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Indian Standard

RECOMMENDATIONS FOR MODULAR CO-ORDINATION IN BUILDING INDUSTRY : HORIZONTAL CO-ORDINATION

(First Revision)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

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RECOMMENDATIONS FOR MODULAR CO-ORDINATION IN BUILDING INDUSTRY: HORIZONTAL CO-ORDINATION

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 27 February 1987, after the draft finalized by the Modular Co-ordination Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Controlling dimensions are key dimensions of buildings for which sizes must be established in relation to the functional and user requirements. These are preferred dimensions intended to be used in the design of buildings and also to assist in the selection of ranges of co-ordinating sizes for standard modular building components. Since the ranges of preferred sizes are intended to be of universal application, a limited selection will be appropriate to the scale and function of individual building types.

0.3 This standard was first published in 1975. This revision has been prepared incorporating the advancement made in the modular planning and design since more than a decade. In this standard the principle of horizontal co-ordination has been explained; and preferred sizes for various types of buildings like residential, industrial, educational, health and office buildings as well as building components and built-in fixtures have been included.

0.4 In the preparation of this standard, considerable assistance has been rendered by the National Buildings Organization, New Delhi.

0.5 In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following:

1) AJ Metric Handbook. The Architectural Press, London (1969).

2) India. Ministry of Works & Housing Development Group on Prefabrication and Modular Co-ordination in Building Report, 1978.

3) Henrik Nissen. Industrialised Building and Modular Design. Cement and Concrete Association, London (1972).

4) The Principles of Modular Co-ordination in Building (revised). CIBW-24, the International Modular Group, 1982.

1. SCOPE

1.1 This standard specifies values of multimodules and range of preferred sizes for horizontal coordinating controlling dimensions for all types of buildings and their components, such as width of doors, windows, built-in furnitures and fixtures as well as widths, and spacings of controlling zones for column and load bearing walls.

2. FIELD OF APPLICATION

2.1 This standard is applicable to the construction of all types of buildings, materials and construction techniques and in accordance with the principles of modular co-ordination (*see* IS : 6820-1987* and IS : 10600-1983†).

2.2 These recommendations state the preferred horizontal dimensions to be applied at the design of components as well as at the design of buildings for which components may by used as parts. Primarily, the preferred dimensions are referring to the building structure.

3. TERMINOLOGY

3.1 For purpose of this standard, the definitions given in IS : 4993-1983‡ and IS : 6408-1971§, and the following shall apply.

3.1.1 *Controlling Lines* — Modular grid lines which establish the need for delineating the datum/reference lines in respect to load bearing elements of structure on the horizontal plane.

3.1.2 Controlling *Dimensions* — Modular co-ordinating dimensions between controlling points, lines and planes (for example, storey height, distance between axis of columns and thickness of controlling zone).

*Recommendations for modular coordination in building industry applications (*first* revision).

†Recommendations for modular coordination: Principles and rules.

‡Glossary of terms relating to modular coordination (*second recision*).

§Recommendations for modular coordination: Application of tolerances in building industry.

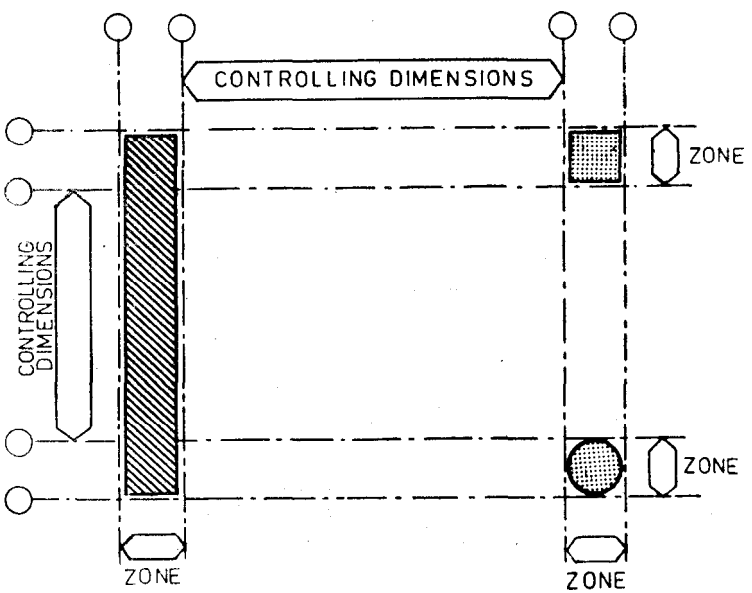
3.1.3 *Controlling Zone* — A zone between controlling planes provided for floor, roof, load bearing walls or columns.

