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Second edition

Code of practice for fire safety of building —

Part 2:

Details of construction

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Rwanda Standards Board

In order to match with technological development and to keep continuous progress in industries, Standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 186-2 was prepared by Technical Committee RSB/TC 28, *Fire Safety*

In the preparation of this standard, reference was made to the following standards:

IS 1642; *Fire Safety of Buildings (General): Details of construction-Code of practice*

The assistance delivered from the above source is hereby acknowledged with thanks.

This second edition cancels and replaces the first edition (RS 186-2: 2013) of which has been technically revised.

DRS 186 consists of the following parts, under the general title *Code of practice for fire safety of building*

- *Part 1: General Principles of Fire Grading and Classification*
- *Part 2: Details of Construction*
- *Part 3: Fire Safety in public buildings*
- *Part 4: Selection, installation and maintenance of automatic fire detection and alarm system*
- *Part 5: Exit requirements and personal hazard*

Committee membership

The following organizations were represented on the Technical Committee on Fire Safety (RSB/TC 28) in the preparation of this standard.

City of Kigali

College of Science and Technology

CABLELINE

Energy Utility Corporation Limited

ELECTRICOM

ISCO

Institute of Engineers Rwanda

Ministry of Disaster Management and Refugees

Ministry of Infrastructure

Rwanda Housing Authority (RHA)

Rwanda Motor Ltd

Rwanda National Police

REAL

Société Rwandaise d'Assurance (SONARWA)

SONATUBES

Rwanda Standards Board (RSB) - Secretariat

Code of practice for fire safety of building — Part 2: Details of construction

1 Scope

This standard lays down the essential requirements of fire safety of buildings with respect to details of construction.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS 186-5, *Code of Practice for Fire Safety of Building — Part 5: Exit requirements and personal hazards*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1

Fire Resistance

Ability of an element of building construction, component for structure to fulfil, for a stated period of time, the required stability, fire integrity and/or thermal insulation and/or other expected duty in a standard fire resistance test

3.2

Fire Separation

The distance in metres measured from any other building on the site, or from other site or from the opposite side of street or other public space to the building for the purpose of preventing the spread of fire.

3.3

Fire Resisting Wall

The wall that provides complete separation of one building from another or part of a building from another part of the same building to prevent any communicator of fire or any access or heat transmission to wall itself which may cause or assist in the combustion of materials of the side opposite to that portion which may be on fire.

3.4

Venting fire

The process of inducting heat and smoke to leave a building as quickly as possible by such parts that lateral spread of fire and heat is checked, fire fighting operations are facilitated and minimum fire damage is caused.

4 Types of Construction

4.1 The design of any building and the type of materials used in its construction are important factors in making the building resistant to a complete burn-out and in preventing the rapid spread of fire, smoke or fumes, which may otherwise contribute to the loss of lives and property.

4.2 The types of construction according to fire resistance are classified into four categories as defined in RS 186-1. The fire resistance ratings for various types of construction for structural and non-structural members should be as given in Table 1.

Table 1 — Fire Resistance Ratings of Structural Elements (in Hours)

Structural Element			**Type of Construction**			
			Type 1	**Type 2**	**Type 3**	**Type 4**
Exterior walls	Fire separation less than 3.7m	Bearing	4	2	2	1
		Non-bearing	2	½	1	1
	Fire separation of 3.7 m or More but less than 9 m	Bearing	4	2	2	1
		Non-bearing	½	1	1	1
	Fire separation of 9 m or more	Bearing	4	2	2	1
		Non-bearing	1	1	1	1
Fire walls			4	2	2	2
Fire separation assemblies (like File check doors)			4	2	2	2
Fire enclosures of exit ways, exit-Way hallways, and stairways			2	2	2	2
Shaft other than exit way elevator Hoist ways			2	2	2	2
Exit way access corridors			1	1	1	1
Vertical separation of tenant spaces			1	1	1	1
Dwelling unit separation			1	1	1	1
Non-load bearing partitions			At least half an hour			
Interior hearing walls, bearing		Supporting more than one floor Partition, columns, girders, trusses (other than roof trusses)	4	2	2	2
		Supporting one and framing floor only	3	1½	1	1
		Supporting a roof only	3	1½	1	1
Structural members support walls			3	1½	1	1

