
Refrigerated display cabinets - Part 5: Temperature test

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Verkaufskühlmöbel - Teil 5: Temperaturprüfung

Meubles frigorifiques de vente - Partie 5: Essai de température

Ta slovenski standard je istoveten z: EN 441-5:1996[SIST EN 441-5:2000](https://standards.iteh.ai/catalog/standards/sist/892560ff-a0bc-4e62-8200-e62bfl71a782/sist-en-441-5-2000)<https://standards.iteh.ai/catalog/standards/sist/892560ff-a0bc-4e62-8200-e62bfl71a782/sist-en-441-5-2000>**ICS:**97.130.20 Hladilne naprave za trgovine Commercial refrigerating
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EUROPEAN STANDARD

EN 441-5

NORME EUROPÉENNE

EUROPÄISCHE NORM

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Descriptors: refrigerators, furniture, commerce, tests, temperature measurements

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Refrigerated display cabinets - Part 5: Temperature test

Meubles frigorifiques de vente Partie 5: Verkaufskühlmöbel - Teil 5: Temperaturprüfung
Essai de température

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This European Standard was approved by CEN on 1995-12-21. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 44 "Household refrigerating appliances and commercial refrigerated cabinets" of which the secretariat is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 1996, and conflicting national standards shall be withdrawn at the latest by July 1996.

This European standard has been drafted on a proposal of CECOMAF (European Committee of Manufacturers of Refrigeration Equipment).

This standard is composed of several parts :

- Part 1: Refrigerated display cabinets - Terms and definitions
- Part 2: Refrigerated display cabinets - General mechanical and physical requirements
- Part 3: Refrigerated display cabinets - Linear dimensions, areas and volumes
- Part 4: Refrigerated display cabinets - General test conditions
- Part 5: Refrigerated display cabinets - Temperature test
- Part 6: Refrigerated display cabinets - Classification according to temperatures
- Part 7: Refrigerated display cabinets - Defrosting test
- Part 8: Refrigerated display cabinets - Water vapour condensation test
- Part 9: Refrigerated display cabinets - Electrical energy consumption test
- Part 10: Refrigerated display cabinets - Test for the absence of odour and taste
- Part 11: Refrigerated display cabinets - Installation, maintenance and user's guide

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

1.1 This standard specifies terminology, general mechanical and physical requirements, test conditions as well as installation, maintenance and user's guide for refrigerated display cabinets for the sale and/or display of food products.

This standard does not cover refrigerated vending machines or cabinets intended for use in catering or similar non retail applications.

1.2 This part of EN 441 specifies methods for the determination of test package temperatures in refrigerated display cabinets.

2 Normative references

This European standard incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 441-1 Refrigerated display cabinets -Part 1 : Terms and definitions

[SIST EN 441-5:2000](https://standards.iteh.ai/catalog/standards/sist/892560ff-a0bc-4e62-8200-e62b171a532/sist-en-441-5-2000)

EN 441-2 Refrigerated display cabinets - Part 2 : General mechanical and physical requirements

EN 441-4 Refrigerated display cabinets - Part 4 : General test conditions

EN 441-6 Refrigerated display cabinets - Part 6 : Classification according to temperatures

3 Test procedure

3.1 Preparation of test cabinet

The cabinet is installed in the test room and the test is prepared according to EN 441-4.

3.2 Loading the cabinet, general

The cabinet shall be loaded with test packages and M-packages (see EN 441-4, 4.2 and 4.3) up to the load limit, as illustrated in figures 1 to 12. These packages shall previously be brought to a temperature equal to that expected during the test. 1000 g packages and 500 g packages are preferably used.

To complete the loading, the following sizes of test packages :

- 25 mm x 100 mm x 200 mm ;
- 37,5 mm x 100 mm x 200 mm ;
- 25 mm x 50 mm x 100 mm ;

and pieces of these packages shall be used as fillers.

The test packages shall be arranged so as to form an even level.

Each refrigerated shelf area shall be loaded with test packages arranged in such a way that they form rows with a length of 200 mm by the depth of the cabinet in the direction of the airflow in the cabinet.

A clearance of 25 mm \pm 5 mm shall be left between package rows and adjacent to the internal end walls of the cabinet.

