Standardization of Optical Disk Cartridges (ODCs) by Ecma International since 1984

September 2011

1 First Programme of Work of TC31, 1987-1991

TC31 was set up by Ecma International with a view to producing Ecma Standards for ODCs, to respond to the market need for standards in this field. However, ODCs being a new medium - at least from a standardization point of view - it was first necessary to identify all important parameters of the unrecorded disk and to agree on those deemed to be relevant for interchange. The next problem was to agree on the format to be used for the recorded disk. Before these essential matters could be considered it was first necessary to agree on the physical dimensions of the case itself. The problem there was that these dimensions, in particular the thickness of the case, should be convenient for the different disk designs under consideration and, at the same time, allow for the design of drives the dimensions of which should be compatible with those of drives for magnetic flexible disk cartridges. The same discussions took place in ISO/IEC JTC 1/SC 23.

Once the problem with the case was practically solved, TC31 decided to undertake the following programme of work:

- To participate actively in the development in SC 23 of International Standard 9171, an ODC with a disk of 130 mm intended for write once read multiple (WORM) applications,
- To participate actively in the development in SC 23 of International Standard 10089, an ODC with a disk of 130 mm intended for rewritable (R/W) applications,
- To develop an Ecma Standard for an ODC with a 90 mm disk intended for R/W applications,
- In parallel with these activities to produce an Ecma Standard for CD-ROM.

1.2 ISO/IEC 9171

The first Draft International Standard (DIS) produced by SC 23 proved to be quite unacceptable. Indeed, it was covering several different, incompatible designs and could, thus, not be considered as an interchange standard but rather as a more or less accurate description of the state of the art. As a consequence, this first DIS was rejected by a large majority. An 8-man team, four from Japan and four from Ecma met for a full week in Manchester/UK and produced a second, entirely new version of the DIS which was eventually accepted as an International Standard ISO/IEC 9171, in 1990. The main characteristics of this International Standard are that it specifies a single unrecorded disk, but two different formats, viz. one based on the continuous composite servo (CCS) tracking method, the other on the sample servo tracking format (SSF).

1.3 ISO/IEC 10089 and ECMA-153

ISO/IEC 10089 is the first standard of the series of standards for R/W optical disk cartridges. It was developed in SC23 with the active participation of, and major contributions from, TC31. However, it still specifies the two different formats CCS and SSF.

TC31 derived from ISO/IEC 10089 a further standard, Standard ECMA-153, which uses the disk specified by ISO/IEC 10089, specifies a single format, viz. CCS only, and is intended for write once (WO) applications only, which is achieved by software means. This Ecma Standard was adopted under the fast-track procedure as International Standard ISO/IEC 11560.

1.4 ECMA-154, ISO/IEC 10090

In close co-operation with SC 23, TC31 developed Standard ECMA-154, the first standard for 90 mm ODCs. Its main characteristics are:

- a single format, CCS, is specified,
- the disk is R/W, but may contain data recorded in embossed parts (read only recording),
- the whole editing, compared to that of ISO/IEC 10089 was improved.

The editing weakness of ISO/IEC 10089 is due to the fact that because two formats are specified, it was not always possible to separate cleanly and logically requirements for the disk from some requirements for the format(s). Standard ECMA-154 was adopted by ISO/IEC under the fast-track procedure as International Standard ISO/IEC 10090.

1.5 ECMA-130, ISO/IEC 10149

A small task force developed this standard. It was adopted under the fast-track procedure as an International Standard by ISO/IEC. It is the sole internationally recognized CD-ROM standard for data interchange.
The 2nd edition of ECMA-130 has been published in 1996.

2 Second Programme of Work of TC31, 1992-1996

The second programme of work adopted by TC31 comprises the development of

- further 130 mm ODCs for different applications,
- one standard for a 130 mm ODC of the WORM type,
- further 90 mm ODCs for different applications,
- two standards for 300 mm ODCs of the WORM type,
- one standard for a 120 mm ODC for different applications.

As a result TC31 produced seven standards, four for 130 mm ODCs and three for 90 mm ODCs, specifying a single format of the CCS type:

- ECMA-183, ECMA-184, ECMA-195, ECMA-238 (WORM)
- ECMA-201, ECMA-223, ECMA-239

In addition two standards for 300 mm were produced, and one standard for 120 mm:

- ECMA-189 for the SSF Method
- ECMA-190 for the CCS Method
- ECMA-240 for CD with PD format.