Floor construction including walls		3	1½	1	1
Roof construction	5 m or less in height to lowest member	2	1½	1	1
	More than 5m but less than 6.7 m in height to lowest member	1	1	1	1
	6.7 m or more in height to lowest member	0	0	0	0
Note: Fire Resistance Ratings of Type 5 wooden frame shall be based on fire rated coating or cover extends the fire resistance rating of structural members at least 1 hour					

4.3 For buildings above 15 m in height non-combustible materials should be used for construction and the internal walls of staircases should be of brick work or reinforced concrete or any other material of construction with minimum of 2 h rating. The walls for the chimney shall be of Type 1 or Type 2 construction depending upon whether the gas temperature is above 200 °C or less.

4.4 When test is done according to relevant approved national or international standard, the fire resistance of an element of structure or combination of elements is determined from one of the following three methods:

a) Information as established by research data;

b) Direct application of the results of fire resistance test on an element of structures; and

c) On the basis for calculating the fire resistance of a structural element; except for columns or walls.

5 Walls

5.1 The fire ratings of some types of constructions for walls are given in Tables 2 to 7. The specifications of materials should be so selected as to give these ratings:

Table 2 — Masonry walls: Solid (required for resisting fire from one side at a time; see 5.1)

Nature of Construction and Materials.	Minimum Thickness (mm), Excluding any Finish, for a fire Resistance (Hours) of :									
	Load Bearing					Non-Load Bearing				
	1	1½	2	3	4	1	1½	2	3	4
Reinforced [a] cement concrete	120 (25)[b]	140 (25)[b]	160 (25)[b]	200 (25)[b]	240 (25)[b]					
Unreinforced cement concrete	150	175	-	-	-					
Non-fines concrete with: a) 13 mm cement/sand or gypsum/sand. b) 13 mm lightweight aggregate gypsum Plaster						150 150	150 150	50 150	150 150	150 150
Bricks of clay: a) Without finish. b) With 13mm lightweight aggregate Gypsum plaster	90 90	100 90	100 90	170 100	170 100	75 75	90 90	100 90	170 90	170 100
Bricks of sand lime: a) Without finish b) With 13 mm lightweight aggregate Gypsum plaster	90 90	100 90	100 90	190 100	190 100	75 75	90 90	100 90	170 90	170 100
Blocks of concrete: a) Without finish b) With 13 mm lightweight aggregate Gypsum plaster c) With 13 mm cement/sand or gypsum/ Sand.	90 90	100 90	100 90	— 100	— 100	75 75 75	90 75 90……90	100 75 100	140 90 140	150 100
Blocks of lightweight concrete: a) Without finish b) With 13 mm lightweight aggregate Gypsum plaster a) c) With 13 mm cement/sand or gypsum/ Sand	90 90	100 90	100 90	140 100	150 100	75 50 75	75 63 75	75 75 75	125 75 90	140 75 100
Blocks of aerated concrete: a) Without finish b) With 13 mm lightweight aggregate Gypsum plaster	90 90	100 90	100 100…….100	140	180 150	50	63	63	75	100

[a] Walls containing at least 1 percent of vertical reinforcement

[b] Minimum thickness of actual cover to reinforcement

Table 3 — Masonry walls: Hollows (required for resisting fire from one side at a time)

Nature of Construction and Materials	Minimum Thickness , Excluding any Finish, for a Fire Resistance (Hours) of:										
	Load Bearing					Non-Load Bearing					
	1	1½	2	3	4	1½	1	1½	2	3	4
Bricks of clay:											
a) a)Without finish	170	170	170	200	200	75	100	100	170	170	200
b) b)With 13 mm lightweight aggregate Gypsum plaster	100	100	170	170	170	75	75	90	100	100	170
Blocks of concrete:											
a) a)Without finish						90	125	125	140	140	150
b) With 13 mm cement/sand or gypsum/ sand.						90	125	125	140	140	140
c) c) With 13 mm lightweight aggregate gypsum plaster	190	200	200	—	—	75	90	90	100	125	125
Blocks of lightweight concrete:											
a) Without finish	100	100	100	—	—	75	905	90	100	140	150
b) With 13 mm cement/sand or gypsum/ Sand						75	75	75	100	140	140
c) With 13 mm lightweight aggregate Gypsum plaster						63	63	75	75	90	100

