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Shipbuilding — Co-ordination of dimensions in ships' accommodation — Part I : Principles of dimensional co-ordination

Construction navale — Coordination dimensionnelle pour l'ameublement des navires — Partie I : Principes de la coordination dimensionnelle

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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.

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Shipbuilding — Co-ordination of dimensions in ships' accommodation — Part I : Principles of dimensional co-ordination

0 INTRODUCTION

The rationalization of traditional shipbuilding methods and the increasing use of prefabricated assemblies necessitates the utilization of standardized components wherever possible. In the outfitting of ships, in order to achieve the maximum benefit from the use of these components a systematic design method, applying both to the components and the space within which they are used, must be adopted which will give a common basis for layout, production and assembly.

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Dimensional co-ordination is a system of applying a range of related dimensions to the sizing of components and assemblies and the structures incorporating them. This method of standardizing sizes or dimensions, which are not necessarily related to particular components, materials or manufacturing processes, permits its application to the widest possible range of components and assemblies, and will give the following advantages :

1) the maximum economy in the production of components by variety reduction;

2) the reduction in manufacture of non-standard units;

3) the avoidance of wastage in cutting components on site by achieving maximum flexibility in assembly;

4) the interchangeability of components giving more choice and flexibility for designers.

Modular co-ordination is a particular form of dimensional co-ordination in which the range of related dimensions is restricted by utilizing a standard step or module, the size of which is selected in order to satisfy the following requirements :

a) it should be sufficiently small to give multiples which satisfy the sizes required for the various components in shipboard use and provide suitable increments to minimize alterations to existing sizes;

b) it should be sufficiently large to achieve an effective measure of simplification to the existing number of sizes;

c) for ease of application, it should be expressed as a whole number bearing a simple relationship to existing systems of measurement;

d) it should be selected to give the widest possible agreement with any national or international standards for dimensional co-ordination in shipbuilding or for related components.

The advantages of dimensional and modular co-ordination have been internationally recongized for many years and an International Standard has been agreed for the increments or modules to be used in the construction industry.

The ultimate aim in publishing recommendations for dimensional co-ordination is the establishment of standardized ranges of sizes for components, and in order to achieve the maximum utilization of these components it is necessary to establish a comprehensive system which will form a framework for sizing, positioning and assembling co-ordinated components.

In shipbuilding the main advantages in utilizing co-ordinated components occur in the accommodation areas where repetitive components are used which are common to the other industries operating dimensional co-ordination.

1 SCOPE AND FIELD OF APPLICATION

This International Standard sets out the basic principles of dimensional co-ordination, with particular reference to the co-ordination of dimensions in ships' accommodation.

2 DEFINITIONS

For the purpose of this International Standard the definitions given in ISO 3827/II are applicable.

3 THE BASIS OF DIMENSIONAL CO-ORDINATION

TABLE 1 – **Standard modules**

Preference	1st	2nd	3rd
	300	100	50

TABLE 2 – **Co-ordinating sizes**

Preference	1st	2nd	3rd
			50
		100	
			150
		200	
			250
	300		
			350
		400	
			450
		500	
			550
	600		
	↓	↓	↓

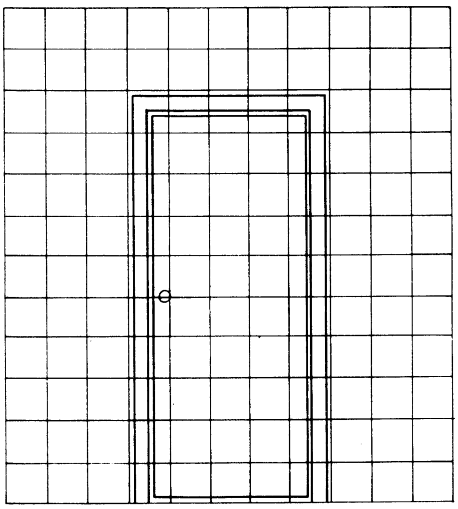
3.1 Dimensional framework

In order to ensure that dimensionally co-ordinated components or assemblies of components fit the spaces allocated to them a dimensional framework, or reference system, is employed which is common to both.

3.1.1 *Modular grids*

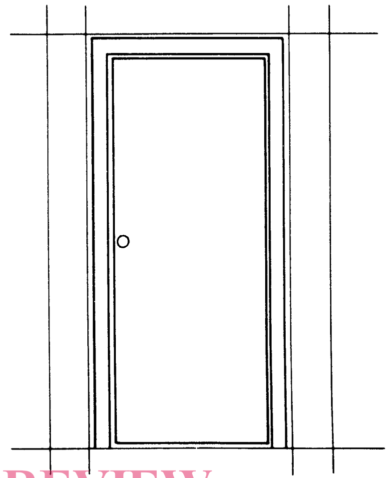
The dimensional framework is represented by a grid, in which the grid lines are spaced in multiples of the standard modules, or increments of size, and the grid lines indicate the boundaries for the component and the space allocated to it.

