

ISO/IEC 22050:2002-10 (E)

Information technology_- Data interchange on 12,7_mm, 384-track magnetic tape cartridges_- Ultrium-1 format

Contents

Section 1 – General

1	Scope	1
2	Conformance	1
2.1	Magnetic tape cartridge	1
2.2	Generating system	1
2.3	Receiving system	1
3	Normative references	1
4	Terms and definitions	2
4.1	Access Point	2
4.2	algorithm	2
4.3	algorithmically processed data	2
4.4	a.c. erase	2
4.5	Average Signal Amplitude	2
4.6	back surface	2
4.7	Beginning of Tape (BOT)	2
4.8	Beginning of Wrap (BOW)	2
4.9	bit	2
4.10	bit cell	2
4.11	Broad Band Signal-to-Noise Ratio (BBSNR)	2
4.12	byte	2
4.13	cartridge	2
4.14	Channel bit	3
4.15	Codeword	3
4.16	Codeword Pair	3
4.17	Codeword Quad (CQ)	3
4.18	CQ Set	3
4.19	cyclic redundancy check (CRC) character	3
4.20	Data Set	3
4.21	Data Set Information Table (DSIT)	3
4.22	End of Data (EOD)	3
4.23	End of Tape (EOT)	3
4.24	End of Wrap (EOW)	3
4.25	Error Correcting Code (ECC)	3
4.26	File Mark	3
4.27	flux transition position	3
4.28	flux transition spacing	3
4.29	forward tape motion	3
4.30	header	3
4.31	Housekeeping Data Set	3
4.32	logical forward	4
4.34	Logical Point	4
4.35	magnetic tape	4
4.36	Master Standard Reference Tape (MSRT)	4
4.37	LTO Cartridge Memory (LTO CM)	4
4.38	Optimum Recording Current	4

4.39	physical end of tape	4
4.40	physical forward	4
4.41	physical reverse	4
4.42	pre-record condition	4
4.43	processed data	4
4.44	Processed Record	4
4.45	Processing (Compression)	4
4.46	Protected Record	4
4.47	Record	5
4.48	recorded element	5
4.50	Reprocessing (Decompression)	5
4.51	reverse tape motion	5
4.52	run length limited encoding (RLL)	5
4.53	Secondary Standard Reference Tape (SSRT)	5
4.54	servo acquisition region	5
4.55	Standard Reference Amplitude (SRA)	5
4.56	Symbol	5
4.57	Synchronised Codeword Quad (SCQ)	5
4.58	Test Recording Density (TRD)	5
4.59	wrap	5
4.60	write equalisation	5
4.61	(1,7) RLL code	5
5	Conventions and notations	6
5.1	Representation of numbers	6
5.2	Dimensions	6
5.3	Names	6
5.4	Alphanumeric string encoding	6
6	Acronyms	6
7	Environment and safety	6
7.1	Cartridge and tape testing environment	7
7.2	Cartridge operating environment	7
7.3	Cartridge storage environment	7
7.4	Tape tension	7
7.5	Safety	7
7.6	Flammability	7
7.7	Transportation	7
Section 2 - Requirements for the Cartridge		8
8	Dimensional and Mechanical Characteristics of the Cartridge	8
8.1	Elements of the cartridge	8
8.2	Reference Planes of the case	8
8.3	Dimensions of the case	8
8.3.1	Overall dimension	8
8.3.2	Reference points for reference planes	9
8.3.3	Positioning notches	10
8.3.4	Handling notches	10
8.3.5	Mis-insertion protection	11
8.3.6	Stacking features	11
8.3.7	Label area of the rear side	12
8.3.8	Central window	12
8.3.9	Sliding door	12
8.3.10	Case opening	12
8.4	Write-inhibit mechanism	13