ECMA-183, ECMA-184 and ECMA-201 have been adopted by ISO/IEC JTC 1 under the fast-track procedure as International Standards ISO/IEC 13481, ISO/IEC 13549 and ISO/IEC 13963, resp.

ECMA-195 has been used by SC 23 as basis for ISO/IEC 13842. The second edition of ECMA-195 is identical with this International Standard.

ECMA-238, ECMA-239 and ECMA-240 have been adopted by ISO/IEC JTC 1 under the fast-track procedure as International Standards ISO/IEC 15486, ISO/IEC 15498 and ISO/IEC 15485, resp. ECMA-238 is based on ISO/IEC 14517.

ECMA-189 and ECMA-190 have been used by SC 23 as basis for ISO/IEC 13614 and ISO/IEC 13403 resp.

3 Third Programme of Work of TC31, 1997-2000

The third programme of work adopted by TC31 comprises the development of:

- 120 mm DVD - Read-Only disk standard, published as ECMA-267 and ISO/IEC 16448.
  The third, improved edition of ECMA-267 was published in April 2001.
- 80 mm DVD - Read-Only disk standard, published as ECMA-268 and ISO/IEC 16449.
  The third, improved edition of ECMA-268 was published in April 2001.
- 120 mm DVD-RAM disk standard, published as ECMA-272 and ISO/IEC 16824.
- a standard for the case for DVD-RAM disks, published as ECMA-273 and ISO/IEC 16825.
- 120 mm ODC with RW format (+RW), published as ECMA-274 and ISO/IEC 16969.

- 120 mm/80 mm DVD-R disk standard, published as ECMA-279 and ISO/IEC 20563.
- 130 mm ODC of the WORM type with a capacity of 5,2 Gbytes. This standard is based on ISO/IEC 15286. The development of this standard follows the same approach as used for ECMA-238 which is based on ISO/IEC 14517. Published as ECMA-280 and ISO/IEC 18093.
- 300 mm ODC of the WORM type with a capacity of 30 Gbytes, published as ECMA-317 and ISO/IEC 20162.
- 356 mm ODC of the WORM type with a capacity of 14,8 Gbytes and 25 Gbytes, published as ECMA-260 and adopted under the ISO/IEC JTC 1 fast-track procedure as ISO/IEC 15898.

4 Fourth Programme of Work of TC31, 2001- 2010

The fourth programme of work of TC31 comprises the development of

4.1 DVD - Read-Only

- Third edition of ECMA-267 (April 2001) and second edition of ISO/IEC 16448 (2002):120 mm DVD - Read-Only
- Third edition of ECMA-268 (April 2001) and second edition of ISO/IEC 16449 (2002): 80 mm DVD - Read-Only

4.2 DVD-RAM, DVD-R, DVD-RW

- ECMA-330: 120/80 mm DVD Rewritable (DVD-RAM) disk, with a capacity of 4,7 Gbytes/1,46 Gbytes per side. The first and the second edition of ECMA-330 were published in December 2001 and June 2002, respectively. ECMA-330 was published as ISO/IEC 17592 in spring 2004.
  To keep ECMA-330 aligned with ISO/IEC 17592, a third edition of ECMA-330 was published in June 2005.
- ECMA-331: Cases for the 120/80 mm DVD-RAM disk, 4,7 Gbytes/1,46 Gbytes per side. ECMA-331 was published in December 2001, and published as ISO/IEC 17594 in spring 2004.
  To keep ECMA-331 aligned with ISO/IEC 17594, a second edition of ECMA-331 was published in June 2004.
- ECMA-338: 120/80 mm DVD-RW (DVD Re-recordable) disk, a capacity of 4,7 Gbytes/1,46 Gbytes per side. ECMA-338 was published in December 2002, and published as ISO/IEC 17342 in spring 2004.
- ECMA-359: 120/80 mm DVD-R (DVD Recordable) Disk, a capacity of 4,7 Gbytes/1,46 Gbytes per side. ECMA-359 was published in December 2004, and published as ISO/IEC 23912 in autumn 2005.
- ECMA-382: 120 mm (8,54 Gbytes per side) and 80 mm (2,66 Gbytes per side) DVD Recordable Disk for Dual Layer (DVD-R for DL). ECMA-382 was published in June 2008.
- ECMA-384: 120 mm (8,54 Gbytes per side) and 80 mm (2,66 Gbytes per side) DVD Re-recordable Disk for Dual Layer (DVD-RW for DL). ECMA-384 was published in December 2008.

