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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1681

INFORMATION PROCESSING

SPECIFICATIONS FOR UNPUNCHED PAPER CARDS

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BRIEF HISTORY

The ISO Recommendation R 1681, *Information processing – Specifications for unpunched paper cards*, was drawn up by Technical Committee ISO/TC 97, *Computers and information processing*, the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1681, which was circulated to all the ISO Member Bodies for enquiry in November 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Israel	Sweden
Belgium	Italy	Switzerland
Brazil	Japan	Thailand
Canada	New Zealand	Turkey
Czechoslovakia	Peru	United Kingdom
France	Poland	U.A.R.
Germany	Romania	U.S.A.
Greece	Spain	

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

INFORMATION PROCESSING

SPECIFICATIONS FOR UNPUNCHED PAPER CARDS

1. SCOPE

This ISO Recommendation specifies the dimensions, material, and physical requirements for the general purpose unpunched paper cards to be used for information interchange between different punched card equipments.

2. DETAIL REQUIREMENTS

2.1 Grain

The grain of the paper shall be in the direction of the card length.

2.2 Defects

Cards shall be free from defects which may cause excessive wear or interfere with the normal operation of data processing equipment.

Among these defects are :

holes, magnetic particles, electrically conductive particles, dust, protruding fibres from edges or surfaces of the card, abrasive materials, residual chemicals, slime spots, other brittle areas and translucent spots which could cause reading errors in equipment.

2.3 Card dimensions

2.3.1 *Nominal dimensions* (see Fig. 1). The card shall be a nominal rectangle of 187.32 mm × 82.55 mm (7.375 in × 3.250 in).

2.3.2 *Actual dimensions*. All points on the edges of the card except as modified by clause 2.6 (Corners) shall fall between two concentric, similarly aligned, parallelograms which are dimensioned as follows :

Outer parallelogram :	Height	82.73 mm (3.257 in)
	Base length	187.45 mm (7.380 in)
Inner parallelogram :	Height	82.47 mm (3.247 in)
	Base length	187.20 mm (7.370 in)

Angles comprised between $90^\circ + 5'$ and $90^\circ - 5'$ (equivalent to 0.12 mm (0.0047 in) projection of short side onto long side).

