File No. GENL-07
Form A26-5756-3

IBM Systems Reference Library

IBM Disk Pack Handling and Operating Procedures

This manual provides suggested operating and handling procedures for this unique new data processing device and illustrates the manufacturing processes involved in producing precision-engineered disk packs. This edition applies to disk packs that have plastic covers as opposed to the metal covered packs described in Form A26-5756-1.

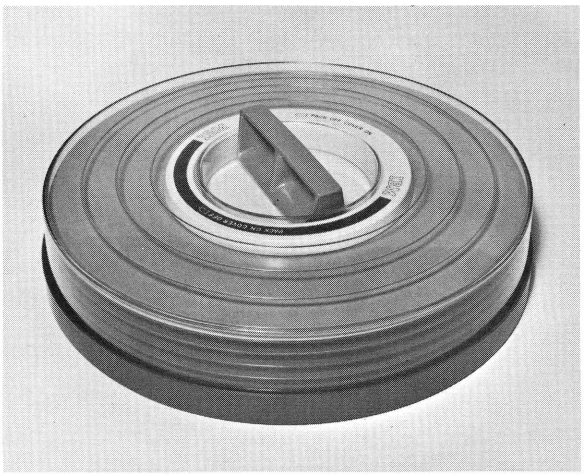
Copies of this and other IBM publications can be obtained through IBM Branch Offices. Comments concerning the contents of this publication may be addressed to: IBM, Product Publications Department, San Jose, California

Introduction

The IBM 1311 Disk Storage Drive with its removable disk pack presents a new concept in data processing. In 1953, the introduction of IBM magnetic tape provided data processing systems with the ability to process large volumes of input and output data at very high speeds; in addition, it provided virtually unlimited storage. In 1956, the RAMAC® Disk File presented another new concept in data processing by permitting storage of large volumes of data that were accessible in a random sequence. The removable disk pack for the IBM 1311 Disk Storage Drive introduces a new concept by combining the large volume and sequential processing advantages of tape systems with the random access abilities of disk storage.

Production techniques implemented by IBM laboratory and manufacturing facilities at San Jose, California, have resulted in the highest standards of quality and reliability for the disk pack.

The IBM disk pack is made up of six disks, each 14 inches in diameter, separated to permit the read/write heads in the 1311 to move between them. Data is recorded on the disks by creating selected combinations of closely spaced magnetic "spots" on an iron oxide coating on the surfaces of the disks. The presence of these "spots" in specified locations on the disk induces electrical pulses in the read/write heads. These pulses are amplified and interpreted as characters of information—numbers, letters, or special symbols. Once data has been written on a disk surface, it can be read as often as desired without any loss in accuracy. Data can be electronically erased and new information recorded in its place.



Receiving the Disk Pack

The disk pack is shipped in a container that can withstand normal freight handling abuse. However, if the container shows shipping damage, an IBM Customer Engineer should be consulted prior to using the disk pack on the 1311 Disk Storage Drive. By so doing the possibility of damage to the Drive and the disk pack can be eliminated.

The original shipping container can be retained and reused for any subsequent shipping of the disk pack. An additional supply of shipping containers can be obtained through your local IBM representative.

Storage Requirements

Disk packs should be stored in the data processing room in enclosed metal cabinets or fire-resistant containers. A separate room can be used to store duplicate master records or other vital data. If such a room is used, it should be constructed of fire-resistant material and contain appropriate fire prevention equipment.

The ideal environment for storage of disk packs is the same environment as the computer room (60°-90°, 10%-80%). If the pack is removed from this environment it should be conditioned to the operating environmental conditions for two hours. The conditioning time is required to assure correct track registration and data recording and retrieval. Storage of the pack in the computer room eliminates the conditioning requirement.

The disk pack should be stored in a clean, enclosed, metal cabinet that is elevated from the floor and protected from sources of dust and dirt such as paper, cards, etc. This precaution will minimize transfer of dust to the Disk Storage Drive during loading operations as well as providing additional protection in case of fire. Disk packs should never be stored in direct sunlight, stacked one on top of another, or stored on edge.

A two-piece cover provides a positive dust seal and maximum pack protection during the time the disk pack is removed from the machine. The top of the cover is used as a mounting tool or handle which permits the operator to secure the disk pack to the disk drive.