It is possible to use partitions with a thickness of approximately 25 mm to position the packages on condition that they have minimal effect on normal airflow and minimal thermal conduction.

Lengthways, any remaining spaces shall be filled with test packages to obtain one or two adjustment rows of which the width can measure from 100 mm up to 300 mm.

Depthwise, any remaining spaces of less than 25 mm wide shall be filled with wooden vertical dividers, placed approximately midway along the space between two M-packages.

3.3 Loading heights

The loading height of the refrigerated shelves shall be as follows :

- a) For horizontal cabinets, the loading height shall be equal to the height defined by the load limit, with a tolerance of (0) (-15) mm (see figures 1, 2, 11, 12).
- b) For closed vertical cabinets, the loading height shall be equal to half of the maximum free height above the refrigerated shelf, with a tolerance of (+25) (0) mm (see figure 10).
- c) For open cabinets with minimum of two superimposed refrigerated shelves, the loading height shall be equal the free height between the refrigerated shelves minus 25 mm, with (0) a tolerance of (-25) mm (see figures 3 and 4), or equal to 100 mm if specified by the manufacturer (see figures 5 and 7) for cabinets intended for example for sensitive food products not suitable for multiple layer stacking.

3.4 Loading the cabinet, M-package locations

The M-packages shall be placed at the position shown on the cabinet drawings (see figures 1 to 12) :

a) Longitudinal section :

For cabinet lengths of less than or equal to 700 mm, M-packages shall be located into two transverse sections of the loading such that the M-package axis is situated at 75 mm from each cabinet end wall.

For cabinet lengths of more than 700 mm, a third transverse section shall be placed midway along the cabinet length, with a tolerance of 75 mm. When the cabinet includes at its center area any mechanical structure, M-packages of this third transverse section and located against the back panel shall be shifted towards the test room air discharge side by 325 mm.

b) Cross section :

For refrigerated shelf depths of less than or equal to 550 mm, M-packages shall be located into two longitudinal sections, such that the M-package axis is situated :

- for island-site refrigerated cabinets, at 150 mm (see figures 1 and 2) ;
- for other cabinets, at 50 mm (see figures 3 to 12) ;

the first one from the loading front and the second one from the back panel.

For refrigerated shelf depths of more than 550 mm, a third longitudinal section shall be placed midway across the shelf depth with a tolerance of :

- for cabinets with forced air cooling : $d/2$ ($+100$) mm from the air discharge side (see figure 1 and figures 3 to 8) ;
- for natural convection cooled cabinets equipped with two evaporators or symmetrical layout : $d/2 \pm 50$ mm (see figures 2, 11 and 12) ;
- for other natural convection cooled cabinets : $d/2$ ($+100$) mm from the evaporator side (see figure 9).

In the height, for each refrigerated shelf, M-packages shall be located into the lower and upper loading layers. When the distance between the axes of M-packages is more than 400 mm, another M-package layer shall be introduced (see figures 3, 4, and 12).

For cabinets with a minimum of four superimposed refrigerated shelves of which two are strictly identical having :

- same shape and same sizes : length, depth and loading height ;
- same air flow design : inlet and outlet ;

- same radiation heat transfer conditions, more particularly same location and intensity of the lower and upper lighting devices ;

M-packages shall be located as follows :

- with two identical refrigerated shelves : on the lower one (see figure 3) ;
- with three identical refrigerated shelves : on the central one (see figures 4 and 10).

Two extra M-packages shall be located within the net volume so that the highest temperature of the warmest test package and the lowest temperature of the coldest test package will be recorded.

3.5 Running-in

The cabinet shall be switched on and operated until stable conditions have been reached (see EN 441-4, 5.1 and 5.4). The test room shall be maintained at the desired climate class as specified in EN 441-4, 4.1.7, while the temperatures of the M-packages are recorded. These recordings will vary cyclically and the length of the cycle is dependent on the time between two successive defrost periods.

For cabinets intended to be switched off at night, it is recognized that (stable conditions) may not be reached. The running-in period shall therefore be at least 2 h and the test period shall commence from the end of the running-in period.

3.6 Closed refrigerated cabinet

The test for closed refrigerated cabinets shall always be carried out on a complete cabinet, regardless of the number of doors or lids. Each door or lid shall be opened six times per hour. Where more than one door or lid pertains to the cabinet to be tested, the sequence in which the doors and lids are opened shall be staggered, i.e. in case of two doors : door 1 at the time of 0 min, door 2 at the time of 5 min, door 1 at the time of 10 min, door 2 at the time of 15 min, etc.