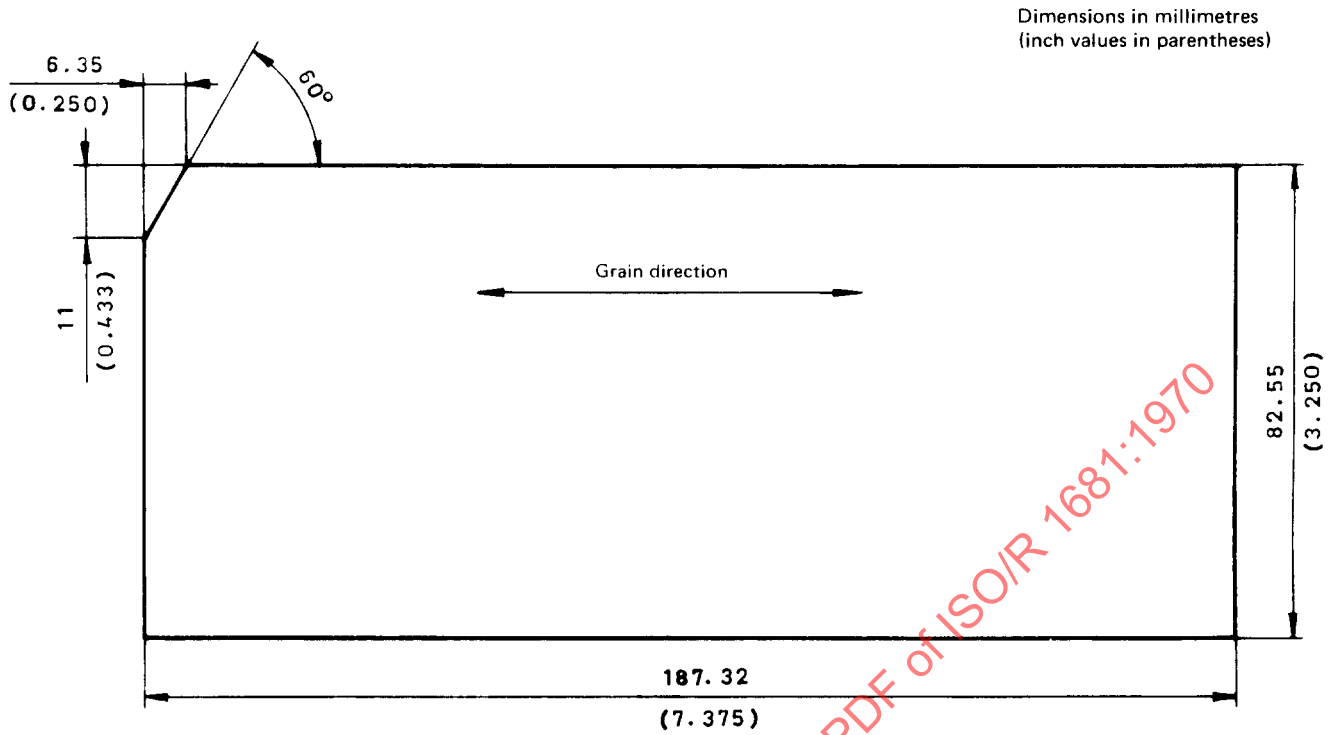


FIG. 1 – Nominal dimensions

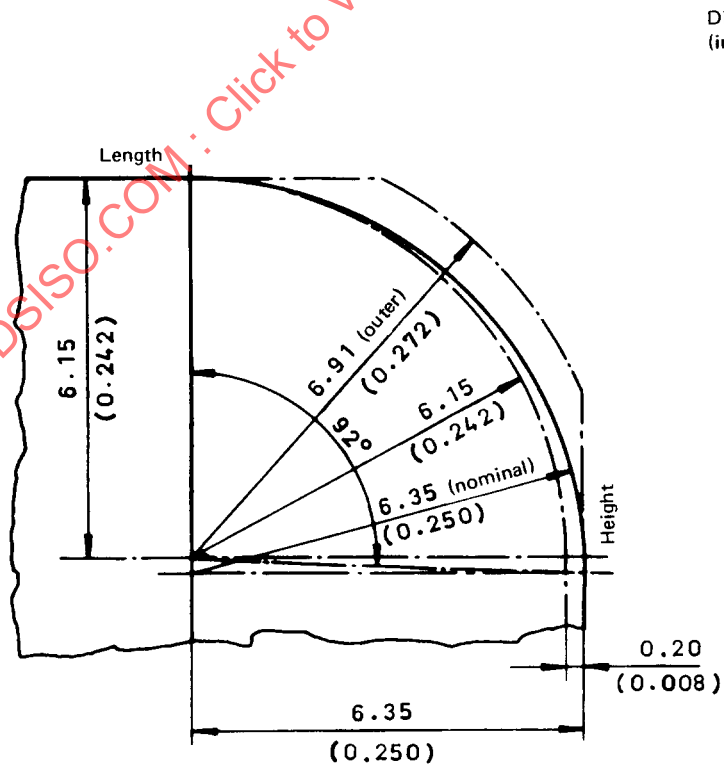


FIG. 2 – Rounded corners

2.4 Card edge

2.4.1 *Condition.* All edges shall be smooth and free from burrs.

2.4.2 *Straightness.* All points on the edge of a card shall fall between two straight parallel lines 0.08 mm (0.003 in) apart.

2.4.3 *Parallelism.* The distance by which the linearized edges depart from true parallelism to each other shall not exceed 0.08 mm (0.003 in).

For the purpose of this measurement the linearized edge is defined as the outer of the two closest, straight parallel lines which wholly contain all points of the edge of the card.

2.4.4 *Squareness.* The distance by which the linearized right-hand edge and the linearized left-hand edge depart from parallelism with a line perpendicular to the linearized top edge shall not exceed 0.12 mm (0.0047 in) total.

Linearized edges are defined as in clause 2.4.3.