The cover of the disk pack is made of polystyrene material. This type of plastic provides a strong protective cover which, with normal care, will protect the disk pack throughout its life. However, if the disk pack is dropped, the cover may chip or crack, as it absorbs the impact of the fall. (See "Operating Procedures.")

Like many other modern high-quality plastics, the cover of the disk pack may ignite if it is exposed to continuous intense heat. The ignition point is 475° Fahrenheit, and if the cover burns it will release carbon monoxide gas, chlorine compounds, and intense smoke.

Machine Room Housekeeping

The read/write heads of the 1311 Disk Storage Drive "float" over the surfaces of the disk pack on a thin "film" of air molecules—a film so thin, that it is measured in millionths of an inch. Some types of dust or dirt on the disk surfaces can cause permanent damage to the disk surface and the read/write heads. An air-filtering system in the 1311 purifies the air that surrounds the disks when the 1311 is in operation. Precaution should be exercised to prevent foreign particles from entering the 1311 while disk packs are being placed on or removed from the system; dirt or dust should be kept to a minimum in the environment of the machine room.

Good housekeeping practices should always prevail in the machine room. It should receive daily attention with a vacuum, wet mop or similar device. Use of cleaning implements that raise dust such as brooms and feather dusters should be avoided. Steel wool or metal abrasives *should never* be used for buffing the floor. Waxes or other top dressings which may flake should, if used at all, be lightly applied.

Disk Pack Handling

For additional protection against dust, the air from the room is filtered before entering a Disk Storage Drive unit. Therefore, the cover of the disk storage drive must always be kept closed, whether a disk pack is installed or not, to prevent dust from bypassing the filters.

If the disk pack receives a sharp impact, such as being dropped or falling from a shelf or table, it must not be placed on a disk storage drive until it has been inspected by an IBM Customer Engineer. Such a pack if mounted on the drive, can further damage the pack and the machine.

The disk pack assembly is specifically designed to prevent removal of the cover when the pack is not on the disk storage drive. *The disk pack should never be handled without its cover.*

Care must be exercised in installing the disk pack. If the hub of the disk storage drive receives a sharp

impact from the disk pack, the contour of the hub and/or the pack drum can be altered and cause misalignment of the disk surfaces to the read/write heads.

Foreign objects must never be placed between the disks or where they can fall or be pushed against the disk surfaces.

Disk packs that contain useful information must never be exposed to an intense magnetic field. (Technically, an intensity greater than 50 oersteds may cause loss of information. The IBM Physical Planning Engineer may be consulted if high-intensity fields are suspected.)

Smoking should be avoided while handling a disk pack. Ashes can contaminate the disks. It is also recommended that smoking be prohibited in the computer room.

Disk Pack Labelling

Only the disk pack center trim shield is labeled, never the cover. The transparent cover enables the disk pack label to be read with the cover on. Labeling the disk pack only, precludes the possibility of placing a labeled cover on the wrong pack, which could result in the altering or loss of pertinent data.

Disk packs should be labeled with a material that can be removed without leaving a residue. Adhesive stickers that can be applied and removed easily are satisfactory. *Never use an eraser to alter the identification on a label.* Erasing creates foreign particles that can interfere with the proper spacing between the read/write heads and the disks. These foreign particles may be too small to detect with the human eye.

Operating Procedures

When the cover is locked onto the pack, the disk pack can be carried by the handle on the cover.

The following instructions should be used when installing or removing the disk pack:

INSTALLATION

Care should be taken when placing the disk pack on the Disk Storage Drive. The close tolerance between the disk pack and the shroud on the drive that surrounds it, has been designed to protect the disk pack when it is installed on the 1311. Nevertheless, care should be exercised while loading and unloading the pack so that the pack is protected from unnecessary abuse.

To install the disk pack on the Disk Storage Drive, unscrew and remove the bottom cover from the disk pack using the bottom cover knob. Place the disk pack on the 1311 drive spindle. Turn the top cover in a clockwise direction (as indicated by the "ON" arrows) until it comes to a full stop. Even though the cover might become disengaged before the full stop point is reached, the cover should continue to be turned to insure the activation of the "pack on" safety switch. The "pack on" safety switch must be activated before the 1311 can be started. The top cover can then be removed, leaving the disk pack locked on the spindle.