The doors shall be opened beyond an angle of 60°.

The door or lid shall be open for a total of 12 s. During this period the door shall be kept open beyond the angle of 60° for 10 s.

Prior to starting the opening cycle, each door or lid shall be opened for 3 min. Where a cabinet is provided with more than one door or lid, each door or lid shall be opened for 3 min consecutively.

If the refrigerated cabinet is fitted with a lighting system, this shall be switched on 1 h before starting the opening cycle and shall be switched off 1 h after the end of the opening cycle.

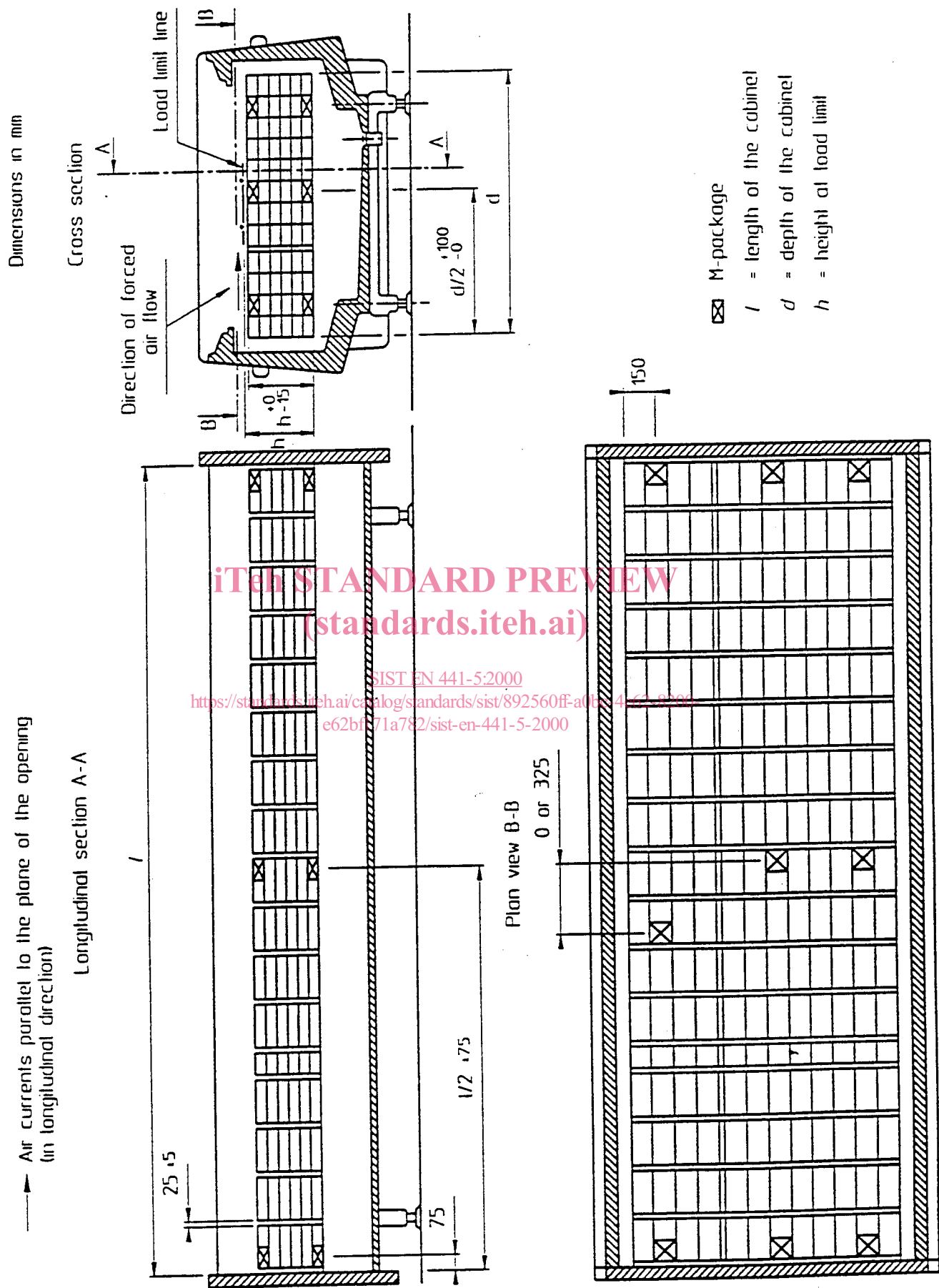


Figure 1 : Refrigerated or frozen food island-site cabinet provided with forced air cooling