4.3 +R, +RW

- ECMA-337: 120/80 mm ODC with RW format (+RW), a capacity of 4,7 Gbytes /1,46 Gbytes per side, and a recording speed up to 4X. ECMA-337 was published in December 2003 (2nd edition), and published as ISO/IEC 17341 in spring 2004. The 3rd edition, with a recording speed up to 4X and VCPS, was published in December 2005, followed by fast-track processing in ISO/IEC JTC 1 in 2006 as the 3rd Edition of ISO/IEC 17341. The 4th edition was published in June 2008.
- ECMA-349: 120/80 mm ODC with +R format, a capacity of 4,7 Gbytes/1,46 Gbytes per side, and a recording speed of up to 4X. ECMA-349 was published in December 2003, and published as ISO/IEC 17344 in autumn 2004. The 2nd edition of ECMA-349 with a recording speed of up to 8X was published in June 2004 and published as 2nd edition of ISO/IEC 17344 in spring 2005. The 3rd edition, with a recording speed up to 16X and

VCPS, was published in December 2005, followed by fast-track processing in ISO/IEC JTC 1 in 2006 as the 3rd Edition of ISO/IEC 17344. The 4th edition of ECMA-349 was published in June 2008.

- ECMA-364: 120/80 mm ODC with +R Dual Layer format (+R DL), a capacity of 8,55 Gbytes/2,66 Gbytes per side, a recording speed of 2,4X, and VCPS. This standard was published in June 2005, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 25434. The 2nd edition of ECMA-364 with a recording speed of up to 8X, and VCPS was published in June 2006 and published as 2nd edition of ISO/IEC 25434 in June 2007. The 3rd edition, with a recording speed up to 16X, and VCPS was published in December 2007, followed by fast-track processing in ISO/IEC JTC 1 in 2008 as the 3rd edition of ISO/IEC 25434. The 4th edition of ECMA-364 was published in June 2008.

- ECMA-371: High speed 120/80 mm ODC with +RW HS format, a capacity of 4,7 Gbytes/1,46 Gbytes per side, a recording speed of 8X, and VCPS. This standard was published in December 2005, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 26925 in 2006. The 2nd edition was published in June 2008.

- ECMA-374: 120/80 mm ODC +RW DL format, a capacity of 8,55 and 2,66 Gbytes per side, a recording speed of 2,4X. ECMA-374 was published in December 2006, and published as ISO/IEC 29642 in November 2007. The 2nd edition of ECMA-374 was published in June 2008.

4.4   120 mm

- ECMA-394: Recordable Compact disc Systems CD-R Multi-Speed. ECMA-394 was published in December 2010. It was decided by the Ecma General Assembly that this standard should not be followed by a fast-track procedure in ISO/IEC JTC 1.

- ECMA-395: Recordable Compact disc Systems CD-RW Ultra-Speed. ECMA-395 was published in December 2010. It was decided by the Ecma General Assembly that this standard should not be followed by a fast-track procedure in ISO/IEC JTC 1.

4.5   130 mm

- ECMA-322: 130 mm ODC of the R/W-WO type with a capacity of 9,1 Gbytes, using MO technology. Published as ECMA-322 in June 2001 and ISO/IEC 22092 in spring 2004.

- ECMA-350: 130 mm ODC of the R/W-WO type with a capacity of 15 Gbytes per side, using phase change technology and Ultra Density Optical Disk (UDO) format. The 2nd Edition of ECMA-350 was published in December 2005, followed by fast-track processing in ISO/IEC JTC 1 as the 2nd Edition of ISO/IEC 17345 in 2006. To keep ECMA-350 aligned with ISO/IEC 17345, a 3rd Edition of ECMA-350 was published in December 2006.

- ECMA-380: Data Interchange on 130 mm Rewritable and Write Once Read Many Ultra Density Optical (UDO) Disk Cartridges – Capacity: 60 Gbytes per Cartridge – Second Generation. This standard was published in December 2007, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 11976 (published in November 2008).