Table 4 — Framed construction, load bearing (required for resisting fire from one side at a time)

Nature of Construction and Materials/ Faced on Each Side with Timber Studs at Centres not exceeding 600 mm		Minimum Thickness (mm) of Protection for a Fire Resistance of 1 h
Plasterboard layers with joints staggered, joints in outer layer taped and filled —Total thickness for each face		25
Lightweight aggregate gypsum plaster One layer of 12.7 mm plasterboard with a finish of		13
Metal lath and plaster, thickness of plaster	Lightweight aggregate gypsum plaster :	22
	Sanded gypsum plaster (metal lathing grade)	13

Table 5 — Framed Construction, Non-Load Bearing (Required to Resist Fire from One Side at a Time)

Nature of Construction and Materials/Steel or Timber Frame at Centres not Exceeding 600 mm, Facing on Both Sides of	Stud Construction	Minimum Thickness (mm) of Protection for a Fire Resistance of			
		½ h	1h	1½ h	2h
Dry lining with materials fixed direct to studs (without plaster finish):					
One layer of plasterboard with taped and filled joints	Timber or steel	12.7			
Two layers of plasterboard with Joints staggered, joints in outer Thickness for each face Layer taped and filed —Total thickness for each face	Timber or steel	19	25		
One layer of wood wool slabs	Timber	25			
One layer of chipboard or of plywood	Timber or steel	18			
Lining with materials fixed direct to studs, with plaster finish					
Plasterboard of thickness:					
1) Finish With no less than 5 mm gypsum plaster	Timber or steel	9.5			
2) With not less than 13 m gypsum plaster finish			12.7		
Wet finish					
Metal lath and plaster, thickness of Plaster:					
1) plaster Sanded gypsum plaster	Timber or steel	13			
2) Lightweight aggregate gypsum	Timber		13	19	25
	steel		13		

Table 6 — Framed external walls load bearing (required for resisting fire from one side at a time)

Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of 1 h
Timber studs at centres not exceeding 600 mm With internal linings of plasterboard layers with joints in outer layer taped and filled, total thickness	31

5.2 The separating walls should be carried through the roof to a height of at least 60 cm above except in the case of reinforced brick/concrete slab roof where it should be bonded flash with a top level of the slab. At the time of designing openings, particular attention should be paid to all such factors as will limit fire spread through these openings. Every opening in the wall should be protected by fire resisting doors having the fire rating of not less than 1 h. Similar protection should also be done in other openings like rope races, motor alley ways, staircases, etc. of rating not less than 2 h. However, for Types 1, Type 2, Type 3 construction, a doorway or opening in a separating wall of any floor should be limited to 56m^2 in area with a maximum height of 2.75 m and maximum width of 2 m.

5.3 When building(s) and /or compartment(s) are separated by separating wall(s) and there is a verandah on one or more sides of such building(s) and/or compartment(s), it is necessary that the separating wall should be built out across the verandah and be carried through the roof of the same; otherwise the building(s) and/or compartment(s) should be regarded as having internal communication and, therefore, subject to danger of spread of fire.

5.4 When opening in walls are provided to allow cable, etc, the space around cables and the wall should be protected in accordance with approved standard. However, such space in case of openings provided to allow plumbing/gas/steam pipes and similar services should be scaled with filter material of fire rating not less than that of the walls in which these are situated.

5.5 Where openings are permitted, they should not exceed three-fourths of the area of the wall in case of an external wall.

5.6 A separating wall should be supported in a vertical line by a similar separating wall through all storeys below. The separating wall should be carried and bonded to the floor of appropriate fire-resisting construction.

5.7 When a separating wall runs parallel to the axis of the north light opening or gabled roof, the screen wall should be carried through, and 60 cm above the top of the north light opening except in cases where the screen wall becomes of such a height that horizontal distance between the north light opening and the roof of the adjoining building and/or compartment or between two sloping faces of the two consecutive roofs at the level of the top of the screen wall, is at least 6 m. If, however, the separating wall is at right angles to the axis of the north light opening or the gabled roof, the ‘saw tooth’ gaps should be bricked up and screen wall extended above the ridge of the north light or the gabled roof.

