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Determination of imposed floor loads in production buildings and warehouses

Détermination des charges imposées aux planchers des usines et des entrepôts

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2633 was drawn up by Technical Committee ISO/TC 98, *Basis for design of structures*, and circulated to the Member Bodies in February 1972.

It has been approved by the Member Bodies of the following countries :

Austria	France	Romania
Belgium	Hungary	South Africa, Rep. of
Chile	India	Spain
Czechoslovakia	Ireland	Thailand
Denmark	Israel	Turkey
Egypt, Arab Rep. of	Poland	United Kingdom
Finland	Portugal	U.S.S.R.

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
New Zealand
Norway
Sweden

Determination of imposed floor loads in production buildings and warehouses

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies methods of determining imposed floor loads to be adopted for certain functions of production buildings and warehouses, for design-calculation purposes.

2 DEFINITION

imposed floor load : The load, being a temporary action, assumed to be produced by the function and use of the building.

Imposed floor loads in production buildings and warehouses¹⁾ consist of :

- a) forces, including their dynamic effects, if any, due to manufacturing equipment :
 - 1) stationary plant and suspended manufacturing equipment;
 - 2) industrial pipelines;
- b) forces, including their dynamic effects, if any, due to handling equipment :
 - 1) fixed handling equipment (conveyors, elevators, rollers, etc.);
 - 2) mobile handling equipment (trucks, cars, overhead cranes, etc.);
- c) forces due to staircases, ramps and access gangways, including mobile building parts (for example partition walls);
- d) forces due to heating, ventilating and similar service equipment and associated equipment;
- e) forces due to materials and products, as well as waste products and loads due to animals that are production subjects;
- f) forces due to erection loads;
- g) forces due to seismic loads;
- h) forces due to wind loads;
- i) forces due to temperature changes and thermal movement;

j) loads due to people (operational staff, probable visitors);

k) forces of an unusual nature (for example forces resulting from the failure of hoppers or mechanical equipment).

3 GENERAL

3.1 The characteristic value of the imposed floor load is the least favourable load which has a probability, accepted from the outset, of not being exceeded during the service life of the structure. In the absence of the necessary statistical data, the characteristic value shall be chosen in accordance with the given (or expected) conditions of normal use of the building and its various floor zones (this characteristic value will be verified, if possible, during the use of the building or similar buildings).

3.2 When designing and calculating building structures, account shall be taken of possible simultaneous actions of floor loads. For certain loading conditions which are dependent on each other, the characteristic value shall be determined statistically for the least favourable combination of the loads. For floor loads whose floor position may alter, account shall be taken of the least favourable position relative to the structural members being calculated.

3.3 The influence of dynamic forces arising from operations with dynamically unbalanced equipment, from the shifting of heavy loads over the floor, or from falling or suddenly displaced goods in storage, shall be taken into consideration by calculating the structures dynamically, or by using dynamic coefficients given in special regulations.

4 ESTABLISHING OF IMPOSED FLOOR LOADS

4.1 Data concerning loads, for calculating load-bearing structures, shall include the values, directions and any application diagrams for floor loads (uniformly distributed and concentrated, static and dynamic), determined on the basis of information available concerning weight, overall dimensions, position, fixing of equipment to floors, as well

1) Garages, depending on the operational conditions, may be referred either to production buildings (garages-repair shops) or to warehouses (garages-parking areas).

as the characteristics of machinery installed, etc. If erection loads are to be taken into account, their values and their possible positions on the lifting gear (including positions due to material already being lifted, to the equipment and its heaviest parts), shall be determined.

The chief sources of the data referred to above are as follows :

- a) standards and catalogues concerning machines (in the absence of the necessary information, data supplied by the producers may be used);
- b) data given by the equipment suppliers;
- c) advice from experts responsible for the technical side of the building being designed;
- d) data supplied by the users of the building.

4.2 When determining the characteristic load from the weight of manufacturing plant, account shall be taken of :

- a) the weight of the plant (inclusive the weight of the drive, additional bearing devices, insulation);
- b) the weight of the heaviest pieces under treatment or the weight of the product being processed (liquids, materials in bulk);
- c) the weight of gangway and working platforms;
- d) loads accruing from necessary maintenance or replacement of stationary plant.

The weight of the product being processed shall be determined in compliance with its maximum possible volume under normal operation of the installation.

4.3 When determining characteristic loads due to handling equipment, the weight of the machine shall be taken as its weight under working conditions (i.e. allowing for the weight of fuel, power sources etc.) and the load carried shall be taken as equal to the nominal load-lifting capacity of the machine.

4.4 Characteristic floor loads in garages depend on the weight of vehicles, probable service equipment, spare parts, etc., with provision for the value of loads of the vehicles depending on the type of vehicles and conditions of the garage use.

4.5 Characteristic floor loads in warehouses shall be determined having regard to the type of stacked materials and methods of storage. Account shall be taken of the greatest volume of materials (or the greatest number of stacked articles) located on the area of the floor being considered under normal operational conditions of the warehouse, allowing for the densest stacking of materials and articles and the possible effect of the increase of density of some materials when stored for a long time (for example effects of the increase of moisture).

4.6 When defining loads on floor zones not occupied by stationary equipment and in warehouses, provision shall be made for the following loads, as well as the loads from mobile handling means :

- a) loads due to crowds of people possible under normal operation of the structure;
- b) loads due to materials and semi-finished products temporarily stored near the process equipment (at intervals between machining operations or ready for transport to the warehouse);
- c) loads due to the weight of waste products, etc.

4.7 When calculating stresses and deformation in structures, the actual floor loads may be replaced by simplified load diagrams of equivalent effect.

4.8 Definitions of simplified diagrams for the calculation of structural parts of different types (panels, beams, joists, columns) shall be differentiated according to the type of member, their dimensions, the actual loading conditions and the type of stress being considered.

5 MINIMUM IMPOSED FLOOR LOADS

When designing load-bearing structures of production buildings and warehouses, the characteristic intensity of the minimum uniformly distributed imposed load in kilonewtons per square metre of the floor shall be taken as

- a) for production rooms such as work-shops with light-weight equipment (benches, machine-tools weighing not more than 5 kN, etc.) as well as garages for parking of passenger vehicles and light vans not exceeding 25 kN gross weight : not less than 3 kN/m²;
- b) for warehouses and garages (except those mentioned above) and for production rooms such as work-shops in works and factories : not less than 5 kN/m².

NOTE — For production buildings and warehouses having specific functions, higher values than the minimum uniformly distributed imposed load may be established.

6 REDUCTION OF IMPOSED FLOOR LOADS

In the design of some floor members the values of imposed floor loads may be reduced, for example in the case of a large floor area or in case of combination of several loads acting upon the floor. This reduction of load, depending on the function and conditions of use of the building or the floor zone, is contained in national regulations.

NOTE — Besides the design of floor members for a uniformly distributed load, a separate design shall be made for the conventional local load applied to a square with a 100 mm side in the most unfavourable position for the member and equal to the uniformly distributed load per square metre (if there are no particular specifications concerning smaller values of this load). Classification of actions and combinations of actions upon structures is the subject of ISO 2945. (At present at the stage of draft.)