4.6   90 mm

- ECMA-351: 90 mm ODC of the R/W type with a capacity of 1,3 Gbytes per cartridge, using MO technology. ECMA-351 was published in December 2003, and published as ISO/IEC 17346 in spring 2005.

- ECMA-353: 90 mm ODC of the R/W type with a capacity of 2,3 Gbytes per cartridge, using MO technology. ECMA-353 was published in June 2004, and published as ISO/IEC DIS 22533 in spring 2005.

4.7   60 mm

- ECMA-365: 60 mm Read-Only single sided dual layer ODC called UMD™, a capacity of 1,8 Gbytes. This standard was published in June 2005, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 25435 in 2006.

4.8 Test Method for the Estimation of the Archival Lifetime of Optical Media

- ECMA-379: Test Method for the Estimation of the Archival Lifetime of Optical Media. This standard was published in June 2007, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 10995 in 2008. ISO/IEC 10995:2008 specifies an accelerated aging test method for estimating the life expectancy for the retrievability of information stored on recordable or rewritable optical disks. This test includes details on the following formats: DVD-R/-RW/-RAM, +R/+RW. It may be applied to additional optical disk formats with the appropriate specification substitutions and may be updated by committee in the future as required. A second edition of ECMA-379 (fully aligned with ISO/IEC 10995:2008) was adopted at the December 2008 General Assembly. A third edition of ECMA-379 was adopted at the June 2010 General Assembly and followed by fast-track processing as ISO/IEC 10995:2nd edition.

- ECMA-396: Test Method for the Estimation of Lifetime of Optical Media for Long-term Data Storage. This standard was published in December 2010, followed by fast-track processing in ISO/IEC JTC 1 as ISO/IEC 16963 in 2011. ISO/IEC 16963:2011 specifies an accelerated aging test method for estimating the life expectancy for the retrievability of information stored on recordable or rewritable optical disks (both CD and DVD). This test includes details on the following formats: CD-R, CD-RW, DVD-R/-RW/-RAM, +R/+RW. It may be applied to additional optical disk formats with the appropriate specification substitutions and may be updated by the committee in the future as required.

5 Modus operandi of TC31

As in ISO/IEC JTC 1/SC 23, TC31 undertakes a project when a number of Companies (National Bodies in JTC1) are willing and able to submit the necessary technical information needed for the development of a standard. These projects, which are basically application-driven, aim at offering to users the ODCs which fit best their needs. Obviously technology advances, for instance the availability of lasers with shorter wavelengths, also play a role in the decision to start a new project.

Ecma Standards for ODCs offer to the Information Technology community clear and explicit descriptions of the different media *at the time of their availability* on the market. The timely publication of these Ecma Standards is of primary interest to users. It cannot be the role of a standardization organization, whether Ecma or ISO, to make a selection amongst the proposed designs and thus pre-empt a decision which must be taken by the open market.

Another aspect to be noted is that of the so-called backward compatibility. In general, this means that when an ODC of higher capacity is offered the corresponding new drive should be able to read ODCs of the previous generation. It must be understood that this is exclusively a drive and not an ODC problem. Indeed, the ability to read older ODCs is a technical-commercial decision to be taken by each manufacturer according to his analysis of the market. It is, so to say "always possible" to design a drive which can read - or even write on - previously used ODCs. This will depend on two factors a) will such a drive be needed, and b) can it be produced at a reasonable price.

6 Conclusion

From the above, it can be gathered that TC31 is operating in a controlled and systematic manner. The number of Ecma Standards and their adoption by ISO/IEC as International Standards reflect the considerable activity of the industry and the numerous but different needs of the users.

7 Definitions and Acronyms

7.1 Definitions

The following definitions are used:

CD-ROM

A 120 mm one-sided optical disk, entirely pre-recorded, in an irreversible way, with data. The recording method and the format are the same as those of the audio CD.

R/W

The data can be written, read and erased many times over the whole recording surface(s).

WORM

The data, once written, can be read many times; data can be appended on the remaining part of the recording surface. The data is recorded in an irreversible way.

WO

The data, once written, can be read many times; data can be appended on the remaining part of the recording surface. This functionality is obtained by software.

ROM

An optical disk part, entirely pre-recorded, in an irreversible way, with data. The data can be read many times.

P-ROM

An R/W disk which is partially ROM.

O-ROM

An optical disk which is entirely ROM.