5.8 All separating walls should be built out to extend 15 cm beyond the eaves of the roof so as to effectively cut off the roofs of the parts so separated. The eaves should be cut away on each side of this extension of the separating wall. If there is an opening on both sides of the separating within 3 m of the wall, those on one side should be bricked up to full thickness of wall, or an alternative should be provided with fire resisting doors of fire rating not less than of 2 h for walls of 4 h rating and 1 hour for other rating.

5.9 Common wooden roof members (trusses, joists and purlins) should not pass through the separating walls but they may be embedded there-in provided they do not extend more than 22.5 cm into wall and are separated from the similar roof member in the adjoining building by at least 11 cm or solid wall material.

5.10 Partition is used for separating sectors or rooms of a building but is not expected to have a fire resistance equal to any of the values. In fact, in practice it should not be considered otherwise than structure of light dimension and strength consistent with the purpose for which it is used. The minimum fire rating of the partition is given in Table 1.

6 Columns and Beams

The fire ratings of some types of construction are given in Table 8, Table 9, Table 12 and Table 13. The specifications or materials should be so selected as to give ratings there-in.

7 Floors and Roofs

7.1 The fire ratings of some types of construction is given in Tables 10, 11, 14, 15, and 16; This specifications of materials should be so selected so as to give these ratings.

Table 7.A — Framed external walls non-load bearing required to resist fire only from inside the building

S/No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection For a Modified Fire Residence of					
		½ h	1h	1½h	2h	3h	4h
Steel frame with an external cladding of Non-combustible sheets (excluding sheet steel), With a steel supporting framework and internal lining of:							
1	Metal lath and plaster thickness of plaster:						
	a) Sanded gypsum plaster (metal lathing grade)	13	13				
	b) Lightweight: aggregate gypsum plaster	10	13	15	15	15	19
2	Two layer of plasterboard with joints staggered Joints in outer layer taped and filed-Total Thickness	21	32				
3	Plasterboard of thickness:						
	a) With not less than 5 mm gypsum plaster finish	12.7					
	b) With not less than 13 mm gypsum plaster finish	9.5					
	c) With not less than 10 mm lightweight aggregate gypsum plaster.	9.5					
4	One layer of wood/wool slabs without finish		50				
5	One layer of compressed straw building slabs:						
	a) Without finish	50					
	b) With not less than 5 mm gypsum plaster finish		50				
6	Aerated concrete blocks	50	50	63	63	75	100
7	Bricks of clay:						
	a) Without finish	75	75	90	90	100	100
	b) With not less than 13 mum lightweight Aggregate gypsum plaster			75	75	90	90

Table 7.B — Framed external walls non-load bearing required to resist fire only from inside the building;

SNo.	Nature of construction and materials	Maximum thickness (mm) of protection to provide sufficient insulation to achieve a modified fire resistance of up to 4 h.
Steel frame with an external cladding of sheet steel fully lapped, steel bolted and fixed to steel sheeting rails, with timber or steel supporting framework and internal lining of:		
1	Metal lath and plaster thickness of plaster:	
	a) Sanded gypsum plaster (metal lathing Grade)	13
	b) Lightweight aggregate gypsum plaster	10
2	One layer of plasterboard with joints taped and filled.	12.7
3	Plasterboard of thickness, with not less than 5 mm gypsum plaster finish	9.5
4	One layer of wood/wool slabs	25
5	One layer of compressed straw building slabs	50
6	One layer of chipboard (fibreboard) or of plywood	18
7	Aerated concrete blocks	50
8	Bricks of clay	75
9	Any internal decorative lining with a cavity fill independently supported and retained in position of mineral fibre insulating material (excluding glass) or a density of 48 kg/m^3	50

Table 7.C Framed Walls Non-Load Bearing Required to Resist Fire Only from Inside the Building