The use of a grid on drawings is an aid in locating components and in reading the drawings; as such it is a tool for communication.



3.2 Modular components

The size of components should be co-ordinated in accordance with the preferences given in tables 1 and 2. A component having a co-ordinating size derived from these preferences is a modular component.



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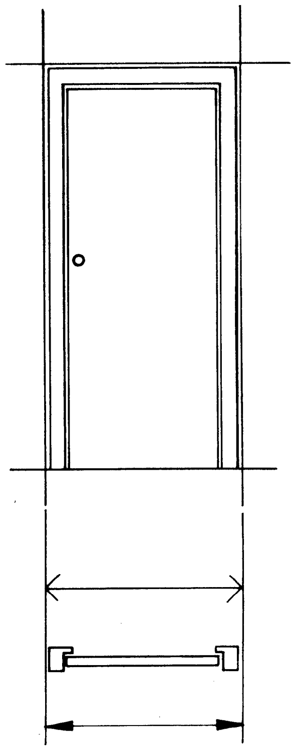
The co-ordinating size of a component is equivalent to the size of the co-ordinating space allocated to it. Both include the work size of the component plus an allowance for its joints and tolerances.

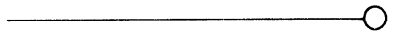


NOTE — In the accompanying sketches certain conventions are used to identify different spaces and sizes. These conventions are :

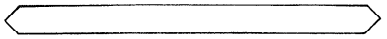
Reference lines : Normally indicated as a continuous line.

Centre and axial lines : Are normally also reference lines but are indicated as a thin chain line.

Controlling lines : Indicated by a circle at the end of a reference line.



Controlling dimensions : Represented by an enclosed arrow.



Co-ordinating space and size : Represented by an open arrow-head.

Work size : Indicated by a solid arrow-head.

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4 THE CONTROLLING REFERENCE SYSTEM

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In establishing a dimensional framework, or reference system, which can be related to both dimensionally co-ordinated components and the structure incorporating them it is essential to establish certain controls over the principal dimensions of the reference stystem.

The initial control is based on the use of the standard modules given in table 1 but, in order to reduce the considerable number of permutations possible with these modules, further controls are necessary.

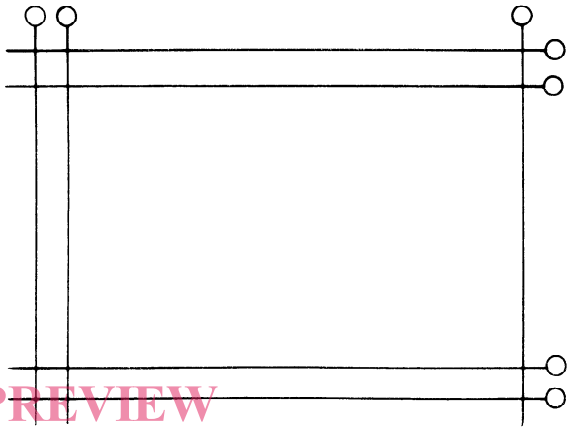
Certain known datum lines, which are related to user requirements, can be identified within the structure and the structure can be divided by these datum lines into a number of spaces. Some of these spaces are termed "usable spaces", for example cabin interiors, and others termed "zones" are the spaces surrounding the usable space and are allocated to the structure or services. These terms are described later in this clause. The principal dimensions of these zones and spaces can be standardized to give a limited range of sizes, which are multiples of the standard modules, but achieve a considerable degree of variety reduction, in relation to particular components. These dimensions are therefore termed "controlling dimensions". The identified datum lines which define the zones and usable spaces are termed "controlling lines" and in three-dimensional considerations the planes which these lines represent on plans, sections and elevations are termed "key reference planes". The entire framework of planes, zones and dimensions is described as the "controlling reference system".

4.1 Lines and planes

4.1.1 *Controlling lines*

"A line representing a key reference plane."

Controlling lines are the identifiable datum lines which indicate the main structural items such as deck levels, ceiling levels, bulkheads, etc.



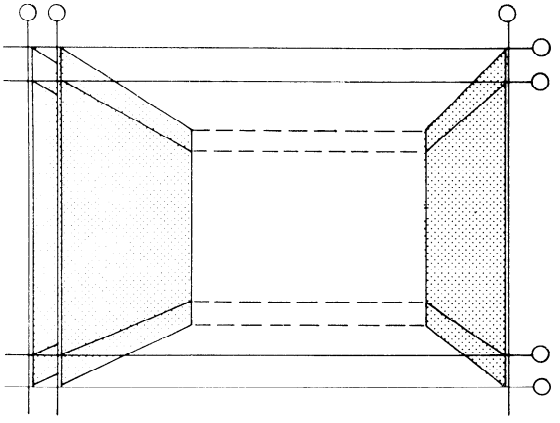
4.1.2 *Key reference planes*

"A reference plane which defines the boundary of a controlling zone or the axis of a bulkhead, etc."