MO (for "magneto-optical")

A recording technology using thermo-magnetic and magneto-optical effects. In P-ROM and O-ROM disks the magneto-optical effect is not used for reading the pre-recorded embossed data.

PC (for "phase change")

A recording technology using the phase change effect. In P-ROM and O-ROM disks the phase change effect is not used for reading the pre-recorded embossed data.

Capacity

The capacity is expressed in user bytes. Two capacities can be stated, e.g., if two sector lengths are available.

7.2 Acronyms

Acronyms used are:

- CCS : Continuous Composite Servo (tracking method)
- SSF : Sample Servo (tracking) Format
- VCPS: Video Content Protection System

8 Annexes

8.1 **Annex A** is a synopsis of the Ecma Standards for ODCs and the corresponding ISO/IEC standards. For the sake of completeness also the ISO/IEC standards are mentioned which are **not** based on Ecma Standards.

8.2 **Annex B** provides a taxonomy, i.e. a classification of the Ecma Standards produced by TC31. These standards provide different facilities, which are either simply specified in the standard or defined as specific Types, i.e. different implementations having common characteristics of the basic cartridge defined by the standard. The table of annex B is a matrix based on the diameter of the disk and on the facilities provided by each Type.

8.3 **Annex C** is a list of the actual Ecma Standards with their full title.

Annex A
(Relationship between Ecma and ISO/IEC standards)

	120 mm (80 mm)	90 mm	130 mm	300 mm	356 mm
1988	ECMA-130				
1989	ISO/IEC 10149				
1990			ISO/IEC 9171		
1991		ECMA-154	ISO/IEC 10089 ECMA-153		
1992		ISO/IEC 10090	ISO/IEC 11560 ECMA-183 ECMA-184		
1993		ECMA-201	ISO/IEC 13481 ECMA-195	ECMA-189 ECMA-190	ISO/IEC 10885
1994		ISO/IEC 13863 ECMA-154* ECMA-201*	ECMA-153* ISO/IEC 13549		
1995		ECMA-223	ISO/IEC 13842 ECMA-195*	ISO/IEC 13614 ISO/IEC 13403	
1996	ECMA-130* ECMA-240	ECMA-239	ECMA-238 ISO/IEC 14517		
1997	ISO/IEC 15485 ECMA-267 ECMA-268	ISO/IEC 15498 ISO/IEC 14760 ISO/IEC 15041	ISO/IEC 15486		ECMA-260
1998	ECMA-279 ECMA-272 ECMA-273 ECMA-274		ECMA-280 ISO/IEC 14517 (corrected)		ISO/IEC 15898
1999	ISO/IEC 16969 ECMA-274* ISO/IEC 16825 ISO/IEC 16824 ECMA-272* ISO/IEC 16449 ECMA-268* ISO/IEC 16448 ECMA-267*		ISO/IEC 18093 ISO/IEC 15286		
2000				ECMA-317	
2001	ISO/IEC 20563			ISO/IEC 20162	

	120 mm (80 mm)	90 mm	130 mm	300 mm
2001	ECMA-330** ECMA-331** ECMA-267** ECMA-268**		ECMA-322**	
2002	ISO/IEC 16449** ISO/IEC 16448** ECMA-330*** ECMA-337** ECMA-338**		ISO/IEC 22092**	
2003	ECMA-337*** ECMA-349**	ECMA-351**	ECMA-350**	
2004	ISO/IEC 17344** ISO/IEC 17342** ISO/IEC 17341** ISO/IEC 17341*** ISO/IEC 17594** ECMA-331* ISO/IEC 17592** ECMA-349*** ECMA-359**	ECMA-353**		
2005	ISO/IEC 23912** ISO/IEC 17344*** ECMA-330* ECMA-337**** ECMA-349**** ECMA-364** ECMA-371**	ISO/IEC 22533** ISO/IEC 17346**	ISO/IEC 17345** ECMA-350***	ECMA-365** (60 mm)
2006	ISO/IEC 26925** ISO/IEC 25434** ISO/IEC 17344**** ISO/IEC 17341**** ECMA-364*** ECMA-374**		ISO/IEC 17345*** ECMA-350*	ISO/IEC 25435** (60 mm)
2007	ISO/IEC 25434*** ISO/IEC 29642** ECMA-364****		ECMA-380**	
2008	ISO/IEC 25434**** ECMA-337***** ECMA-349***** ECMA-371*** ECMA-374*** ECMA-382** ECMA-384**		ISO/IEC 11976**	
2009				
2010	ECMA-394 ECMA-395			