SN◦	**Nature of construction and materials** **Timber frame with external cladding of weather** **Baoding or external plywood, 9.5 mm with an** **Internal lining of:**	**Minimum thickness (mm) of protection for a fire resistance of 1½ h**
1	Plasterboard not less than 9.5 mm thick, finished With:	
	c) Gypsum plaster	
	d) Lightweight aggregate gypsum plaster	13 10
2	Plasterboard not less than 12.7 mm thick, finished With:	
	a) Gypsum plaster	10
	b) Lightweight aggregate gypsum plaster	10

Table 8 — Reinforced concrete columns (see 6.1)

S/N	Nature of Construction and Materials	Minimum Dimension (m), Excluding any Finish, for a Fire Resistance of						
			½ h	1 h	1½	2h	3h	4h
1	Full exposed	Width	150	200	250	300	400	450
		cover	20	25	30	35	35	35
2	50 percent exposed	width	125	160	200	200	300	350
		cover	20	25	25	25	30	35
3	One face exposed	Thickness	100	120	140	160	200	240
		cover	20	25	25	25	25	25

Table 9 — Concrete Beams (see 6.1)

S/N	Nature of Construction and Materials	Minimum Dimensions (mm),, Excluding any Finish, For a Fire Resistance of						
			½ h	1 h	1½	2h	3h	4h
1	Reinforced concrete (simply supported)	Width	80	120	150	200	240	280
		cover	20	30	40	60	70	80
2	Reinforced concrete (continuous)	width	80	80	120	150	200	240
		cover	20	20	35	50	60	70
3	Pre-stressed concrete (simply supported)	width	100	120	150	200	240	280
		cover	25	40	55	70	80	90
4	Pre-stressed concrete (continuous)	width	80	100	120	150	200	240
		cover	20	30	40	55	70	80

Table 10 — Concrete floors (see 7.1)

S/N	Nature of Construction and Materials	Minimum Dimensions (mm), Excluding any Finish for a Fire Resistance of						
			½ h	1 h	1½	2h	3h	4h
1	Reinforced concrete (simply supported)	Thickness	75	95	110	125	150	170
		cover	15	20	25	35	45	55
2	Reinforced concrete (continuous)	Thickness	75	95	110	125	150	170
		cover	15	20	20	25	35	45

Table 11 — Concrete floors: Ribbed open soffit (see 7.1)

S/N	Nature of Construction and Materials	Minimum Dimension (mm), Excluding any finish, for a fire resistance of						
			½ h	1 h	1½	2h	3h	4h
1	Reinforced concrete (simply supported)	Thickness	70	90	105	115	135	150
		Width	75	90	110	125	150	175
		cover	15	25	35	45	55	65
2	Reinforced concrete (continuous)	Thickness	70	90	105	115	135	150
		Width	75	80	90	110	125	150
		cover	15	20	-	35	45	55

Table 12 — Encased steel columns, 203 mm x 203 mm

(Protection applied on four sides; see 6.1)

S/N	Nature of Construction and Materials	Minimum Thickness (mm) of Protection For a Modified Fire Residence of				
		1 h	1½h	2h	3h	4h
Hollow protection (without an air cavity over the flanges) :						
1	[a]Metal lathing with towelled light weight aggregate gypsum plaster	13	15	20	32	
2	Plasterboard with 1*6 mm wire binding at 100 mm pitch, finished with Lightweight aggregate gypsum plaster not less than the thickness Specified:	10	13	15	15	15
	a) 9.5 mm plasterboard	10	15			
	b) 19 mm plasterboard	10	13	20		
3	Solid bricks of clay, composition sand lime, reinforced in every Horizontal joint, unplastered	50	50	50	75	100
5	aerated concrete blocks	60	60	60		
6	Solid blocks of lightweight concrete hollow protections (with an air cavity over the flanges)	50	50	50	60	75
Solid protection						
1	Concrete, not leaner than 1:2: 4 mix (unplastered):					
	a) Concrete not assumed to be load bearing, reinforced)	25	25	25	40	60
	b) Concrete assumed to be load bearing	50	50	50	75	75
2	[b]Lightweight concrete § not learner than 1 : 2 : 4 (mix) (unplastered) concrete not assumed to be load bearing, reinforced	25	25	25	40	60

[a] So fixed, or designed, as to allow full penetration for mechanical bond.