While the disk pack is on the drive, the top and bottom covers should be reassembled and stored in a designated storage area.

REMOVAL

After depressing the stop key, wait until the disk pack has stopped before proceeding. *The Disk Storage Drive cover should never be opened until after the pack has come to a complete stop.*

The disk pack is removed from the 1311 by replacing the top cover over the top of the pack, engaging the cover pins, and turning the cover in a counterclockwise direction (as indicated by the "OFF" arrows) for two full turns. The cover has then been securely fastened to the disk pack so that both the pack and the top cover can be removed from the spindle of the 1311 as a unit. The bottom cover must then be immediately attached to create a positive dust seal.

Shipping Procedures

When a disk pack is being shipped from one location to another location, certain precautions should be followed:

1. The pack must be tightly secured in its two-piece cover. This cover presents a positive dust seal and therefore it is not necessary to use a plastic bag around the pack.
2. In order to properly protect the disk pack from shock, it should be shipped or transported in the proper IBM shipping container. If the original shipping container has become worn or damaged, another can be obtained through the local IBM office. Any questions regarding packaging of the disk pack for shipment can be answered by the local IBM representative.
3. If, after a disk pack has been received, the shipping container shows damage, an IBM Customer Engineer should be consulted prior to using the disk pack on the 1311 Disk Storage Drive. By so doing the possibility of damage to the machine and the disk pack can be eliminated.
4. When a disk pack is removed from a container, it should be dusted before it is taken into the machine room for its conditioning period.

The 1311 Disk Storage Drive was designed so that the removable packs would be transportable. If the above suggestions are followed and reasonable care is used in handling, shipping the disk pack should not present any unusual hazards in data processing. No warranty of safety of data or pack, however, is expressed or implied by IBM.

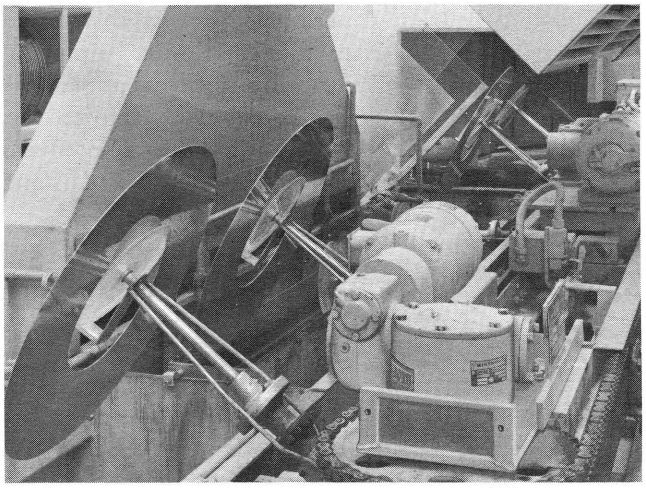
Manufacturing the disk pack is divided into two phases: fabricating the individual disks and assembling the disks with the 18 other components that make up the completed disk pack. Both the fabricating and assembling processes are performed under carefully controlled manufacturing standards and environments.

Fabricating the Disk

An important requisite for a high-quality magnetic recording disk is a high-quality substrate—an aluminum disk before the iron oxide coating is applied. The substrate for the disk pack is the result of several years of engineering development in conjunction with other industries.

The first step in the preparation of a disk is a polishing operation that brings the aluminum surface of the disk to a degree of smoothness similar to that of quality plate glass.

The polishing operation is followed by a cleaning operation. Cleaning the disks is an automated operation in which the disks are alternately dipped in acid, alkaline, and water tanks and "scrubbed" clean by an ultrasonic cleaning process. This operation is performed in one of the many "clean" rooms utilized in the fabricating and assembling process. These clean rooms are air conditioned, humidity controlled, and air filtered to exacting specifications. The nature of the operation being performed determines the extent of filtering; in some operations the dust particles removed are so small that it would require more than 400 such particles to cover the period at the end of this sentence.



