



Optical disc

CD, DVD

Introduction

This guide aims to assist small to medium collecting organisations and individuals to care for optical discs in their collections, specifically CDs (compact discs) and DVDs (digital versatile discs) as the most common type of disc found in collections. The guide is not intended to replace the advice of a trained professional but provides the first steps in caring for optical disc collections. This guide can be used in conjunction with the others in this series: Film, Floppy disk, Magnetic tape and Digital.

The information provided in this guide includes terminology and names of technologies and processes that are complex and specific to the format in focus. For many these terms and names may be challenging to recognise or understand. Please don't be discouraged, definitions can be clarified by consulting with a conservator, professional service provider, GLAM sector agencies as well as the references and further reading provided in this guide.

Background

Dating from 1982 to the present, optical discs include three main types: manufactured read-only memory discs (CD-ROM, DVD-ROM); recordable discs (CD-R, DVD-R); and rewritable (CD-RW, DVD-RW). While these disc types may appear similar, they can be composed of different materials and structural form to allow for a range of storage capacity and capability. The data lifespan is determined by the physical longevity of the discs, their structural materials and the obsolescence of equipment, hardware and/or software required to play them.

Assessment

Before you begin assessing the discs in your collection, consider whether the required equipment – such as a DVD player or external disc drive – is accessible. Ensure you have a clean workspace with enough room to carefully position the discs as you assess them. Allow enough space to set up any additional light source and for storage and documentation, which

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Optical disc examples



may include a notebook and pencil or computer to record your findings. It is recommended that you wear nitrile gloves when handling the discs, and handle them with care.

Media and materials

The basic structure of an optical disc includes a polycarbonate plastic base layer, a data-reading layer and a protective lacquer layer. Optical discs are read from the centre outwards by a laser, following a spiral data track as the disc spins at high speed.¹

- Assessing an optical disc by appearance alone provides limited information. Look for details on the case, in accompanying documentation and printed on the disc label that might indicate the type of disc, nature of content and system requirements.

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Scratched optical disc



- CDs and DVDs have the same physical dimensions – 120mm diameter, 1.2mm thick, with a central hole.
- Optical discs record data on reflective layers composed of metals or dyes. Standard CDs have a data capacity of 700 megabytes, while DVDs have a larger capacity of 4.7 gigabytes.

Condition issues

- **Environmental conditions** such as fluctuating temperatures and relative humidity can cause damage including warping, bending, delamination of discs and/or oxidation of the metal in the reflective layers, and degradation, distortion or discolouration in dye-based layers.
- **Disc rot** or **laser rot** is indicated by pin-sized holes in the reflective layer, a coffee-coloured discolouration, or distortion in the reflective layer, which can appear as a snowflake-like or milky-white pattern. This affects early era CDs and can impact playback or cause data loss.
- Loss of data, disc skipping or disc failure can occur if discs are marked with fingerprints or other **pollutants** such as dirt, dust, moulds and solvents. Pollutants can prevent proper reading of discs, causing surface abrasions and providing food for pests.

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- If discs are scratched and written on with ink pens not designed for discs, this can result in distortions, corrosion and interference with playback or can render discs unreadable.
- Light, particularly **ultraviolet (UV)** light, causes plastics to degrade and unfiltered light can impart heat and cause fading of dye layers, which can lead to errors in or loss of data.
- Discontinuation in manufacture and support for the required hardware and software can lead to recorded material becoming inaccessible.

Handling

- Avoid touching the disc surface with bare hands and hold the discs by the centre hole or outer edge. Discs are easily damaged by rough handling, resulting in scratches and marks.
- Label discs with a CD marking pen, preferably on the clear inner ring of the disc. Avoid applying adhesive labels or tapes of any type.
- Do not bend or flex discs or put any weight on top of a disc. This prevents damage and warping, which could render discs unreadable.

Preservation

Risks usually associated with art and heritage object-based collections such as incorrect relative humidity (RH%) and temperature, light, pest activity, pollutants and improper storage conditions can all adversely affect optical discs. Good preventive conservation strategies will help to reduce these risks and assist in caring for your collection.