[b] Reinforcement shall consist of steel binding wire not less than 2*3 mm in thickness or a steel mesh weighing not less than 0*5 kg/m2. In concrete protection, the spacing of that reinforcement shall not exceed 200 mm in any direction

Table 13 — Encased Steel Beams, 406 mm x 176 mm

(Protection applied on three sides; see 6.1)

S/N	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a fire resistance of					
		½ h	1 h	1½	2 h	3 h	4 h
Hollow protection (without an air cavity beneath the lower flange).							
	1 * Metal lathing with trowelled lightweight aggregate Gypsum plaster (metal lathing grade)Plasterboard with 1*6 mm wire binding at 100 mm pitch, finished with lightweight aggregate gypsum plaster not less than the thickness specified:	13	13	15	20	25	
	9*5 mm plasterboard	10	10	15			
	19 mm plasterboard	10	10	13	20		
Solid protection							
1	Concrete, not leaner than 1:2 : 4 mix (unplastered):						
	a) Concrete not assumed to be load bearing, reinforced	25	25	25	25	50	75
	b) Concrete assumed to be load bearing	50	50	50	50	75	75
2	Lightweight concrete [4]not learner than 1 : 2 : 4 (mix) Unplastered	25	25	25	25	40	60

[1] So fixed, or designed, as to allow full penetration for mechanical bond.

[2] Where wire binding cannot be used, expert advice should be south regarding alternative methods of support to enable the lower edges of the plasterboard to be fixed together and to the lower flange, and for the top edge of the plasterboard to be held in position.

[3] Reinforcement shall consist of steel binding wire not less than 2.3 mm in thickness or a steel mesh weighing not less than 0.5 kg/m2. In concrete protection, the spacing of that reinforcement shall not exceed 200 mm in any direction.

[4] Concrete not assumed to be load bearing, reinforced

Table 14 — Timber floors — tongued and grooved boarding, or sheets of tongued and grooved plywood or wood chipboard, of not less than 21 mm finished thickness

S/N	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of:		
		½ h	1 h	2 h
37 mm (minimum) timber joists with a ceiling of:				
1	Timber lathing and plaster, plaster of thickness	15		
2	Metal lathing and plaster, thickness of plaster:			
	Sanded gypsum plaster (metal lathing grade)	15		

	Lightweight aggregate gypsum plaster	13	13	25
3	One layer of plasterboard with taped and filled joints	12.7		
4	Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	19	31	
5	One layer of plasterboard not less than 9.5 mm thick, finished with:			
	Gypsum plaster	5		
	Sanded gypsum plaster	13		
	Lightweight aggregate gypsum plaster	13		
6	One layer of plasterboard not less than 12*7 mm thick, finished with:			
	Gypsum plaster	5		
	Lightweight aggregate gypsum plaster	10		
7	One layer of asbestos insulating board with any transverse joints backed by fillets of asbestos insulating board not less than 9 mm thick, or by timber	9	12	

Table 15 — Timber floors — Tongued and grooved boarding, or sheets of tongued and grooved plywood or wood chipboard, of not less than 15 mm finished thickness (see 7.1)

S/N	Nature of construction and materials	Minimum Thickness (mm) of Protection for fire resistance of		
		1½	1 h	2 h
37 mm (minimum) timber joists with a ceiling of :				
1	Timber lathing and plaster, plaster of thickness	15		
2	Metal lathing and plaster, thickness of plaster for			
	Sanded gypsum plaster (metal lathing grade)	15		
	Lightweight aggregate gypsum plaster	13	13	25
3	One layer of plasterboard with joints taped and filled and backed by timber	12.7		
4	Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	22	31	
5	One layer of plasterboard not less than 9*5mm thick, finish with:			
6	Gypsum plaster	5		
	Sanded gypsum plaster	15		

	Lightweight aggregate gypsum plaster	13		
7	One layer of plasterboard not less than 9*5 mm thick, Finish with:			
	Gypsum plaster	5		
	Lightweight aggregate gypsum plaster	10		

Table 16 — Timber floors — Any structurally suitable flooring of timber or particle boards (see 7.1)