4. HORIZONTAL CO-ORDINATION — GENERAL CONCEPT

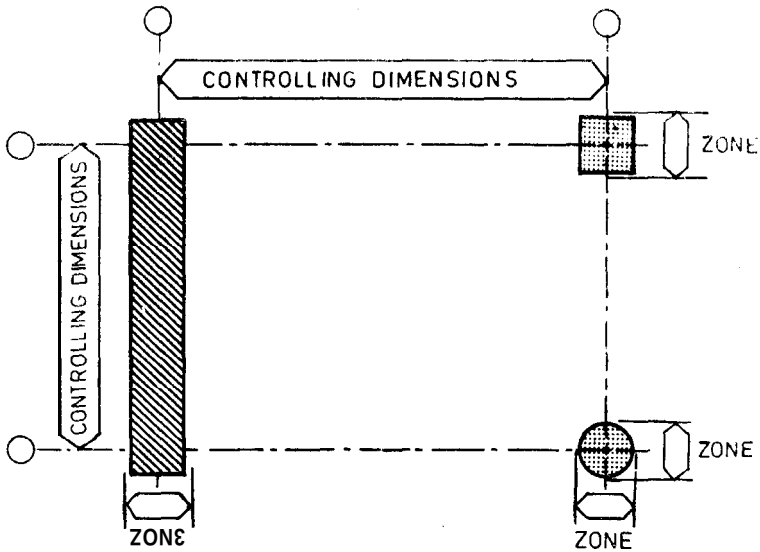
4.1 Traditionally, at sketch design stage and working drawing stage of the building project, the drawings are prepared by two methods: (a) indicating internal clear dimensions of activity spaces, and (b) at working drawing stage, introducing centre line dimensions for elements of construction. In horizontal co-ordination, this is recognized as boundary planning and axial planning respectively (*see* Fig. 1). In practice, however, such clear cut distinction does not exist.

4.2 The modular grid shall establish the primary reference. The boundary planning is the first point, line or a plane for positioning components and elements of construction in relation to such grid.

4.3 Axial planning shall normally be adopted to decide, only position of certain structural components like, columns, load bearing walls, beams, etc.



1 A BOUNDARY PLANNING



1B AXIAL PLANNING

FIG. 1 BOUNDARY PLANNING AND AXIAL PLANNING

4.4 Boundary planning may be combined with axial planning for positioning structural elements (*see* Fig. 2).

4.5 Boundary planning shall be a deciding factor for position and size of components, assemblies and elements of construction.

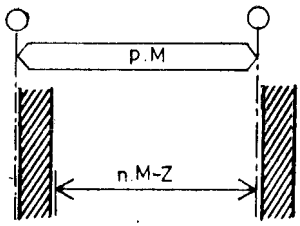
5. PREFERRED HORIZONTAL DIMENSIONS

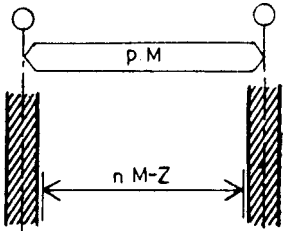
5.1 The preferred horizonal dimensions for building components and building are such multiples of 3M (*see* **5.2**) which are preferred against other multiples of basic module.