2.5 Measuring requirements

For the purpose of measuring a card and locating the edge of a card, a point on the edge of the card shall be the centre of a line 10 mm (0.375 in) in length on a flat, contacting, metal surface at least 10 mm (0.375 in) long which is being pressed against the edge of the card with a force of approximately 50 mN per millimetre of its length in contact with the card*.

NOTE. — The method of measuring physical dimensions is not specified in this ISO Recommendation. However, any measurement of physical dimensions shall be made by using the appropriate apparatus that can measure adequately the physical dimensions within the specified tolerances.

2.6 Corners

2.6.1 Diagonal corner cut

2.6.1.1 *DIMENSIONS.* The corner cut shall remove 6.35 ± 0.4 mm (0.250 ± 0.016 in) from the long edge and 11 ± 0.4 mm (0.433 ± 0.016 in) from the short edge of the card (at a reference angle of 60° to the long edge of the card). (See also Appendix Y).

2.6.1.2 LOCATION

2.6.1.2.1 *Preferred location.* The preferred location for the cut shall be at the upper left corner (see clause 2.4.4 and Fig. 1).

2.6.1.2.2 *Alternative location.* An alternative location for the cut shall be at the upper right corner.

2.6.2 Other corners

2.6.2.1 *PREFERRED CORNERS.* All corners, except the diagonally cut corner, shall be square (see clause 2.4.4 and Fig. 1).

2.6.2.2 *ALTERNATIVE CORNERS.* An alternative corner, for all corners except the diagonally cut corner, shall be rounded to a nominal radius of 6.35 mm (0.250 in). (See Fig. 2).

The edge of the rounded corner shall fall between two concentric arcs. The centre of the arcs is located 6.15 mm (0.242 in) from the long edge and 6.35 mm (0.250 in) from the short edge of the card.

The inner arc is 92° and has a radius of 6.15 mm (0.242 in); the outer arc has a radius of 6.91 mm (0.272 in) (see Fig. 2). The edge is also bounded by the line parallel to the top linearized edge and passing through the lower end of the 92° arc.

* In common practice, this value is equivalent to 5 gf/mm.

2.7 Curl

2.7.1 Requirements. The maximum curl of cards, when at equilibrium with any relative humidity between 20 and 75 % shall not exceed the following values when tested according to clause 2.7.2 :

Axis of curl parallel to the grain of the paper : 3.04 mm (0.12 in)

Axis of curl at right angles to the grain of the paper : 6.35 mm (0.25 in)

Axis of curl diagonal to the grain of the paper : 6.35 mm (0.25 in)

2.7.2 Measuring procedure. This test is performed at 20 ± 2 % relative humidity and 75 ± 2 % relative humidity. In each case, the temperature is maintained at 23 ± 2 °C (73 ± 3.5 °F).

A deck of 10 cards is laid on a smooth, horizontal surface with the wire side of the paper up.

A similar deck is laid on a smooth, horizontal surface with the felt side of the paper up.

After 24 hours, the cards are examined and, if necessary, the deck is turned so that the concave side of the deck is up. A straight edge, weighing 2.5 ± 0.1 g, is placed across the two high points of the deck of cards. The amount of curl is then measured from the bottom of the straight edge to the low point of the top card of the deck. The test is preferably performed with separate decks at 20 % and at 75 % relative humidity, though the deck used at 20 % relative humidity may later be used at 75 % relative humidity. The cards tested at 75 % relative humidity may not, however, later be tested at 20 % relative humidity.

2.8 Characteristics of pre-printing

If printing is required, it shall be legible without excess ink, and cause no embossment or distortion of the card. The ink shall be non-abrasive, non-conductive and non-blocking when dry, and shall not transfer to feed rolls, contact rolls or brushes of data processing machines, and shall not change the physical properties of the cards so that they fall outside the specified limits.

3. PAPER REQUIREMENTS AND TEST METHODS

3.1 Furnish

The paper shall be 100 % chemical pulp; no ground wood allowed.

The fibre composition shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.2 Basis weight

The paper shall weigh $161 \text{ g/m}^2 \pm 5$ % ($99 \text{ lb} \pm 5$ % per ream of five hundred 24 in × 36 in sheets).

Weight shall be determined by the method given in ISO Recommendation R 536, *Determination of paper substance*.