*   2nd or 3rd edition of the Ecma Standard, published for full alignment with the corresponding International Standard (endorsed by fast-track processing or in another way)

** 1st NEW edition of Ecma or ISO/IEC Standard

*** 2nd NEW edition of Ecma or ISO/IEC Standard

**** 3rd NEW edition of Ecma or ISO/IEC Standard

***** 4th NEW edition of Ecma or ISO/IEC Standard

Annex B

(Classification of Optical Disk and Case/Cartridge standards)

Size in mm	Maximum Capacity	Ecma Standard	ISO/IEC Standard	Recording Technology MO	PC	Media Types R/W	WORM	WO	P-ROM	O-ROM
60	1,8 Gbytes	365	25435	-	-	-	-	-	-	UMD™
80	5,3 Gbytes **	268	16449	-	-	-	-	-	-	DVD-ROM
90	128 Mbytes	154	10090	■	-	■	-	-	■	■
90	230 Mbytes	201	13963	■	-	■	-	-	■	■
90	385 Mbytes	223	none	■	-	■	-	-	-	-
90	640 Mbytes	none	15041	■	-	■	-	-	■	■
90	650 Mbytes	239	15498	■	-	■	-	-	■	■
90	1,3 Gbytes	none	14760	-	■	■	-	-	■	■
90	1,3 Gbytes	351	17346	■	-	■	-	-	-	-
90	2,3 Gbytes	353	22533	■	-	■	-	-	-	-
120	660 Mbytes	130	10149	-	-	-	-	-	-	CD-ROM
120	660 Mbytes	394	-	-	-	-	CD-R	-	-	-
120	660 Mbytes	395	-	-	-	CD-RW	-	-	-	-
120	650 Mbytes	240	15485	-	■	■	■	-	-	-
120	17,0 Gbytes **	267	16448	-	-	-	-	-	-	DVD-ROM
120	5,2 Gbytes	272	16824	-	■	DVD-RAM	-	-	-	-
-	Case for DVD-RAM	273	16825	-	-	-	-	-	-	-
120	6,0 Gbytes	274	16969	-	■	+RW	-	-	-	-
80/120	2,46/7,90 Gbytes *	279	20563	-	■	-	DVD-R	-	-	-
80/120	2,92/9,4 Gbytes *	330	17592	-	■	DVD-RAM	-	-	-	-
-	Case for DVD-RAM	331	17594	-	-	-	-	-	-	-
80/120	2,92/9,4 Gbytes *	337	17341	-	■	+RW 4X	-	-	-	-
80/120	2,92/9,4 Gbytes *	338	17342	-	■	DVD-RW	-	-	-	-
80/120	2,92/9,4 Gbytes *	349	17344	-	■	-	+R 16X	-	-	-
80/120	2,92/9,4 Gbytes *	359	23912	-	■	-	DVD-R	-	-	-
80/120	5,32/17,10 Gbytes **	364	25434	-	■	-	+R DL	-	-	-
80/120	2,92/9,4 Gbytes *	371	26925	-	■	+RW HS	-	-	-	-
130	650 Mbytes	none	9171	-	-	-	■	-	-	-
130	650 Mbytes	none	10089	■	-	■	-	-	-	-
130	650 Mbytes	153	11560	■	-	-	-	■	-	-
130	1 Gbyte	183	13481	■	-	■	-	■	-	-
130	1,3 Gbytes	184	13549	■	-	■	-	■	■	■
130	2 Gbytes	195	13842	■	-	■	-	■	■	■
130	2,6 Gbytes	none	14517	■	-	■	-	■	■	■
130	2,6 Gbytes	238	15486	-	-	-	■	-	-	-
130	5,2 Gbytes	none	15286	■	-	■	-	■	■	■
130	5,2 Gbytes	280	18093	-	-	-	■	-	-	-
130	9,1 Gbytes	322	22092	■	-	■	-	■	-	-
130	30 Gbytes *	350	17345	-	■	■	■	-	-	-
300	12 Gbytes	189	13614	-	-	-	■	-	-	-
300	12 Gbytes	190	13403	-	-	-	■	-	-	-
300	30 Gbytes	317	20162	-	-	-	■	-	-	-
356	6,8 Gbytes	none	10885	-	-	-	■	-	-	-
356	14,8 & 25 Gbytes	260	15898	-	-	-	■	-	-	-