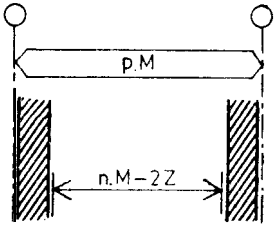
5.2 The values of multimodule for horizontal co-ordination dimensions in modular co-ordination shall be 3M, 9M, 15M, 21M, 27M, 33M, 39M and 45M.

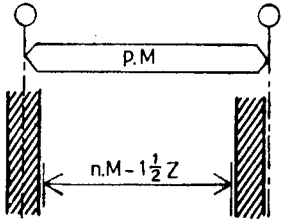
5.3 The series of preferred dimensions include eight sub-series as stated in **5.2** each beginning with odd multiple of 3M which is subsequently doubled; for example, $n \times 3M$ where n is odd number, namely, 1, 3, 5, 7, 9, 11, 13, 15.

5.4 Increments in the series of preferred dimensions are increased stepwise by doubling.



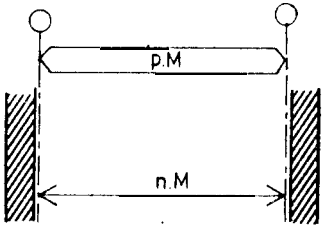


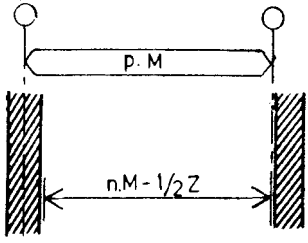




pM = PLANNING MODULE
M = MODULE

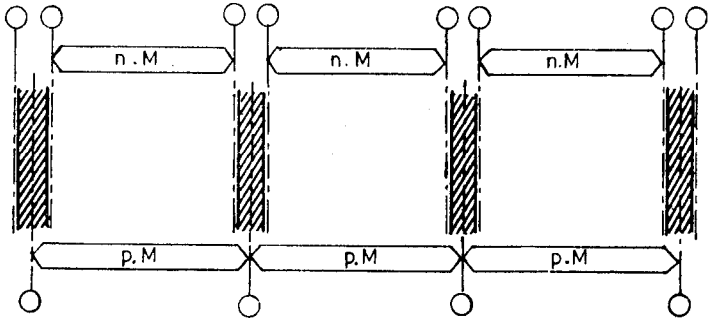
P = PLANNING
il = ZONE





2A BOUNDARY PLANES

2B AXIAL PLANES



2C DERIVATION OF ROOM DIMENSION S with reference to WALL THICKNESSES

FIG. 2 COMBINATION OF BOUNDARY PLANNING AND AXIAL PLANNING

6. MODULAR ROOM DIMENSIONS

6.1 In the perfect modular designs, all room dimensions shall be modular.

6.2 The modular room dimensions shall be designed and that modular fixtures, fittings and partitions shall fit into them without shaping on site. This shall only be achieved when all building components are made available on modular dimensions for the modular planning.

7. AXIAL PLANNING

7.1 While applying this principle, modular room dimensions shall only be achieved if the wall thicknesses are also modular (*see* example in Fig. 3). But in practice, the use of conventional bricks also results in non-modular wall thickness.

7.2 If wall axial principle is neglected, modular room dimensions shall be achieved with conventional bricks, which are thicker than 2M by introducing a neutral zone in the wall (*see* Fig. 4).

7.3 Thus, the modular room dimension becomes $n \times M + 10$ mm with plaster and $n \times M + 30$ mm without plaster. In practice, the clear room dimensions are considered without plaster and '5-mm Rule'. The room dimensions shall be determined with rules for modular openings (*see* Fig. 4).

7.4 Modular room dimensions in the carcass shall not be normally achieved with economical wall thickness and inaccuracies that occur in present constructional methods. Therefore, modular room dimensions shall not normally be utilized.