These are the three dimensional planes represented by the controlling lines on plans, elevations, etc.

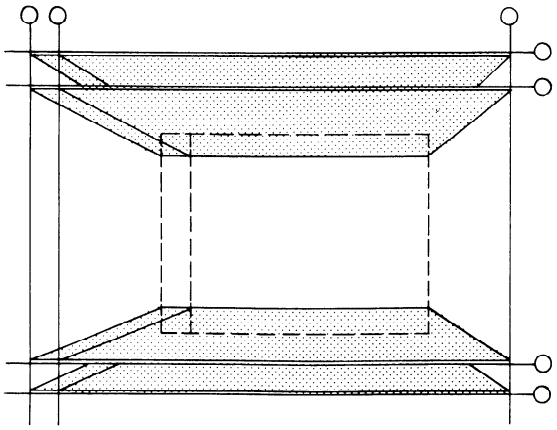
4.1.2.1 VERTICAL KEY REFERENCE PLANES

These are the planes relating to the finished surfaces of bulkheads, linings, casings, etc.



4.1.2.2 HORIZONTAL KEY REFERENCE PLANES

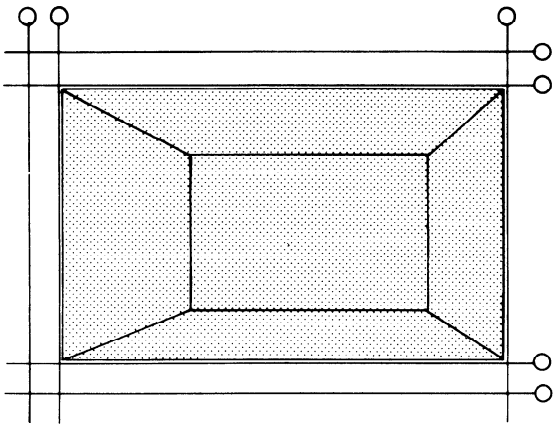
These are planes relating to finished horizontal surfaces such as floor, deck, ceiling, etc.



4.2.2 *Usable space*

"The space between controlling zones in which human or mechanical activity takes place."

Vertically, usable spaces are bounded by finished floor and ceiling planes and horizontally they are the spaces between bulkheads or linings.



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4.2 Zones and spaces

The effect of delineating the key reference planes on the structure is to divide it into a number of zones and usable spaces. When the principal dimensions of these zones and spaces are standardized a controlling reference system is achieved which will accept modular components.

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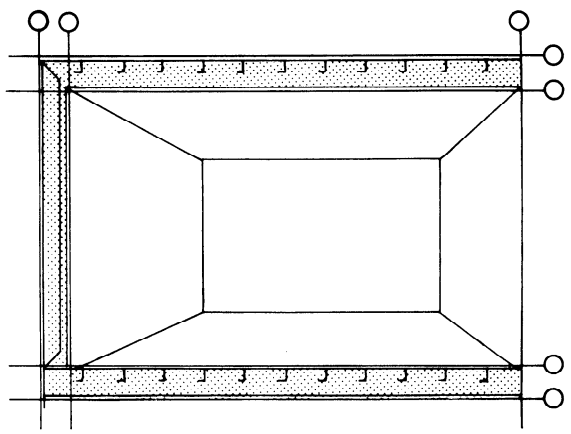
4.2.1 *Controlling zones*

"A zone between key reference planes provided for a deck, deckhead, bulkhead or lining."

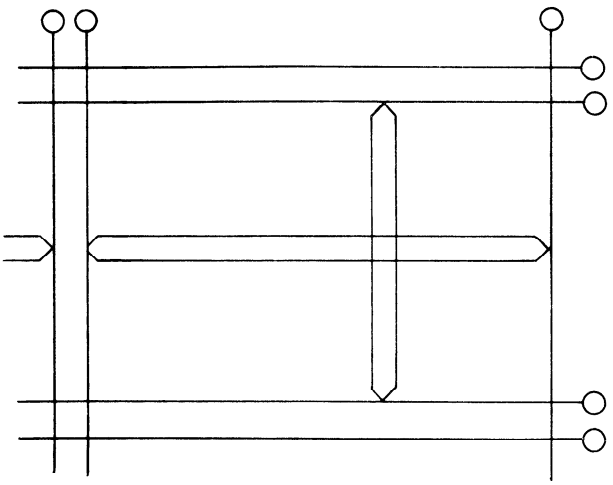
This is a space, having standardized dimensions, which is allocated to a part of the structure. It may be occupied, but not always filled, by one or more components. In principle, finishes should be contained with the zone.