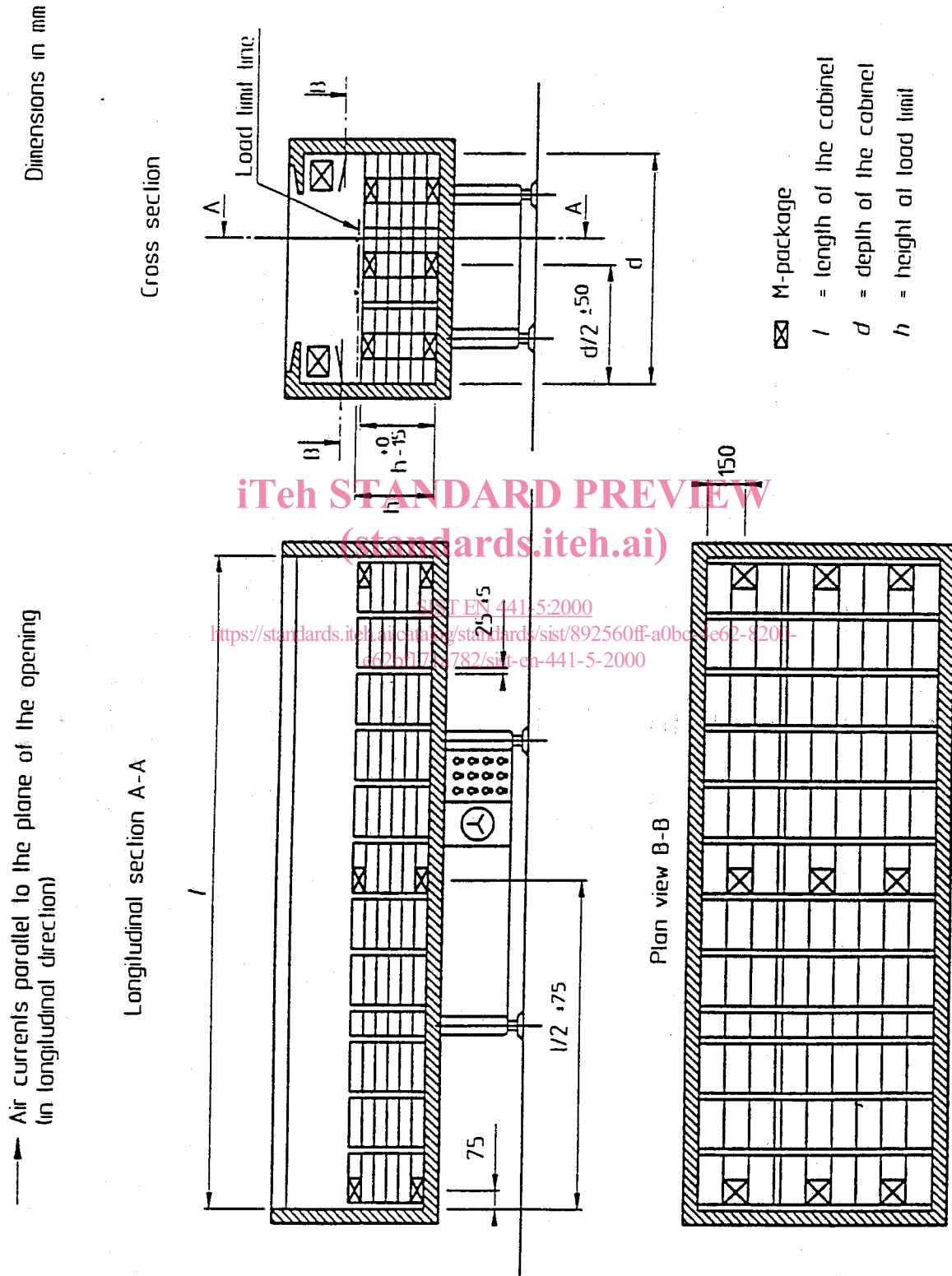


Figure 2 : Refrigerated or frozen food island-site cabinet provided with natural convection cooling