S/N	Nature of Construction and Materials	Minimum thickness (mm) of protection for a fire resistance of:	
		½ h	1 h
37 mm (minimum) timber joists with a ceiling of :			
	1 Timber lathing and plaster, plaster of thickness.	15	
	2 Metal lathing and plaster, thickness of plaster for:		
	a) Sanded gypsum plaster (metal lathing grade)	15	
	b) Lightweight aggregate gypsum plaster	13	19
3	One layer of plasterboard with joints taped and filled and backed by timber	2*7	
4	Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	25	
5	Two layers of plasterboard, each not less than 9*5 mm thick, joints between Boards staggered and outer layer finished with gypsum plaster	5	
6	One layer of plasterboard not less than 9.5 mm thick, finished with:		
	a) Sanded gypsum plaster	13	
	b) Lightweight aggregate gypsum plaster	15	
7	One layer of plasterboard not less than 12*7 mm thick, finished with:		
	a) Sanded gypsum plaster	15	
	b) Lightweight aggregate gypsum plaster	13	

7.2 In case of a building of more than 15 m in height, all floors should be compartmented with area not exceeding 750 m^2 by a separation wall with 2 h fire rating. For floors having provision of sprinklers, the area may be increased by 50 %. In long buildings, the fire separation walls should be at distance not exceeding 40 m. For departmental stores, shopping centres and similar occupancies, the area may be reduced to 500 m^2. Where this is not possible provision of the sprinklers should be kept with appropriate spacing.

7.3 A surface covering of non-combustible and non-toxic material should be laid directly on the incombustible floor. Wood flooring may be laid directly on such surface covering or directly on such floor provided that in either case there is no intervening space and that any wood fillets for affixing such flooring is bedded not more than 2.5 cm thickness in the non-combustible floor.

7.4 In the case of building used for storage purposes, the floor surface should conform to the above, in addition, it should be at least 15 cm above the ground level or the level of the door sills whichever is higher, and should slant towards the doors. An opening through a floor should comply with the following:

a) at the time of designing openings particular attention should be paid to all such factors which will limit fire spread through these openings.

b) when opening in floors are provided to allow cable, etc, the space around cable and the floor should be protected according to the provision of relevant national or international standard; However such space in case of openings provided to allow plumbing/gas/steam pipes and similar services should be sealed with filler material of fire rating not less than 1 h.

c) openings for steam, gas and/or water pipes and electrical conduits, whether of iron or earthenware, should have a radial clearance, to allow for any heat expansion, not greater than 3 mm.

d) the enclosure for staircases and hoists should be constructed entirely of brick, concrete or of reinforced concrete or similar material of construction having 2 h rating. Every opening from the enclosure on to a roof used as floor or to any other part of the building should be fitted with a fire resistant door of rating not less than 1 h.

e) if any staircase or hoist extends to the top storey of a building the roof of which is not a roof used as a floor, the enclosing walls should be carried through and at least 45 cm above the roof of the building and a skylight or window glazed should be provided above the roof of the building. Alternatively, if the roof of the building is used as a floor; it should comply with (d), and this should also apply for any furnace or motor chamber communicating with the staircase or hoist enclosure.

7.5 Linings or false ceilings should not be permissible in buildings and in situations where permitted, such additions should not detract in any way from minimum fire rating of half an hour. In some cases, requiring provision of skylights, monitor lights or north lights in the roofs and where these are necessary, the glazings should be of glass in metal frames for fire rating of half an hour minimum.

7.6 Composite roofs may be used over as addition to the roofs of buildings as a weather proofing, but should not be considered as a roof in itself that is, without the support of a non-combustible construction beneath, unless it is of not less than half an hour fire resistance.

8 Air-Conditioning

8.1 Air-conditioning systems should be so installed and maintained as to minimize the danger of spread of fire, smoke or fumes thereby from one floor or fire area to another, or from outside into any occupied building or structure.

8.2 Air-conditioning systems circulating air to more than one floor area should be provided with dampers designed to close automatically in case of fire and thereby prevent spread of fire or smoke. Such a system should also be provided with automatic controls to stop fans in case of in which case these should be designed to remain in operation.