4.2.3 *Controlling dimensions*

"A dimension between key reference planes, for example deck to ceiling height, and width of controlling zones.

These are the standardized principal dimensions of zones and spaces and are expressed as a selection from the range of multiples of standard modules. The controlling dimensions will be given in a separate part of the International Standard on dimensional co-ordination in shipbuilding.



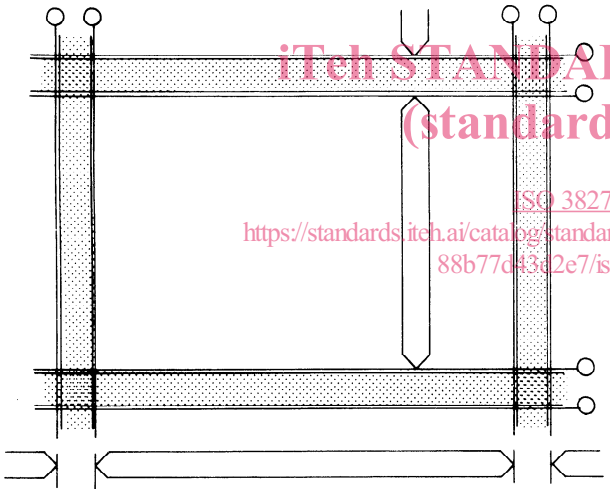
5 CONTROL : BOUNDARY AND AXIAL CONTROLLING LINES

In applying the controlling reference system to a design there are two methods for locating the controlling lines in relation to the structural or subdivision zones.

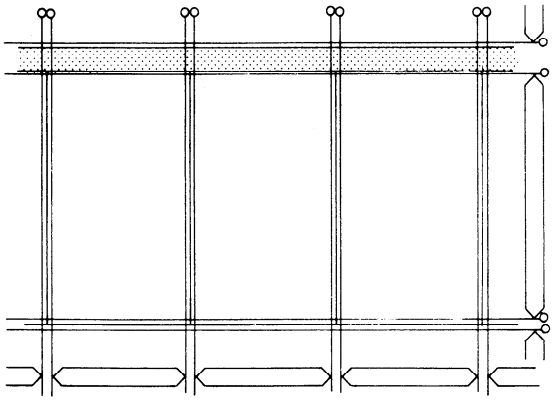
5.1 Method 1 (preferred) : Controlling lines on the boundaries of zones

Controlling lines on the boundaries of zones, i.e. on either face of the zone, are recommended as the method which will give the most benefit in accommodation areas, especially where repetitive arrangements occur, such as a row of similar cabins.

The main advantage of face dimensioning, where the controlling lines occur on the boundaries of zones, i.e. at the junction of components, is that there is then a usable space for components and assemblies which bears a direct relationship to the controlling dimensions regardless of the size of the zones.



In practical applications this method enables co-ordinated components abutting bulkheads, linings, etc. to be positioned within the usable space, without the need for special fitting or make-up pieces to compensate for the variations in the width of the zones which contain the bulkheads, etc.

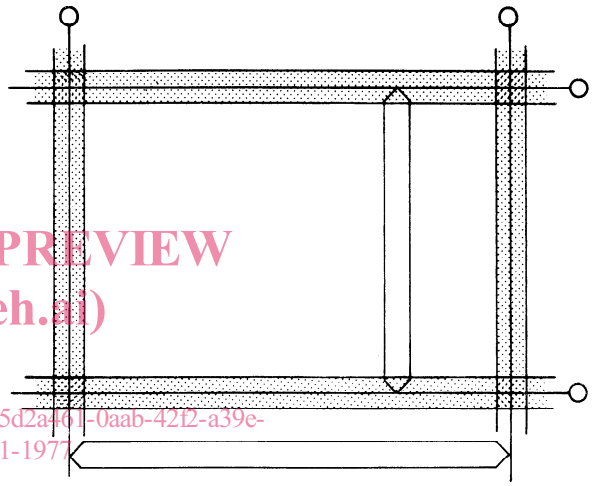


5.2 Method 2 : Controlling lines on the axial lines of the zones

NOTE — The lines are generally placed on the true axis of the zone but may be positioned anywhere within the zone.

This method may be employed in the positioning of zones, but the varying width of zones for bulkheads, linings, etc., will necessitate special fittings or make-up pieces in order to utilize modular components.

It may, however, be desirable to integrate both methods in certain instances in order to obtain the maximum utilization of modular components.



