.4	Guard_3 field.....	65
14.3	Locating data relative to wobble addresses.....	66
14.3.1	General.....	66
14.3.2	Start position shift (SPS).....	66
<b>15</b>	<b>Track format.....</b>	<b>68</b>
15.1	General.....	68
15.2	Track shape.....	68
15.2.1	General.....	68
15.2.2	Groove geometry.....	69
15.3	Track path.....	69
15.4	Track pitch.....	70
15.4.1	Track pitch in BCA zone.....	70
15.4.2	Track pitch in embossed HFM areas.....	70
15.4.3	Track pitch in rewritable areas.....	70
15.4.4	Track pitch between embossed HFM area and rewritable area.....	70
15.5	Track layout of HFM grooves.....	70
15.5.1	General.....	70
15.5.2	Data format.....	71
15.5.3	Addressing and control data.....	72
15.5.4	Recording frames.....	76
15.6	Track layout of wobbled grooves.....	78
15.6.1	General.....	78
15.6.2	Modulation of wobbles.....	78
15.6.3	Wobble polarity.....	80
15.7	ADIP information.....	80
15.7.1	General.....	80
15.7.2	ADIP unit types.....	80
15.7.3	ADIP word structure.....	81
15.7.4	ADIP data structure.....	82
15.7.5	ADIP error correction.....	85
15.8	Disk information (DI) in ADIP aux frame.....	87
15.8.1	General.....	87
15.8.2	Error protection for disk-information (DI) aux frames.....	88
15.8.3	Disk-Information (DI) data structure.....	89
<b>16</b>	<b>General description of information zone.....</b>	<b>139</b>
16.1	General.....	139
16.2	Format of information zone.....	140
<b>17</b>	<b>Layout of rewritable area of information zone.....</b>	<b>140</b>
17.1	General.....	140
17.2	Physical sector numbering.....	144
<b>18</b>	<b>Inner zone.....</b>	<b>145</b>
18.1	General.....	145
18.2	Permanent information and control data (PIC) zone.....	148
18.2.1	General.....	148
18.2.2	Content of PIC zone.....	148
18.2.3	Emergency brake.....	149
18.3	Rewritable area of inner zone(s).....	151
18.3.1	Protection zone 2.....	151
18.3.2	Buffer.....	151

18.3.3	INFO 2/Reserved 8	151
18.3.4	INFO 2/Reserved 7	151
18.3.5	INFO 2/Reserved 6	152
18.3.6	INFO 2/Reserved 5	152
18.3.7	INFO 2/PAC 2	152
18.3.8	INFO 2/Reserved	152
18.3.9	INFO 2/DMA 2	152
18.3.10	INFO 2/Buffer 2	152
18.3.11	INFO 2/Control data 2	152
18.3.12	OPC/Test zone	152
18.3.13	Reserved	152
18.3.14	INFO 1/Buffer 1	153
18.3.15	INFO 1/Drive area (optional)	153
18.3.16	INFO 1/Reserved 3	154
18.3.17	INFO 1/Reserved 2	154
18.3.18	INFO 1/Reserved 1	154
18.3.19	INFO 1/DMA 1	154
18.3.20	INFO 1/Control Data 1	154
18.3.21	INFO 1/PAC 1	154
18.3.22	INFO 1/Reserved	155
<b>19</b>	<b>Data zone</b>	<b>155</b>
<b>20</b>	<b>Outer zone(s)</b>	<b>155</b>
20.1	General	155
20.2	INFO 3/Buffer 3	155
20.3	INFO 3/DMA 3	156
20.4	INFO 3/Control data 3	156
20.5	Angular buffer	156
20.6	INFO 4/DMA 4	156
20.7	INFO 4/Control data 4	156
20.8	INFO 4/Buffer 4	156
20.9	DCZ 0/Test zone, DCZ 1/Test zone and DCZ 2/Test zone	156
20.10	Protection zone 3	156
<b>21</b>	<b>Physical-access control clusters</b>	<b>156</b>
21.1	General	156
21.2	Layout of PAC zones	157
21.3	General structure of PAC clusters	157
21.4	Primary PAC cluster (mandatory)	161
21.5	Disk write-protect (DWP) PAC cluster (optional)	164
21.6	IS1 and IS2 PAC clusters	168
<b>22</b>	<b>Disk management</b>	<b>169</b>
22.1	General	169
22.2	Disk-management structure (DMS)	170
22.2.1	General	170