8. 5-mm RULE

8.1 Horizontal dimensions in design of the buildings are controlled by the planning module 3M.

8.2 The sizes of building components, room dimensions and buildings are based on preferred horizontal modules.

8.3 The wall, which is the structural part of the vertical division, shall be placed one joint proportion on the boundaries of a modular plane, that is, the actual dimension as a rule for the structural elements shall be '5 mm' less on all modular boundary plane. This Rule shall be called as 5-mm Rule for all horizontal dimensions (*see* Fig. 5).

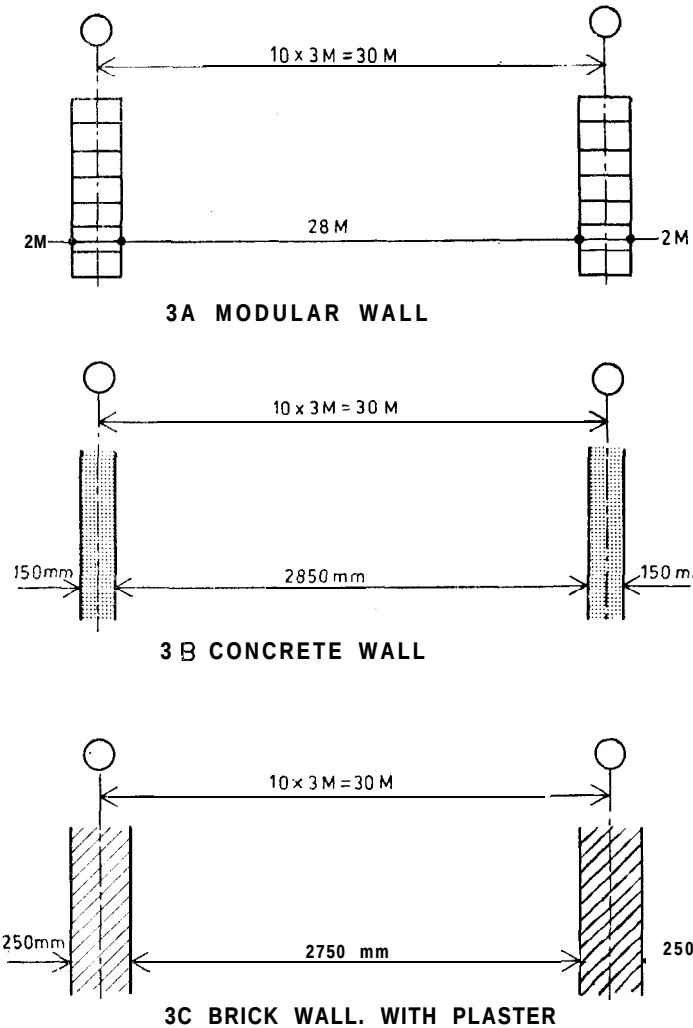
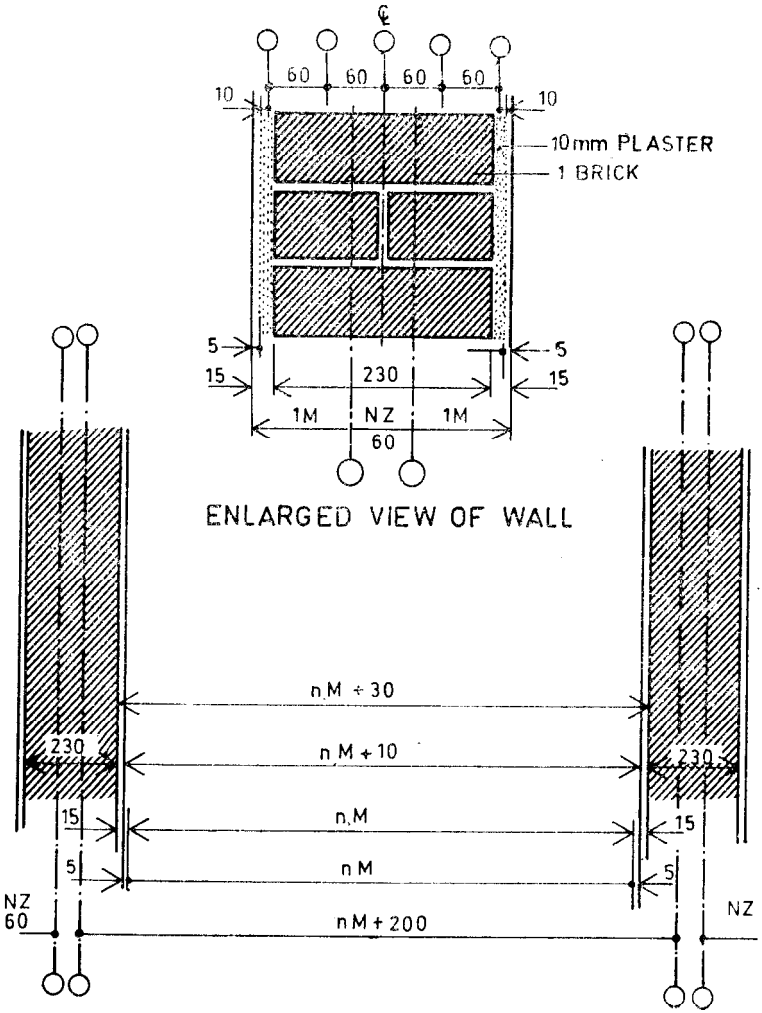
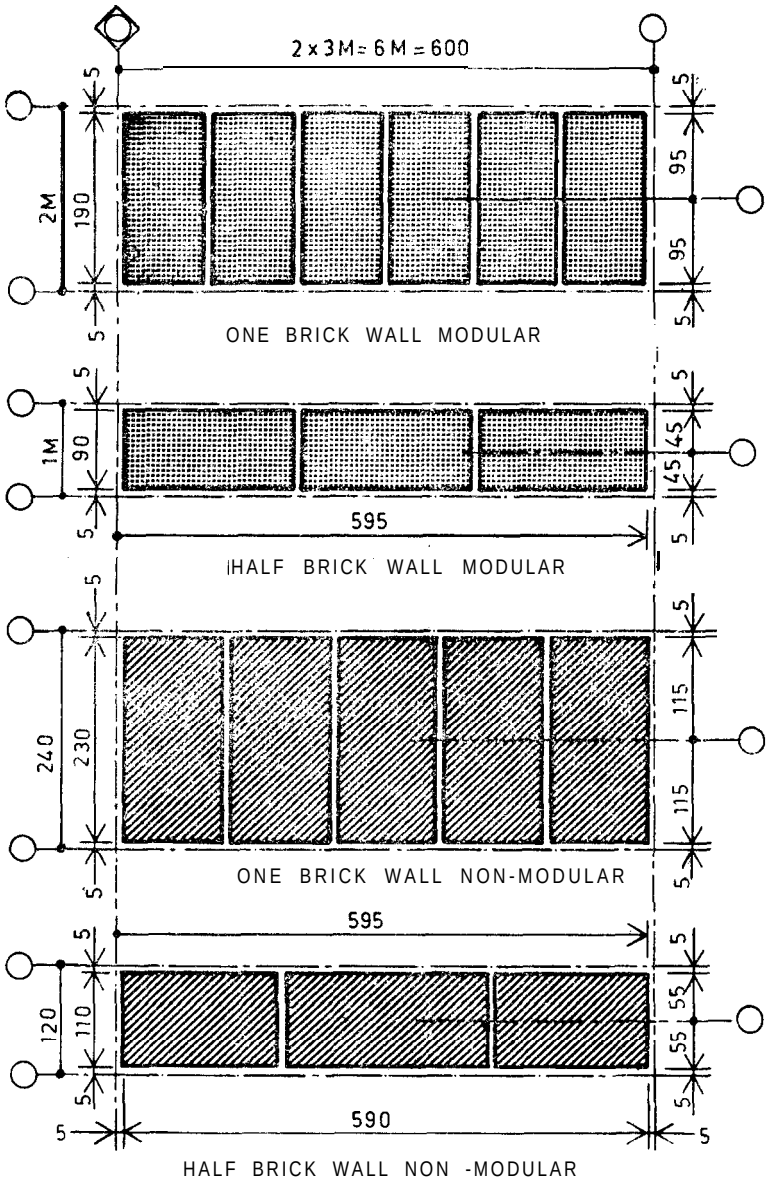