Legend

none	no Ecma or ISO/IEC standard in existence for this ODC		
■	specified in the standard		
-	not specified in the standard	*	double-sided
ccccc	to be published	**	double-layered, double-sided

Annex C

(Titles of current Ecma Standards)

1) **ECMA-130 – 1996 (2nd Edition)**   **ISO/IEC 10149**
   Data Interchange on Read-only 120 mm Optical Data Disks (CD-ROM)

2) **ECMA-153 – 1994 (2nd Edition)**   **ISO/IEC 11560**
   Information Interchange on 130 mm Optical Disk Cartridges of the Write Once, Read Multiple
   (WORM) Type, using the Magneto-Optical Effect
   NOTE
   This title conflicts with the definition of WORM given in clause 7; the Standard specifies a WO disk.

3) **ECMA-154 – 1994 (2nd Edition)**   **ISO/IEC 10090**
   Data Interchange on 90 mm Optical Disk Cartridges, Read Only and Rewritable, M.O.

4) **ECMA-183 – 1992**   **ISO/IEC 13481**
   Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1 Gbyte per Cartridge

5) **ECMA-184 – 1992**   **ISO/IEC 13549**
   Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1,3 Gbytes per Cartridge

6) **ECMA-189 – 1993**   **ISO/IEC 13614**
   Information Interchange on 300 mm ODCs of the WORM Type using the SSF Method

7) **ECMA-190 – 1993**   **ISO/IEC 13403**
   Information Interchange on 300 mm ODCs of the WORM Type using the CCS Method

8) **ECMA-195 – 1995 (2nd Edition)**   **ISO/IEC 13842**
   Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 2 Gbytes per Cartridge

9) **ECMA-201 – 1994 (2nd Edition)**   **ISO/IEC 13963**
   Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 230 Mbytes per Cartridge

10) **ECMA- 223 – 1995**
   Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 385 Mbytes per Cartridge

11) **ECMA-238 – 1996**   **ISO/IEC 15486**
   Data Interchange on 130 mm Optical Disk Cartridge of Type WORM using Irreversible Effects -
   Capacity: 2,6 Gbytes per Cartridge

12) **ECMA-239 – 1996**   **ISO/IEC 15498**
   Data Interchange on 90 mm Optical Disk Cartridge - HS-1 Format - Capacity: 650 Mbytes per
   Cartridge

13) **ECMA-240 – 1996**   **ISO/IEC 15485**
   Data Interchange on 120 mm Optical Disk Cartridge using Phase Change Technology - PD
   Format - Capacity : 650 Mbytes per Cartridge

14) **ECMA-260 – 1997**   **ISO/IEC 15898**
   Data Interchange on 356 mm Optical Disk Cartridges (WORM), using Phase Change Technology -
   Capacity: 14,8 Gbytes and 25 Gbytes per Cartridge

15) **ECMA-267 – 2001 (3rd Edition)**   **ISO/IEC 16448**
   120 mm DVD Read-Only Disk

16) **ECMA-268 – 2001 (3rd Edition)**   **ISO/IEC 16449**
   80 mm DVD Read-Only Disk

17) **ECMA-272 – 1999 (2nd Edition)**   **ISO/IEC 16824**
   120 mm DVD Rewritable Disk (DVD-RAM)

18) **ECMA-273 – 1998**   **ISO/IEC 16825**
   Case for 120 mm DVD-RAM Disks

19) **ECMA-274 – 1999 (2nd Edition)**   **ISO/IEC 16969**
   Data Interchange on 120 mm Optical Disk using +RW Format - Capacity: 3,0 Gbytes and 6,0
   Gbytes

20) ECMA-279 – 1998   **ISO/IEC 20563**
80 mm (1,23 Gbytes per side) and 120 mm (3,95 Gbytes per side) DVD-Recordable Disk (DVD-R)

21) ECMA-280 – 1998   **ISO/IEC 18093**
Data Interchange on 130 mm Optical Disk Cartridges of Type WORM (Write Once Read Many) using Irreversible Effects - Capacity: 5,2 Gbytes per Cartridge

22) ECMA-317 – 2000   **ISO/IEC 20162**
Data Interchange on 300 mm Optical Disk Cartridges of Type WORM (Write Once Read Many) using Irreversible Effects - Capacity: 30 Gbytes per Cartridge.