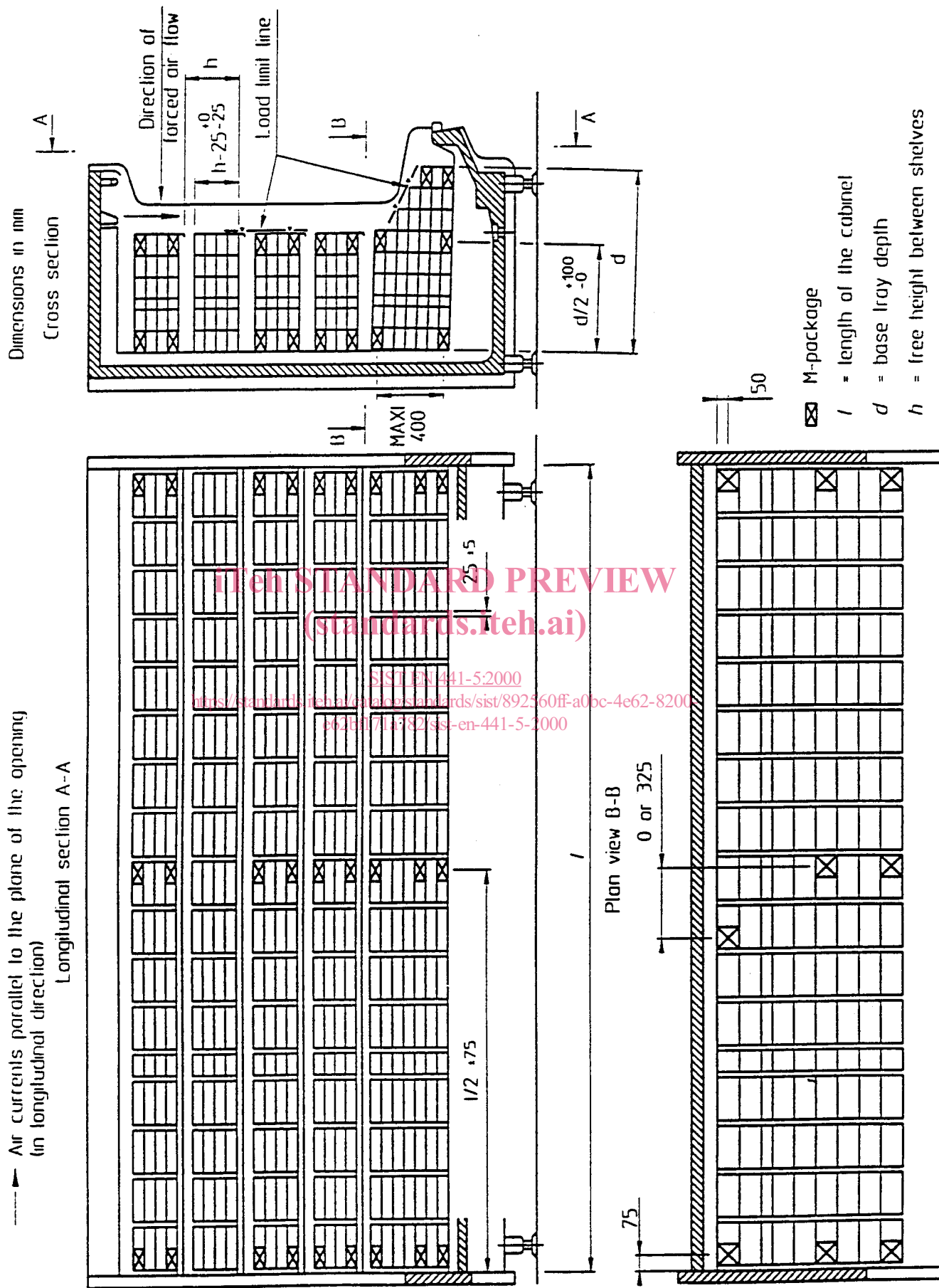


Figure 3 : Multi-deck refrigerated cabinet provided with forced air cooling (5 shelves)