	22.2.2 Disk-definition structure (DDS).....	171
	22.2.3 Defect list (DFL).....	174
<b>23</b>	<b>Assignment of logical-sector numbers (LSNs).....</b>	<b>179</b>
<b>24</b>	<b>Characteristics of grooved areas.....</b>	<b>180</b>
<b>25</b>	<b>Method of testing for grooved area.....</b>	<b>180</b>
	25.1 General.....	180
	25.2 Environment.....	180
	25.3 Reference drive.....	180
	25.3.1 General.....	180
	25.3.2 Read power.....	180
	25.3.3 Read channels.....	180
	25.3.4 Tracking requirements.....	181
	25.3.5 Scanning velocities.....	181
	25.4 Definition of signals.....	181
	25.4.1 General.....	181
	25.4.2 Push-pull signal.....	181
	25.4.3 Wobble signal.....	182
<b>26</b>	<b>Signals from HFM grooves.....</b>	<b>182</b>
	26.1 Push-pull polarity.....	182
	26.2 Push-pull signal.....	183
	26.3 Wobble signal.....	183
	26.4 Jitter of HFM signal.....	183
<b>27</b>	<b>Signals from wobbled grooves.....</b>	<b>183</b>
	27.1 Phase depth.....	183
	27.2 Push-pull signal.....	183
	27.3 Wobble signal.....	184
	27.3.1 General.....	184
	27.3.2 Measurement of $I_{NWS}$ .....	184
	27.3.3 Measurement of the wobble CNR.....	184
	27.3.4 Measurement of harmonic distortion of wobble.....	184
<b>28</b>	<b>Characteristics of recording layer.....</b>	<b>185</b>
<b>29</b>	<b>Method of testing for recording layer.....</b>	<b>185</b>
	29.1 General.....	185
	29.2 Environment.....	185
	29.3 Reference drive.....	185
	29.3.1 General.....	185
	29.3.2 Read power.....	185
	29.3.3 Read channels.....	185
	29.3.4 Tracking requirements.....	186
	29.3.5 Scanning velocities.....	186
	29.4 Write conditions.....	186
	29.4.1 Write-pulse waveform.....	186
	29.4.2 Write powers.....	186
	29.4.3 Average power.....	187
	29.4.4 Write conditions for i-MLSE measurement.....	187
	29.4.5 Write conditions for cross-erase measurements.....	187
	29.5 Definition of signals.....	187
<b>30</b>	<b>Signals from recorded areas.....</b>	<b>188</b>
	30.1 HF signals.....	188
	30.2 Modulated amplitude.....	188
	30.3 Reflectivity-modulation product.....	189
	30.4 Asymmetry.....	189
	30.5 i-MLSE@DOW( $n$ ).....	190
	30.6 Cross-erase @ DOW( $n$ ) <sub>XE</sub> .....	190

30.7	Read stability.....	190
<b>31</b>	<b>Local defects.....</b>	<b>191</b>
<b>32</b>	<b>Characteristics of user data.....</b>	<b>191</b>
<b>33</b>	<b>Method of testing for user data.....</b>	<b>191</b>
33.1	General.....	191
33.2	Environment.....	192
33.3	Reference drive.....	192
33.3.1	General.....	192
33.3.2	Read power.....	192
33.3.3	Read channels.....	192
33.3.4	Error correction.....	192
33.3.5	Tracking requirements.....	192
33.3.6	Scanning velocities.....	192
33.4	Error signals.....	192
33.4.1	Byte error.....	192
33.4.2	Burst error.....	192
33.4.3	Symbol error rate (SER).....	193
33.4.4	Random symbol error rate (RSER).....	193
<b>34</b>	<b>Minimum quality of recorded information.....</b>	<b>194</b>
34.1	General.....	194
34.2	Random symbol error rate (RSER).....	194
34.3	Maximum burst errors.....	194
34.4	User-written data.....	194
<b>35</b>	<b>Burst-cutting area (BCA).....</b>	<b>194</b>
<b>Annex A (normative) Thickness of transmission stacks (TSs) in case of multiple layers.....</b>		<b>196</b>
<b>Annex B (normative) Measurement of reflectivity.....</b>		<b>199</b>
<b>Annex C (normative) Measurement of scratch resistance of cover layer.....</b>		<b>205</b>
<b>Annex D (normative) Measurement of repulsion of grime of cover layer.....</b>		<b>207</b>
<b>Annex E (normative) Measurement of wobble amplitude.....</b>		<b>210</b>
<b>Annex F (normative) Write-pulse waveform for testing.....</b>		<b>215</b>
<b>Annex G (normative) Optimum power control (OPC) procedure for disk.....</b>		<b>222</b>
<b>Annex H (normative) HF signal pre-processing for integrated-maximum likelihood sequence error estimation (i-MLSE) measurements.....</b>		<b>225</b>
<b>Annex I (normative) Measurement procedures.....</b>		<b>237</b>
<b>Annex J (informative) Measurement of birefringence.....</b>		<b>249</b>
<b>Annex K (informative) Measurement of thickness of cover layer and spacer layer.....</b>		<b>251</b>
<b>Annex L (informative) Measurement of impact resistance of cover layer.....</b>		<b>254</b>
<b>Annex M (informative) Groove deviation and wobble amplitude.....</b>		<b>256</b>
<b>Annex N (informative) Guidelines for write pulse adjustment using L-SEAT edge-shift.....</b>		<b>258</b>
<b>Bibliography.....</b>		<b>267</b>