3.3 Thickness

The thickness shall be 0.178 ± 0.01 mm (0.0070 ± 0.0004 in).

Thickness shall be determined by the method given in ISO Recommendation R 534, *Determination of the thickness of single sheets of paper*.

* Until an ISO Recommendation on this subject is published, see Appendix Z.

3.4 Bursting strength

The minimum bursting strength shall be 380 kN/m^{2**} (55 lbf/in^2).

Bursting strength shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.5 Stiffness

The minimum stiffness in the machine direction shall be $16 \times 10^{-4} \text{ N}\cdot\text{m}^{***}$ and in the cross direction shall be $7.8 \times 10^{-4} \text{ N}\cdot\text{m}^{***}$.

Stiffness shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.6 Retention of folding endurance after accelerated ageing

After accelerated (heat) ageing for 72 hours at 105°C , the folding endurance retention in the machine direction shall not be less than 25 % of the original average folding endurance and never less than 25 double folds.

Folding endurance shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.7 Internal tearing resistance

The minimum resistance to tear in each direction shall be 1.225 N^{****} .

Tearing resistance shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.8 Ash

The ash content shall not exceed 2 %.

The ash content shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.9 pH Value

The pH obtained by the hot extraction method shall not be below 5.0.

Hydrogen Ion Concentration shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.10 Frictional characteristics

3.10.1 The static coefficient of friction shall be between 0.30 and 0.45.

3.10.2 The kinetic coefficient of friction shall not be less than 75 % of the static coefficient of friction.

3.10.3 The instrument for performing the test shall consist of

- a smooth, level, metal plate to support the cards, dimensions $76 \text{ mm} \times 76 \text{ mm}$ (3 in $\times$ 3 in), mass 1000 g;
- a 1000 g capacity Chatillon push-pull gauge calibrated for horizontal use;
- a motor-driven mount for the gauge which can advance the gauge horizontally and steadily at the rate of 90 cm per minute (3 ft per minute).

The bottom of the weight shall have a smooth, clean, rubber surface.

* Until an ISO Recommendation on this subject is published, see Appendix Z.

** In common practice, this value is equivalent to 3.9 kgf/cm^2 .

*** In common practice, these values are equivalent to 17 gf/cm and 8.0 gf/cm .

**** In common practice, this value is equivalent to 125 gf.

In performing the test, eleven properly conditioned 187.32 mm × 82.55 mm (7.375 in × 3.250 in) cards, which have been handled by their edges only, are laid flat on the metal plate with the left end of the cards against a stop.

The top card is advanced to the right about 50 mm (2 in) and the weight is placed on the cards, near the right end, so that it is supported by all cards. The gauge is then advanced toward the left so that it pushes against the weight in the direction of the long axis of the card. A reading is taken when the weight and the top card begin to move. This reading, in grammes, divided by 1000, is the static coefficient of friction. Ten successive readings are taken by sequentially placing the top card on the bottom of the deck and repeating the procedure. If, as the movement of the weight and top card continues, there is a change in the reading, the new reading, in grammes, divided by 1000, is the kinetic coefficient of friction.

3.11 Expansion and contraction

Maximum expansion and contraction with 20 % to 75 % and 75 % to 20 % changes in relative humidity shall be :

Machine direction : 0.25 %

Cross direction : 0.70 %

Expansion and contraction tests are made by exposing cards sequentially to 20 %, 75 % and 20 % relative humidity at 23 °C. Tolerance for humidity and temperature control is ± 2 % and ± 2 °C.

These cards are allowed to remain fully exposed for at least 2 hours at each humidity. At the end of 2 hours, the cards are measured with a precision of 0.01 mm (0.0005 in), to check their conformity to the specified tolerances.

The percentage extension is calculated from the difference between the original measurement at 20 % relative humidity and the final measurement at 75 % relative humidity.

The percentage contraction is calculated from the difference between the measurement at 75 % relative humidity and the final measurement at 20 %. If the relative humidity, as measured with a wet and dry bulb psychrometer, is not exactly 20 % and 75 % but within the specified tolerances, corrections are applied assuming a straight line relationship between relative humidity and card dimensions.