Preventive conservation

- Store discs in purpose-fit cases to prevent dust, dirt and mechanical damage. Archival quality materials such as Tyvek envelopes or inert plastic cases are ideal.
- Store the discs vertically in standard-sized cases with vertical supports at regular intervals at least as large as the item being supported, or vertically in standard, ventilated archive boxes.
- Remove liner notes or other materials from the case when storing. Appropriate labelling and documentation of these materials are necessary to avoid their dissociation from the disc.

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Optical discs in storage



- Store on static or mobile shelving, or in metal storage cabinets. Metal should be powder-coated or baked enamel.
- Archival copies and access copies should be stored in separate geographical locations.
- Discs stored at lower temperatures should be gradually acclimatised to their new environment (within their cases) before playback.
- Always put discs away in their storage cover after use.

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- The following table demonstrates the recommended storage environment:

CONDITIONS	RECOMMENDED PARAMETERS
Temperature	Cold (0–8°C), cool (8–16°C) or room temperature (16–23°C)
Relative Humidity (RH%)	20–50 RH%
Light	Avoid direct sunlight and limit light exposure
Storage area	A dark, cool, dry, clean and stable environment

Potential treatment

Before playback the disc should be checked for any potential issues that may cause damage to the disc or playback equipment.

- A damaged case will need to be replaced.
- Use a soft cotton cloth or non-abrasive lint-free cloth to clean discs. Wipe from the inside of the disc outwards. Do not clean in a circular pattern as this can make marks that resemble the data track, which the laser will try to follow. Avoid cleaning the label side of the disc.
- Further advice can be sought through a conservator via the [AICCM directory of conservators](#).

Migration

Migration is a key method for ensuring ongoing access to optical discs. It can involve copying the disc contents to a new, more stable storage solution. When preparing to migrate a collection, consider the following:

- Choose which discs you will migrate and create a priority list. Migration can be time consuming and expensive so perhaps not all discs will be able to be migrated. Consider whether the material is unique and original, its condition, and its usability, and which items are at greatest risk.
- Identify and record the file formats and media types.

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Optical disc capture station



- Material on optical discs can be migrated in two ways: by copying individual files from the disk to another storage device or by creating a disk image to preserve the complete disk structure and data including hidden contents.
- Successfully migrated content may still be inaccessible within contemporary computer systems due to incompatibility. An emulator (software program designed to mimic specific computer systems) may enable access to content.
- It is advisable to also make a preservation copy and an exhibition copy, and keep copies in separate geographical locations to ensure copies are not lost.

Disposal advice

All types and formats of CDs and DVDs can be recycled to recover valuable resources like polycarbonate – the plastic used to construct optical discs – and aluminium for reuse in manufacturing other products. Check with your local council for an appropriate recycler near you.

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References and further reading

C Cranmer, [*Archiving Australian Media Arts*](#), ACMI website, 2023.

F Byers, [*Care and Handling of CDs and DVDs: A Guide for Librarians and Archivists*](#), Council on Library and Information Resources, National Institute of Standards and Technology, 2003.

J Iraci, [*Error Analysis and File Recovery Software for Digital Storage Media – Canadian Conservation Institute \(CCI\) Notes 19/2*](#), Canadian Conservation Institute, Government of Canada website, 2019.

J Iraci, [*Longevity of Recordable CDs, DVDs and Blu-rays – Canadian Conservation Institute \(CCI\) Notes 19/1*](#), Canadian Conservation Institute, Government of Canada website, 2019.

J Iraci, [*Remedies for deteriorated or damaged modern information carriers*](#), Technical Bulletin no.27, Canadian Conservation Institute, Government of Canada website, 2005.

L Finch and J Webster, [*Caring for CDs and DVDs \[PDF 205KB\]*](#), National Preservation Office, The British Library, 2008.

Library of Congress, [*CD-ROM Longevity Research*](#), Library of Congress website, n.d.

M Swalwell, H Stuckey, C Moya and D de Vries, [*Collecting, Curating, Preserving and Researching Media Arts: A good practice report*](#), Swinburne University of Technology, 2023.

National Archives of Australia (NAA), [*Digital preservation planning*](#), NAA website, n.d.

National Archives of Australia (NAA), [*Preserving CDs and DVDs*](#), NAA website, n.d.

Preservation Self-Assessment Program (PSAP), [*Optical Media*](#), PSAP website, University of Illinois Urbana-Champaign, n.d.