Automatic application equipment is used to apply an iron oxide coating to the disk. This coating, consisting of microscopically small iron oxide particles mixed with a binding agent, is uniformly applied over the surface of the disk. The thickness of the coating is controlled within millionths of an inch.

Lint-free uniforms, caps, gloves, and boots are worn by the operator during this operation. The air-filtering requirements for the cleaning and coating operation are essential in order to provide a perfectly clean surface during the coating operation. A clean surface and a uniform iron oxide coating are the basic requirements for obtaining the necessary quality for 1311 Disk Storage operations.

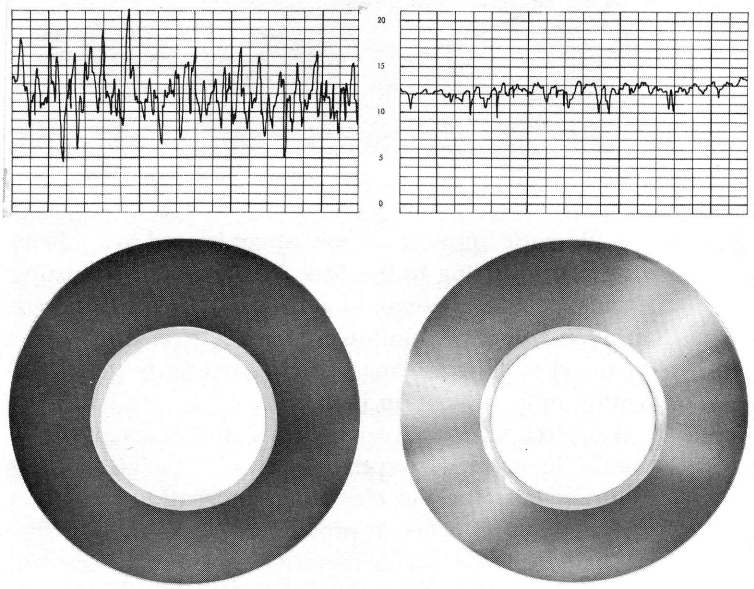
From the coating room, the disks are transported to the baking ovens where the coating is hardened and bonded to the aluminum disk. Throughout all of these operations, the disk surfaces are never touched by the operator's hands, and never come in contact with each other.

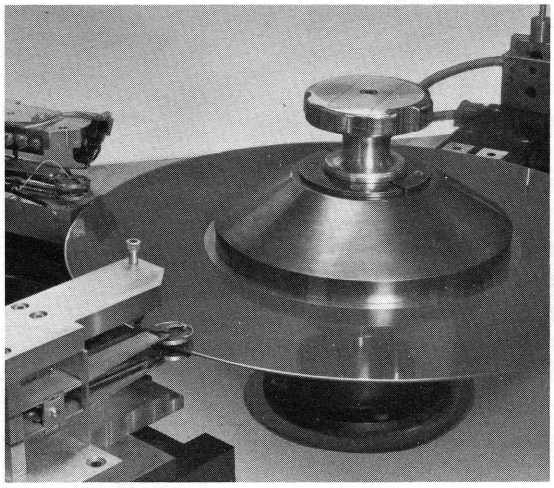
Following the baking operation, the disks are polished by specially developed techniques in order to provide additional uniformity in the iron oxide coating. The uniformity of the disk surface is recorded electronically. The illustration below shows the relative smoothness of a disk surface before and after the polishing operation.

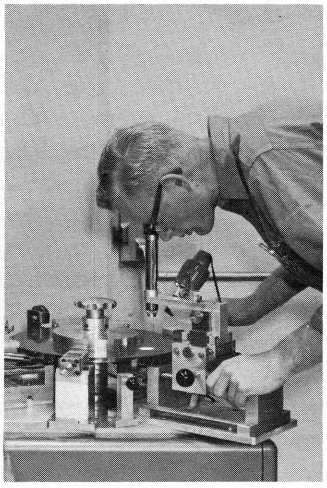
From beginning to end, the process requires strict control of material and operations. Quality control and process control personnel measure, test, and evaluate the process and product constantly so that the quality of the disks will not vary.

Dynamic tests evaluate the performance of the individual disks before they are assembled into a disk pack. Special tools and instruments are used to test for irregularities such as wavy or sloping edges.