3.12 Writing quality

Writing quality is determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.13 Smoothness (Roughness)

The maximum roughness on either side of the paper shall correspond to a reading of 125 Sheffield Units and the ratio of the smoothness of one side to the other shall not exceed 1.3 : 1.

The smoothness shall be determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

3.14 Abrasion loss

The loss of mass from each side of the paper shall not exceed 50 mg.

The abrasion loss is determined by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps**.

* Until an ISO Recommendation on this subject is published, see Appendix Z.

3.15 Electrical resistance and conductivity

The electrical resistance of a card, determined under the conditions and the method of measurement described below, shall be between 40 and 200 MΩ.

3.15.1 Conditioning

The measurements are made at 23 °C (73 °F) and 50 % relative humidity.

3.15.2 Apparatus

CONTACT PLATES. The lower plate, which rests on a rubber sheet, shall have a length of at least 190 mm (7.385 in) and a width of at least 85 mm (3.257 in).

The upper plate is a rectangle of 178 mm × 76 mm (7 in × 3 in). Its thickness is about 10 mm (0.375 in). A supplementary weight is added, if necessary, to bring the total mass to 3400 g (7.5 lb).

MEASURING APPARATUS. The measuring apparatus is a voltmeter of about 100 MΩ internal resistance.

CURRENT SOURCE. The current source is provided by a 45 V battery.

3.15.3 Test method

The card is inserted between the two plates lying horizontally. It must be centred between edges of the contact plates so that the card surface to be measured is equal to that of the upper plate.

The current source, the voltmeter, the contact plates, and the card are connected in series.

The reading on the voltmeter dial is converted to megohms by the formula

$$R = \frac{(E - V) M}{V}$$

where

R is the card resistance, expressed in megohms;

E is the source voltage, in volts;

V is the dial reading of the voltmeter, in volts;

M is the internal resistance of the voltmeter, expressed in megohms.

4. TESTING CONDITIONS

Unless otherwise specified, tests for physical requirements shall be performed on cards conditioned at 50 ± 2 % relative humidity and 23 ± 2 °C (73 ± 3.5 °F)* by the method standardized by Technical Committee ISO/TC 6, *Paper, board and pulps*.

The paper shall be brought into equilibrium from a drier state.

* It is to be noticed that ISO Recommendation R 187, *Method for the conditioning of paper and board test samples*, allows, in a note to section 4, the use of one of the other atmospheres defined by ATCO, and in particular the one specified in the present ISO Recommendation.

APPENDIX X

STORAGE AND USE OF PUNCHED CARDS

Cards should be stored and used under the following conditions :

- *storage**. : Relative humidity between 30 and 65 %; temperature between 5 and 50 °C (41 and 122 °F).
- *use**. : Relative humidity 50 ± 10 %; normal temperature of use between 18 and 24 °C (65 and 75 °F).

Recommendations are classified under the three following sections :

1. Climatic conditions :
 - 1.1 Importance of climate for cards
 - 1.2 Ambient conditions for working and storage areas
 - 1.3 Acclimatization of cards
2. Storage procedures
3. Card handling

and it is strongly recommended to follow the few procedures that are listed below.

X.1 CLIMATE CONDITIONS

X.1.1 Importance of climate for cards

Without proper precautions, cards will be affected by heat, cold and, most significantly, by humidity. Variations in the humidity will alter the card's size and weight by changing its moisture content, and may cause warping, the most frequent source of card trouble in data processing installations.

More precise indications of the affects of humidity are as follows :

Dimensions : When humidity is high, moisture is absorbed by cards, usually causing them to swell in length, width and thickness. When humidity is low, cards lose moisture and shrink in all dimensions. For instance, a variation of relative humidity from 20 to 75 % or from 75 to 20 % may cause variations of card dimensions up to 0.45 mm (0.018 in) in length and 0.58 mm (0.023 in) in width.

A new card does not return to its original dimensions when brought back to the initial conditions of measurement after exposure to a wide variation or a high level of relative humidity. For instance, a card exposed to a relative humidity higher than 70 % may become permanently deformed, causing the card to be out of tolerance. It is therefore recommended to stay under 65 % relative humidity for storage.