8.5	Flexibility of the case	13
8.5.1	Requirements	13
8.5.2	Procedure	13
8.6	Tape reel	13
8.6.1	Locking mechanism	13
8.6.2	Axis of rotation of the reel	14
8.6.3	Reel flanges	14
8.6.4	Metallic insert	14
8.6.5	Toothed rim	15
8.6.6	Hub of the reel	15
8.6.7	Relative positions of hub and case	15
8.6.8	Characteristics of the toothed rim	15
8.7	Magnetic tape	16
8.7.1	Tape wind	16
8.7.2	Wind tension	16
8.7.3	Circumference of the tape reel	16
8.7.4	Moment of inertia	16
8.8	Leader pin assembly	17
8.8.1	Leader pin assembly dimensions	17
8.8.2	Leader tape attachment to leader pin assembly	17
8.8.3	Latching the leader pin assembly in the case	17
8.8.4	Mechanism and tape exit keepout area	18
8.9	LTO CM	18
8.10	Areas reserved for cartridge presence sensing	19
8.11	Handling grips and insertion indicator	19
8.11.1	Side grips	19
8.11.2	Insertion indicator	19
8.11.3	Top grip	19
8.11.4	Bottom grip	20
8.12	Pad Printing Areas	20
8.13	Opacity	20
Section 3 - Requirements for the Unrecorded Tape		35
9	Mechanical, physical and dimensional characteristics of the tape	35
9.1	Materials	35
9.2	Tape length	35
9.2.1	Length of magnetic tape	35
9.2.2	Length of leader tape	35
9.2.3	Length of splicing tape	35
9.3	Tape Width	35
9.3.1	Width of magnetic tape	35
9.3.2	Width of leader tape	35
9.3.3	Width of splicing tape	35
9.3.4	Procedure	36
9.4	Tape Thickness	36
9.4.1	Procedure	36
9.5	Longitudinal curvature	36
9.5.1	Procedure	36

9.6	Edge Quality	36
9.6.1	Edge deviation	36
9.7	Tape flatness	37
9.7.1	Cupping	37
9.7.2	Curl/Twist	38
9.8	Coating adhesion	38
9.8.1	Procedure	38
9.9	Layer-to-layer adhesion	38
9.9.1	Requirement	38
9.9.2	Procedure	39
9.10	Coefficient of friction	40
9.10.1	Requirement	40
9.10.2	Procedure for the measurement of the dynamic friction between the magnetic surface and the back surface	40
9.10.3	Procedure for the measurement of the dynamic friction between the back surface and SS-310 stainless steel	40
9.10.4	Procedure for the measurement of the dynamic friction between the magnetic surface and AlO ₂ /TiC ceramic	40
9.11	Surface quality	41
9.11.1	Surface roughness	41
9.12	Abrasivity	41
9.13	Tensile strength	41
9.13.1	Breaking strength	41
9.13.2	Offset yield strength	41
9.14	Longitudinal compliance	41
9.14.1	Procedure	42
9.15	Residual elongation	42
9.15.1	Requirement	42
9.15.2	Procedure	42
9.16	Flexural rigidity	42
9.16.1	Requirement	42
9.16.2	Procedure	42
9.17	Transverse dimensional stability	42
9.18	Electrical resistance of coated surfaces	42
9.18.1	Requirement	42
9.18.2	Procedure	42
10	Magnetic Recording Characteristics	43
10.1	General	43
10.2	Test conditions	43
10.3	Optimum Recording Current	44
10.4	Signal amplitude	44
10.5	Resolution	44
10.6	Overwrite	44
10.6.1	Requirement	44