FIG. 3 AXIAL PLANNING PRINCIPLE IN WALL THICKNESSES WITH MODULAR AND NON-MODULAR DIMENSIONS



All dimensions in millimetres.

FIG. 4 MODULAR ROOM DIMENSIONS



All dimensions in millimetres.

FIG. 5 5-mm-RULE

9. COMPONENT DIMENSIONS

9.1 The controlling dimensions for widths of building components like doors, windows, built-in furnitures and fixtures shall be in accordance with the sizes given in Table 1 (read in conjunction with Fig. 1).

9.2 For a certain type of component, the degree of dimensional simplification and choice of dimensions shall be determined with reference to functional requirements, structure, production techniques, economy transport conditions, etc.

9.3 The dimensions of many components and assemblies contained within controlling zones other than those covered in Table 1. In some cases, such sizes may be co-ordinated by the use of sub-modules.

10. BUILDING DIMENSIONS

10.1 Structural dimensions longitudinal and transversal, that is, spans, spacing between columns, widths of floor elements, length of wall elements, shall be selected among preferred dimensions. Planning grids, rectangular or square masks shall conventionally serve as a tool for simplification of design process in general.

10.2 In buildings, load bearing structural elements are normally centered over the lines of planning grids or on a grid displaced half planning module or half basic module (*see* Fig. 6).

10.3 The controlling dimensions for various buildings shall be as given in **11, 12, 13, 14,** and **15,** and in Tables 2, 3 and 4 (read in conjunction with Fig. 1).

11. RESIDENTIAL BUILDINGS

11.1 Horizontal preferred dimensions for residential buildings shall be multiple of 3M as outlined in Table 2.

12. INDUSTRIAL BUILDINGS

12.1 The recommended preferred horizontal dimensions for industrial buildings, single and multi-storeyed, shall primarily be applied to the design of structural components and building elements. The 3M, 6M, 12M, 24M, 48M, 96M, etc The large dimension intervals in the series shall be used as planning module for industrial buildings as outlined in Table 2.

13. HEALTH BUILDINGS

13.1 Horizontal preferred dimensions for health buildings shall be multiple of 6M as outlined in Table 3.

TABLE 1 PREFERRED ZONES AND DIMENSIONS FOR BUILDING COMPONENTS

(Clauses 9.1 and 9.3)

	CONTROLLING ZONE mm	SERIES					
		0·25 M	0·75 M	1·25 M	1·75 M	2·25 M	2·75 M
M INTERVAL	25	●					
	50	●					
	75		●				
	100	●					
	125			●			
	150		●				
	175				●		
	200	●					
	225					●	
	250			●			
	275						●
	300		●				
M/2 INTERVAL	350				●		
	400	●					
	450					●	
	500			●			
	550						●
	600		●				
M INTERVAL	700				●		
	800	●					
	900					●	
	1000			●			
	1100						●
	1200		●				