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6 CONTROL : CONTROLLING DIMENSIONS

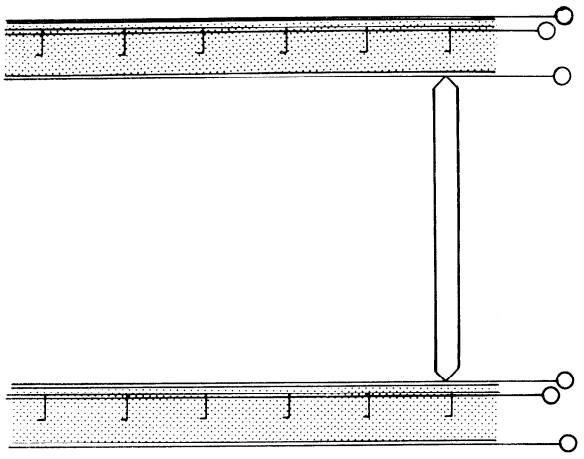
Recommendations for the sizes of controlling dimensions are given in ISO 3827/IV. The object of these recommendations is to provide a framework of controlling dimensions for use in the design of ships' deckhouses and accommodation and for guidance in the selection of co-ordinated sizes for components.

6.1 Vertical controlling dimensions

Vertical controlling dimensions are the dimensions for the deck to ceiling height.

In order to make the maximum use of dimensionally co-ordinated components, a rectilinear structure is preferable and ISO 3827/IV contains a recommendation that wherever possible flat decks without camber or sheer should be arranged and the recommendations are based on this

premise. If camber and/or sheer is present careful consideration should be given to the design in order to give the maximum possible degree of co-ordination.



6.1.1 *Deck to ceiling height*

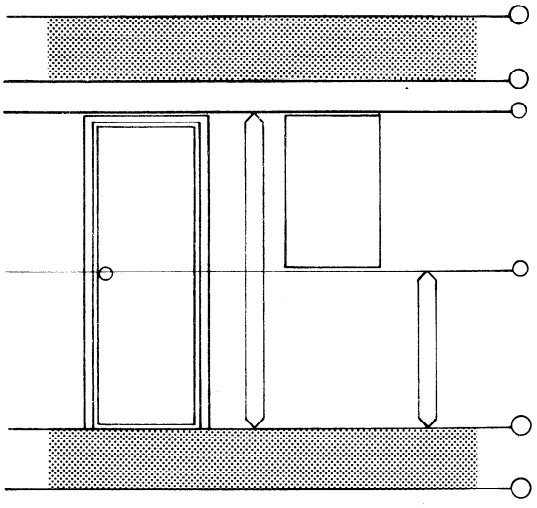
Controlling dimensions for the deck to ceiling height are measured between controlling lines situated on the boundaries of the finished floor to ceiling zones.

This dimension is of primary importance in the co-ordination of dimensions for shipbuilding as the maximum benefit would appear to derive from standard components for deckhouse subdivision, i.e. bulkhead and lining panels.

Heights in multiples of 100 mm (preferred) or 50 mm may be selected.

6.1.2 *Intermediate vertical controlling dimensions*

Intermediate vertical controlling dimensions are the dimensions for the height of window, sidelight and doorset heads and for the height of window and sidelight sills above the controlling plane at floor finish level. In relation to windows and sidelights these dimensions govern the position of the openings in linings to take window boxes rather than the position of the window itself.



6.1.3 *Height of zones*

The zones which contain the deck and finish, services and ceiling are governed by the physical requirements for these items together with the deck structure. The height of the zones will be decided by these physical requirements and the tween deck height in order to achieve a preferred dimension for the deck to ceiling height.

6.2 Horizontal controlling dimensions

Horizontal controlling dimensions are for the width and spacing of controlling zones for the structural bulkheads, linings, etc., and for the spacing of zones for subdivision bulkheads.

The controlling lines to which the dimensions are located may be positioned either on the boundaries or on the axes of the zones.

As in the vertical controlling dimensions, a rectilinear structure is preferable for the maximum use of co-ordinated standard components and ISO 3827/IV makes a recommendation that, wherever possible, raked and/or cambered house fronts, shaped house sides and sloping side shell should be avoided or obviated internally. Wherever shaping is present, consideration must be given to its effect in order to obtain the maximum possible degree of co-ordination.

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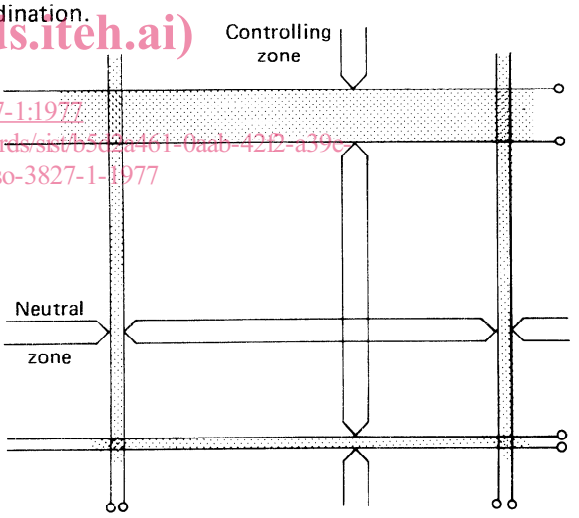


6.2.1 *Spacing of zones*

Horizontal controlling dimensions given in the table for the spacing of zones are applicable to both axial and boundary methods and refer to the horizontal distances between the controlling lines for the zones.