Magnetic impulses are written over the entire surface of the disks and then read back for measurements of correct intensity. Each disk is thus inspected for microscopic imperfections.

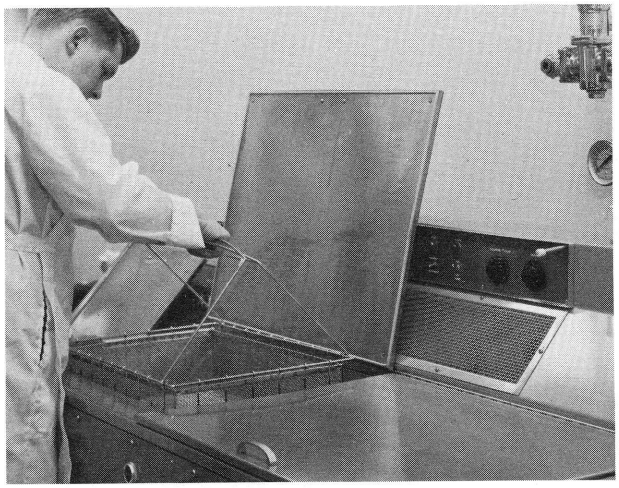




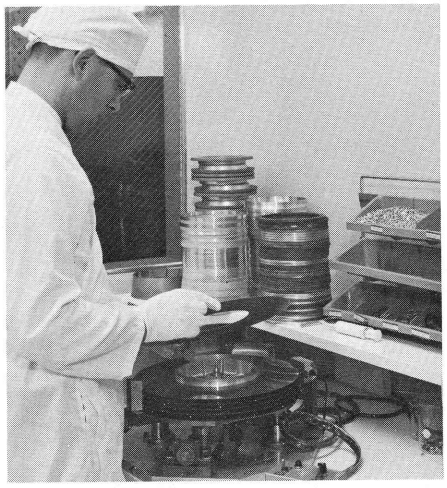


Assembling the Disk Pack

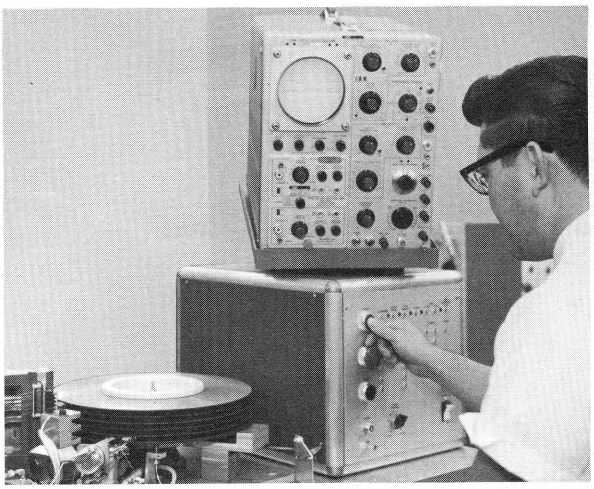
Before the disks are assembled, the other components of the disk pack are brushed, wiped clean, and then ultrasonically cleaned. This operation consists of placing parts into a sonic-energy chamber where minute particles of dirt and dust are shaken loose by high-velocity sound waves and then "rinsed" away by gas vapors.



From the sonic-energy chamber, the parts are moved into a clean room. Here, the disks and the other components are carefully assembled so that the disk pack is precisely balanced—a strict requirement because of the high rotational speed of the disks on the 1311.



Automated test stands evaluate each assembled disk pack. Tests for "flutter" and balance are made under actual operating conditions. At the same time, magnetic impulses are written on the disks and then read back and compared for accuracy. Mechanical or magnetic defects instantly stop the test operation and the pack can be rejected.



It is important to remember that the IBM disk pack is designed to meet the close tolerances required for read and write operations on the IBM 1311 Disk Storage Drive. When a disk pack is not on a Disk Storage Drive, it is contained in its protective cover. The disk pack and its cover combine to make a relatively rugged container that can withstand a normal amount of abuse to which it may be subjected while being transported about and placed on tables, shelves, or portable carts and stands. But, because the disk pack is a precision instrument, it should be handled with care.

IBM GENL Printed in U. S. A. A26-5756-3

IBM
International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, New York