Warp : A card exposed to a relative humidity beyond the extremes of 40 to 60 % may become temporarily, or even permanently, warped; it has a tendency to warp, in particular, when the relative humidity is low. Even when keeping it within these limits, an abrupt change in relative humidity may cause a temporary warp. In this case, the stresses that cause warp will usually disappear as soon as the card has reached a moisture balance with its new surroundings.

NOTE. — Inherent warp on cards may be found, but very rarely; it cannot be corrected and is even increased when the cards have been exposed to extreme humidity levels.

However, when the recommended ambient conditions for the storage and use have been complied with, the dimensional changes and the distortion of cards at their time of use are comparatively minor.

* It must be stressed that the relative humidity and the temperature values given above apply only to the storage and the use areas. They have no influence on the values required for conditioning and tests given in section 4 of the present ISO Recommendation.

X.1.2 Ambient conditions for storage and working areas

From what has just been stated, it results that :

- the relative humidity levels and the temperatures of working and storage areas must be taken into account : it is recommended that they should be recorded;
- it would be desirable that the relative humidity to which cards are exposed be maintained constant : abrupt changes are particularly to be avoided.
In fact, it is possible to maintain to the desirable levels the humidity of almost every working area, except perhaps when the outside temperature is extreme or the humidity very high; great care must be exercised in regulating thermostats and hygrometers.
- In winter, a favourable relative humidity in the machine room is more easily maintained at lower temperatures. Continuous high heat dries the air and may cause a drop in recommended humidity levels.
- In summer, an excessive relative humidity may be reduced by the use of de-humidifiers.

It must be pointed out, however, that there are often very great variations in the atmosphere of one room, particularly near pipes, radiators, or open windows, and cards should not be stored near any of these. Care must be exercised in opening and closing windows. The cards should not be placed directly on the floor, particularly if the floor is other than a wooden one, or against a wall, as local conditions of cold and high humidity often occur at such a point. The method of heating is immaterial provided that systems are not used which put noxious fumes and water vapour into the air.

The following points should be taken into account :

- moving cards from the storage area to the working area may cause warp especially if there is a sharp difference in relative humidity and cards are not protected during transportation;
- cards transferred from a cold room to a warm room may collect moisture in much the same way as the outside of a glass of iced water.

X.1.3 Acclimatization of cards

Even when the recommendations concerning the storage have been observed, cards should be given ample time to achieve a moisture balance with the machine room atmosphere, in order to perform properly.

This time depends primarily on the difference between the relative humidity of the machine room and the cards, on the manner in which cards are packed (in full cartons, in open-trays, etc.) and the extent of air circulation around them (open or closed cartons, etc.).

Although there are no precise data, the following values may give an approximation of this time :

- (a) Card alone : 2 hours
- (b) Cards in opened cartons :
 - for a difference in relative humidity of $\pm 10\%$: 1 day
 - for a difference in relative humidity of $\pm 20\%$: 10 days
 - for a difference in relative humidity of $\geq \pm 30\%$: 15 days

In all circumstances, a carton of cards should not be opened before equilibrium of temperature is reached with the working area. Where space permits, storage facilities should be set up in the working area for a five to ten day supply.

X.2 STORAGE PROCEDURES

Cartons protect the characteristics of cards. To a certain extent, they reduce edge damage and slow down the exchange of humidity with the outside.

Therefore, for storage, it is advisable

- to keep cards in their original cartons or special drawers, until used;
- that the cartons be squarely supported at the bottom to prevent any tendency for the weight to distort the cartons;
- not to put weights on top of the cartons.

If half-full cartons were stacked, cards could actually be distorted. It is possible, however, to put incompletely filled cartons on top of a stack, cards lying then on their faces.

While cards properly stored have a very long and trouble-free life, it is nevertheless recommended, in the best interests of the user, that not more than a few months' supply should be stored by the customer and that cards should be used in rotation, old stock being consumed before newer supplies are opened.

X.3 CARD HANDLING

- For the purpose of card processing; it is recommended to fan the cards lightly before passing them through machines.
- Cards should be flat for machine feeding; if they exhibit slight distortion, the machine operator can generally eliminate it by gently manipulating the cards.