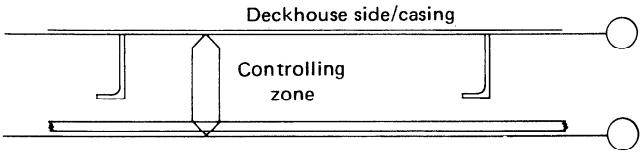
First preference Multiples of 300 mm from 300
Second preference Multiples of 100 mm from 300

6.2.2 *Width of controlling zones*

Horizontal controlling dimensions for the width of controlling zones refer to the dimensions within the boundaries of zones.

These sizes are for the zones such as deckhouse side or casing and include structure, space for services, fixings and finished linings.

The sizes of controlling zones should be in multiples of 50 mm, although some deviation may be required by structural arrangements.

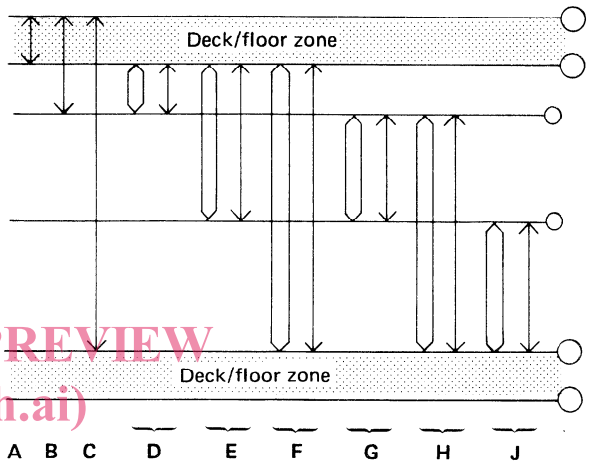


6.3 Neutral zones

ISO 3827/II defines a neutral zone as "a zone which interrupts the regular increments of a reference system".

Neutral zones are used to accommodate non-modular sized components; in the shipbuilding application these may be for subdivision bulkheads, and the size of the zone will be determined from the actual thickness of the panels, plus finishes, fixings, etc. but not including trim.

The total possible range of vertical co-ordinating spaces derived from controlling and intermediate controlling lines is restricted, in the shipbuilding application, to those for internal subdivision, as shown in the sketch. The spaces shown are given a reference letter for ease of identification, and are referred to as space types. Related components and assemblies will not necessarily contain all the space types and only those types commonly associated with particular components will be considered in the tables of co-ordinating spaces to be published in subsequent International Standards in this series, for example internal door-sets commonly include space types F and H.



NOTE — It will be noted that space types D to J, which occur between controlling lines, are related to controlling dimensions.

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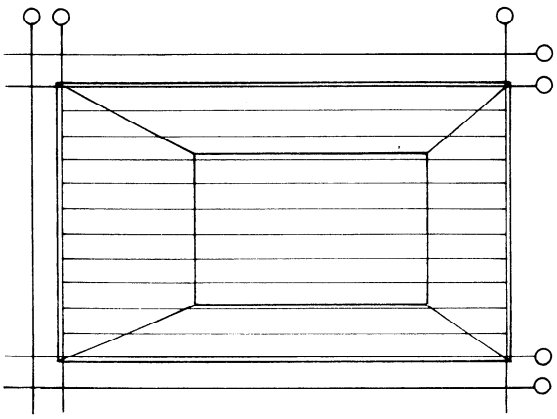
7 LOCATION OF COMPONENTS

Components and assemblies should be located in a space within the reference system defined by reference planes or lines in the system, the co-ordinating space. This space should include the space required for joints and tolerances or deviations.

In co-ordinated planning, different methods of locating components may be applied and a distinction is made between vertical and horizontal location.

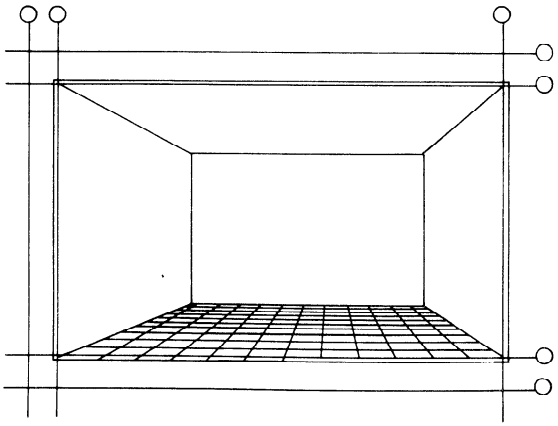
7.1 Vertical location

For vertical location a component only requires a single dimension from it to the finished floor plane. This dimension should accord with the recommendations for vertical controlling dimensions and intermediate vertical controlling dimensions contained in ISO 3827/IV.