Note: Symbol ● Indicates preferred size

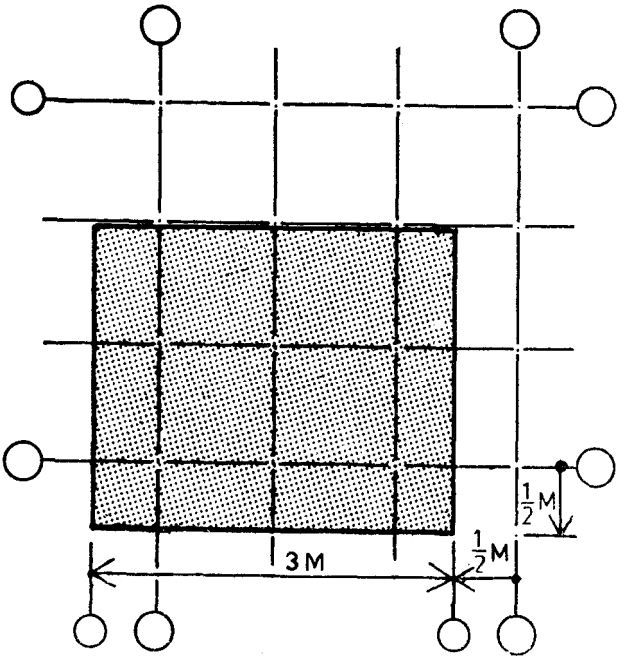


FIG. 6 DISPLACEMENT OF PLANNING GRID

14. OFFICE BUILDINGS

14.1 Horizontal preferred dimensions for office buildings shall be multiple of 6M as outlined in Table 3.

15. EDUCATIONAL BUILDINGS

15.1 The horizontal planning module shall be 12M increment. Horizontal preferred dimensions for educational buildings shall be multiple of 12M as outlined in Table 4.

TABLE 2 PREFERRED CONTROLLING DIMENSIONS FOR RESIDENTIAL AN0 INDUSTRIAL BUILDINGS

(Clauses 10-3 11.1 and 12.1)

	CONTROLLING SPACE mm	SERIES							
		3M	9M	15M	21M	27M	33M	39M	45M
3M INTERVAL	300	●							
	600	●							
	900		●						
	1200	●							
	1500			●					
	1800		●						
	2100				●				
	2400	●							
	2700					●			
	3000			●					
	3300						●		
	3600		●						
	3900							●	
	4200				●				
	4500								●
	4800	●							
6M INTERVAL	5400					●			
	6000			●					
	6600				●		●		
	7200		●						
	7800							●	
	8400				●				
	9000								●
	9600	●							

Note: Symbol ● indicates preferred size

TABLE 3 PREFERRED CONTROLLING DIMENSIONS FOR HEALTH AND OFFICE BUILDINGS

(Clauses 10·3, 13·1 and 14·1)

CONTROLLING SPACE	mm	SERIES			
		3M	9M	15M	21M
6M INTERVAL	600	●			
	1200	●			
	1800		●		
	2400	●			
	3000			●	
	3600		●		
	4200				●
	4800	●			
12M INTERVAL	6000			●	
	7200		●		
	8400				●
	9600	●			
24M INTERVAL	12000			●	
	14400		●		
	16800				●
	19200	●			
48M INTERVAL	24000			●	
	28800		●		
	33600				●
	38400	●			
96M INTERVAL	48000			●	
	57600		●		
	67200				●
	76800	●			

Note: Symbol ● indicates preferred size

TABLE 4 PREFERRED CONTROLLING DIMENSIONS FOR EDUCATIONAL BUILDINGS

(*Clauses* 10.3 *and* 15.1)

CONTROLLING SPACE mm		SERIES			
		3M	9M	15M	21 M
12 M INTERVAL	1200	●			
	2400	●			
	3600		●		
	4800	●			
	6000			●	
	7200		●		
	8400				●
	9600	●			
24M INTERVAL	12000			●	
	14400		●		
	16800				●
	19200	●			
48M INTERVAL	24000			●	
	28800		●		
	33600				●
	38400	●			
96 M INTERVAL	48000			●	
	57600		●		
	67200				●
	76800	●			
192M INTERVAL	92000			●	
	115200		●		
	134400				●
	153600	●			

NOTE : Symbol ● indicates preferred size

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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