10.7	Ease of erasure	44
10.8	Broad Band Signal-to-Noise Ratio	44
10.8.1	Requirement	44
10.9	Tape quality	44
10.9.1	Missing pulses	44
10.9.2	Missing pulse zone	45
Section 4 - Requirements for an Interchanged Tape		45
11	Method of recording servo bands	45
11.1	General	45
11.2	Servo bands	45
11.2.1	Servo stripes	46
11.2.2	Servo bursts	46
11.2.3	Servo frames	46
11.2.4	Servo signal amplitude	47
11.2.5	Servo signal polarity	47
11.2.6	Servo defects	48
11.3	Servo frame encoding	48
11.3.1	Method of encoding position and manufacturer's data	48
11.3.2	LPOS word construction	50
11.3.3	Tape manufacturer encoding	51
11.3.4	Cross tape identification	53
11.4	Servo band location	53
11.5	Servo band pitch	53
11.6	Nominal servo locations	53
11.7	Long-term average servo location	53
12	Method of recording data tracks	54
12.1	Physical recording density	54
12.2	Nominal bit cell length	54
12.3	Long-term average bit cell length	54
12.4	Short-term Average Bit Cell Length (STA)	54
12.5	Rate of change of the STA	54
12.6	Bit shift	54
12.7	Recording performance test conditions	54
12.8	Track sequence addressing	54
12.9	Location of data tracks	55
12.10	Track width	55
12.11	Adjacent track pitch	56
12.12	Azimuth	56
12.13	Total character skew	56
12.14	Channel Layout	56
13	Format	57
13.1	General	57
13.2	Protected Record	58
13.3	Processed Protected Record Sequence	59
13.3.1	Control Symbols	59
13.3.2	End Marker	60
13.3.3	Access Points	60
13.3.4	Alignment and append points	61

13.4	Data Set	61
13.4.1	Format Identification Data Set (FID)	61
13.4.2	User Data Set	62
13.4.3	EOD Data Set	62
13.4.4	Housekeeping Data Set	62
13.5	Data Set Information Table (DSIT)	62
13.5.1	Drive Manufacturer Use	63
13.5.2	Drive Manufacturer Use C1	63
13.5.3	Reserved	63
13.5.4	Drive Manufacturer's Identity	63
13.5.5	Data Set number	63
13.5.6	Valid Data Length	64
13.5.7	Access Point Offset	64
13.5.8	Total Records	64
13.5.9	Total File Marks	65
13.5.10	Record Count	65
13.5.11	File Mark Count	66
13.5.12	Thread Count	66
13.5.13	Data Set Type	66
13.5.14	Data Set Flags	67
13.5.15	Thread Write Pass	67
13.5.16	Tape Write Pass	67
13.6	ECC	67
13.6.1	Sub Data Set	68
13.6.2	C1 Sub Data Set	68
13.6.3	ECC Encoded Sub Data Set	69
13.6.4	Codeword Pair designation	70
13.7	Codeword Quads (CQ)	70
13.7.1	Codeword Pair Header	71
13.7.2	First Codeword Pair	72
13.7.3	Second Codeword Pair	72
13.8	Allocation of CQs to Logical Tracks	73
13.9	Data randomisation	74
13.10	RLL encoding	74
14	Recording of data on tape	75
14.1	Synchronised Data Set	75
14.1.1	Data Set Separator (DSS)	75
14.1.2	VFO Field 1	76
14.1.3	VFO Field 2	76
14.1.4	Synchronised Codeword Quad (SCQ)	76
14.2	Write equalisation bit encoding	77
14.3	Writing cells on tape	77
15	Regions on tape	77
15.1	Logical Points and regions	77
15.2	Calibration Region	79
15.3	User Data Region	79
15.4	Interrupted Data Sets	79
15.5	Repeated CQ Sets	80

15.6	Amble CQs	80
15.7	Beginning of Wrap (BOW)	81
15.8	End of Wrap (EOW)	81
15.9	Appending and Overwriting	81
15.10	Servo Tracking Faults	82
Annexes		
A	- Measurement of Bit Shift	83
B	- Measurement of Broad Band Signal-to-Noise Ratio	84
C	- Tape Abrasivity Measurement Procedure	86
D	- LTO Cartridge Memory	88
E	- Flexural Rigidity Procedure	107
F	- LTO CM electrical interface	109
G	- Recommendations for transportation	126
H	- Inhibitor Tape	127
I	- Vendor code lists	128