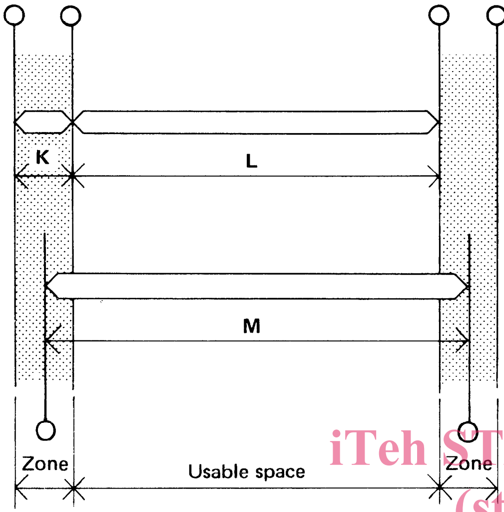
7.2 Horizontal location

For horizontal location, components require location in two directions; for this reason it is convenient to introduce a grid to which they may be related. A grid is defined in ISO 3827/II as "a rectilinear network of reference lines in one plane" and as such it is intended as a reference tool for the layout of modular designs. The horizontal dimensions for components derived from the grid should be based upon the horizontal controlling dimensions for width and spacing of zones.



The relationship of components, grids and controlling lines will depend upon the size of grid, the sizes of the zones and whether the controlling dimensions are on the faces or axes of zones.

The range of space types for horizontal co-ordinating spaces is limited to three, i.e. width of zone, face spacing of zones, and axial spacing of zones. These types are also given identification reference letters.



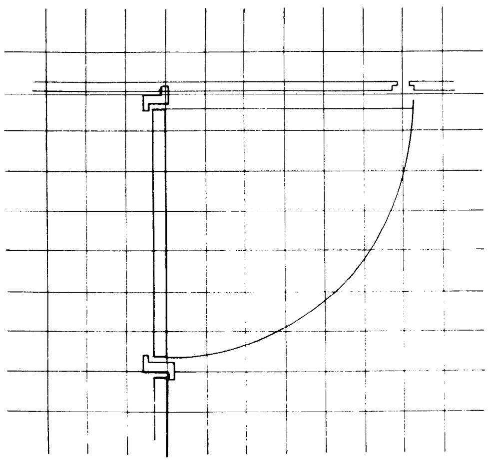
NOTE — It will be noted that space types L and M, which occur between controlling lines, are related to controlling dimensions.

7.3 Location : grids

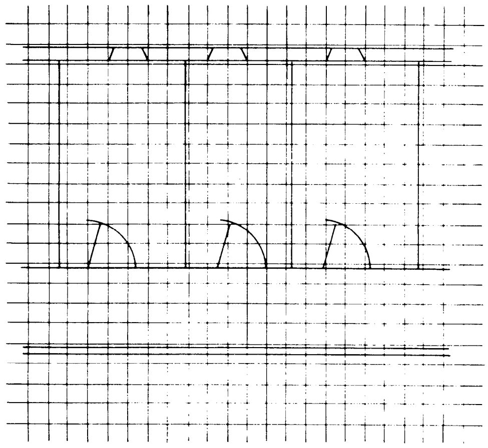
The advantage of using various grids on drawings is that they provide a reference system for sizing and positioning modular components both for the designer and for those reading the drawings.

7.3.1 *Size of grid*

The basic module grid, i.e. with spacing of 100 mm between the lines, is sufficiently small to show detailed construction and the precise relationship of components, and would generally be used on drawings to scales of 1 : 50 and 1 : 20.



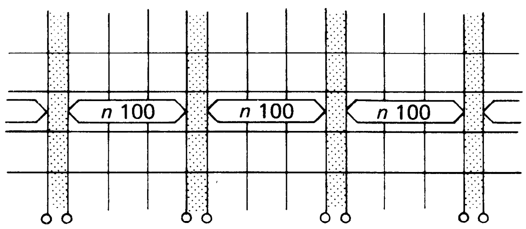
The 300 mm grid is more convenient for layout drawings. On this grid the components will often be offset from the grid lines. This grid would generally appear on drawings to scales of 1 : 200 and 1 : 100.



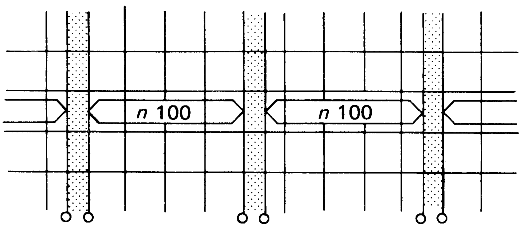
7.3.2 *Application of grids*

In applying grids to the layout of ships' accommodation areas, the relationship between the grid and the zones will vary with the size of the grid, the width of the zones, the method employed for spacing the zones and the alternative of continuous or interrupted grids.