23) ECMA-322 – 2001   **ISO/IEC 22092**
Data Interchange on 130 mm Magneto-Optical Disk Cartridges - Capacity: 9,1 Gbytes per Cartridge.

24) ECMA-330 – 2005 (3rd Edition)   **ISO/IEC 17592**
120 mm (4,7 Gbytes per side) and 80 mm (1,46 Gbytes per side) DVD Rewritable Disk (DVD-RAM)

25) ECMA-331 – 2004 (2nd Edition)   **ISO/IEC 17594**
Cases for 120 mm and 80 mm DVD-RAM Disks

26) ECMA-337 – 2008 (4th Edition)   **ISO/IEC 17341**
Data Interchange on 120 mm and 80 mm Optical Disk using +RW Format – Capacity: 4,7 and 1,46 Gbytes per side (Recording speed up to 4X)

27) ECMA-338 – 2002   **ISO/IEC 17342**
80 mm (1,46 Gbytes per side) and 120 mm (4,70 Gbytes per side) DVD Re-recordable Disk (DVD-RW)

28) ECMA-349 – 2008 (4th Edition)   **ISO/IEC 17344**
Data Interchange on 120 mm and 80 mm Optical Disk using +R Format - Capacity: 4,7 and 1,46 Gbytes per Side (Recording speed up to 16X)

29) ECMA-350 – 2006 (3rd Edition)   **ISO/IEC 17345**
Data Interchange on 130 mm Rewritable and Write Once Read Many Ultra Density Optical (UDO) Disk Cartridges - Capacity: 30 Gbytes per Cartridge - First Generation

30) ECMA-351 – 2003   **ISO/IEC 17346**
Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 1,3 Gbytes per Cartridge.

31) ECMA-353 – 2004   **ISO/IEC 22533**
Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 2,3 Gbytes per Cartridge.

32) ECMA-359 – 2004   **ISO/IEC 23912**
80 mm (1,46 Gbytes per side) and 120 mm (4,70 Gbytes per side) DVD Recordable Disk (DVD-R).

33) ECMA-364 – 2007 (3rd Edition)   **ISO/IEC 25434**
Data Interchange on 120 mm and 80 mm Optical Disk using +R DL Format – Capacity: 8,55 and 2,66 Gbytes per side (Recording speed up to 8X)

34) ECMA-365 – 2005   **ISO/IEC 25435**
Data Interchange on 60 mm Read-Only ODC – Capacity: 1,8 Gbytes (UMD™).

35) ECMA-371 – 2008 (2nd Edition)   **ISO/IEC 26925**
Data Interchange on 120 mm and 80 mm Optical Disk using +RW HS Format – Capacity: 4,7 and 1,46 Gbytes per side (VCPS, Recording speed of 8X).

36) ECMA-374 – 2008 (2nd Edition)   **ISO/IEC 29642**
Data Interchange on 120 mm and 80 mm Optical Disk using +RW DL Format – Capacity: 8,55 and 2,66 Gbytes per Side (Recording speed 2,4X).

37) ECMA-379 – 2010 (3rd Edition)   **ISO/IEC 10995**
Test Method for the Estimation of the Archival Lifetime of Optical Media.

38) ECMA-380 – 2007   **ISO/IEC 11976**
Data Interchange on 130 mm Rewritable and Write Once Read Many Ultra Density Optical (UDO) Disk Cartridges – Capacity: 60 Gbytes per Cartridge – Second Generation.

39) ECMA-382 – 2008   **ISO/IEC 12862**
120 mm (8,54 Gbytes per side) and 80 mm (2,66 Gbytes per side) DVD Recordable Disk for Dual Layer (DVD-R for DL)

40) ECMA-384 – 2008   **ISO/IEC 13170**
120 mm (8,54 Gbytes per side) and 80 mm (2,66 Gbytes per side) DVD Re-recordable Disk for

41) ECMA-394 – 2010
Recordable Compact Disc Systems CD-R Multi-Speed

42) ECMA-395 – 2010
Recordable Compact Disc Systems CD-RW Ultra-Speed

43) ECMA-396 – 2010   **ISO/IEC 16963**
Test Method for the Estimation of Lifetime of Optical Media for Long-term Data Storage

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