Interrupted grid : It is recommended that for ease of detail design an interrupted grid be employed to accommodate the varying widths of zones. Controlling lines are positioned on the faces of the zones and the spacings of zones are multiples of 100 mm. This method will ensure that the usable space, where the maximum benefit from co-ordinated components will be obtained, is always fully modular.



Continuous grid : In the initial planning and layout of the accommodation areas it may be convenient to utilize a continuous grid but in this instance varying relationships between the grid and zones will be apparent. Great care must therefore be taken to ensure that allowance is made for the widths of the neutral zones contained within a particular layout.



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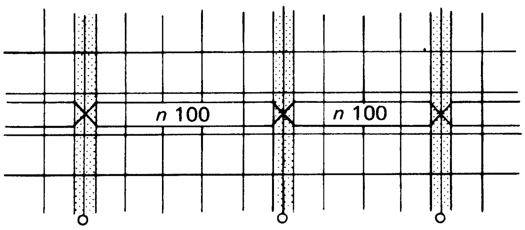
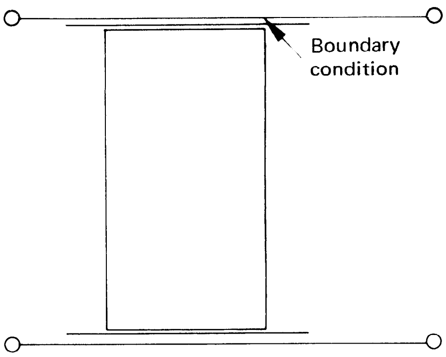
Axial spacing may also be employed with a continuous grid, but this method is not recommended as the usable space between zones then varies with the width of the zones.



7.4 Location : zones

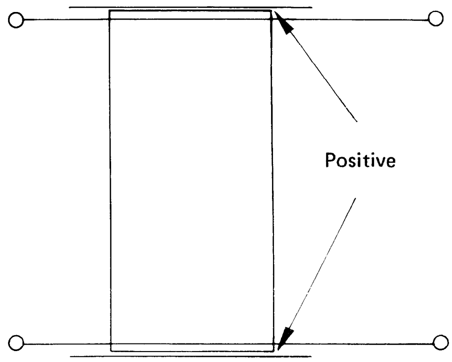
7.4.1 *Penetration of zones*

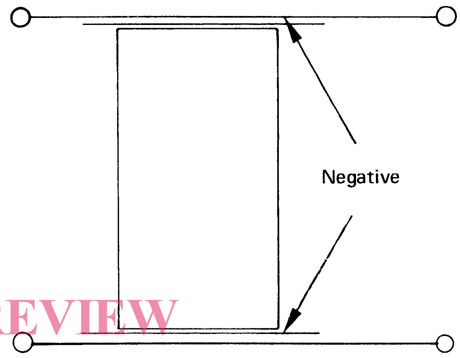
The range of co-ordinating spaces derived from the controlling and intermediate controlling lines may be regarded as preferred ranges. However, it is sometimes essential that a component within a co-ordinating space should penetrate the adjoining zone or stop short of it. This relationship between the key reference plane, which defines the boundary of a controlling zone, and the reference plane which defines the boundary of the co-ordinating space for a component or assembly is known as a boundary condition.



7.4.1.1 POSITIVE AND NEGATIVE BOUNDARY CONDITION

Boundary conditions are positive where the co-ordinating space extends past the key reference plane, and negative where the co-ordinating space stops short of the key reference plane.





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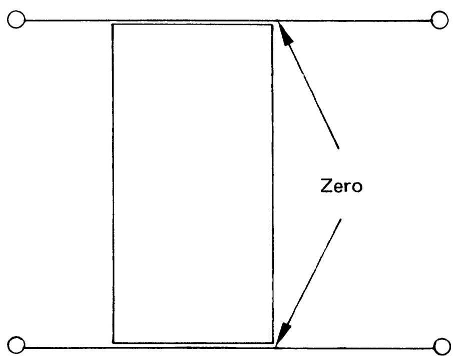
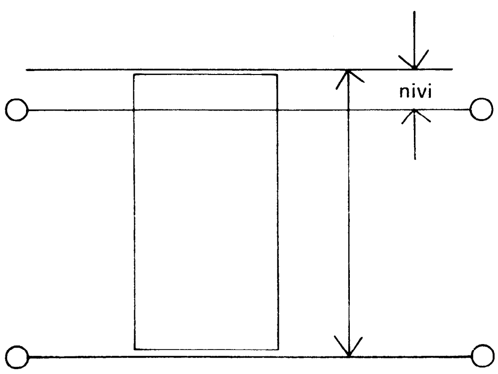
7.4.1.2 ZERO BOUNDARY CONDITION

The preferred co-ordinating space, whose boundary is coincident with the key reference plane, has a zero boundary condition.