8.3 Air–conditioning systems serving large places of assembly (over 1 000 persons), large depart-mental stores or hotels with over 100 rooms in a single block should be provided with effective means for preventing circulation of smoke through the system in the case of fire in air filters or from other sources drawn into the system even though there is insufficient heat to actuate heat sensitive devices controlling fans or dampers. Such means should consist of approved effective smoke detectors.

8.4 Air-conditioning should conform to the following:

a) escape routes like staircases, common corridors, lift lobbies, etc, should not be used as return air passage;

b) the ducting should be constructed of metal in accordance with relevant national standard;

c) wherever the ducts pass through fire walls or floors, the opening around the ducts should be sealed with fire resisting materials of same rating as of walls/floors;

d) as far as possible, metallic ducts should be used even for the return air instead of space above the false ceiling;

e) the material used for insulating the duct system (inside or outside) should be of flame resistant and non-conductor of heat;

f) area more than 750 m^2 on individual floor should be segregated by a fire wall and automatic fire dampers for isolation should be provided; and

g) in case of more than one floor, automatic fire dampers arrangement should be providing by ducting on each floor for isolation purposes. Where plenums used for return air passage, ceiling and its fixtures and air filters of the air handling units should be flame resistant [(see 8.4 (e)]. Inspection panels should be provided in the main trucking. No combustible material should be fixed nearer than 15 cm to any duct unless such ducting is properly enclosed and protected with flame resistant material.

h) The fire dampers should be located in and return air ducts passages at the following points automatically operate and simultaneously switch off air handling fans:

   1) at the fire separation wall,

   2) where ducts/passages enter the central vertical shaft,

   3) where the ducts pass through floor, and

   4) at the inlet of supply air duct and the return air duct of each compartment on every floor.

8.5 In case of buildings more than 24 m in height in non-ventilated lobbics corridors, smoke extraction shaft should be provided. The automatic fire damper should be so arranged so as to close by gravity in a direction of movement and to remain tightly closed upon operation.

9 Smoke and fire venting

9.1 Provision has to be made for venting allows escape of hot gases and smoke release by accidental burning of combustible material stored or are being processed inside a building, and will give ample time for all the inmates to escape before the roof collapses either in part or wholly in the event of fire.

Provisions in this regard are essential for industrial buildings; details of which are covered in a separate standard. The form of vent should be a ventilator-cum-exhaust which in addition to the requisite grading of fire rating is easily openable.

9.2 Smoke venting facilities, where required for safe use of exits in windowless buildings, underground structures, large area factories, departmental store, domestic dwelling, theatres, cinemas, lecture halls, and where required should be automatic in action.

9.3 Natural draft smoke venting should utilize roof vents or vents in walls at or near the ceiling level; such vents should be normally open, or if closed, should be designed for automatic opening in case of fire, by release of heat smoke sensitive elements, breakage of glass, or melting of plastic under the influence of heat; or by other approved methods.

9.4 Where smoke venting facilities are installed for purposes of exit safety, these should be adequate to prevent dangerous accumulation of smoke during the period of time necessary to evacuate the area served, using available exit facilities with a margin of safety to allow for unforeseen contingencies.

9.5 The discharge apertures of all natural draft smoke vents should be so arranged as to be readily susceptible to opening by fire service personnel.

9.6 Power operated smoke exhausting systems may be substituted for natural draft vents

9.7 In case of buildings more than 15 m in height the staircase should be ventilated to the atmosphere at each landing and a vent at the top, the vent openings should be 0.5 m in the external wall and top.

If the staircase cannot be ventilated because of location or other reasons, the provision should be made for pressurization (50 Pa) to be separated automatically with the fire alarm. The roof of the shaft in the latter case should be I m above the surrounding roofs. Glazing or glass bricks should not be used in the staircase.

10 Service ducts

10.1 Service ducts should be enclosed by walls and doors (if any) of 2 hours fire rating; if ducts are larger than 1 m^3 the floor should seal than, but provide suitable openings for the pipes to pass through, with the gaps sealed.

10.2 A vent opening at the top of the service shaft should be provided between one-fourth and one-half of the area of the shaft.

11 Basements

11.1 Each basement should be separately ventilated. Vents with cross-sectional area not less than 2.5 % of the floor area, spread evenly round the perimeter of the basement, should be provided in the form of grills or breakable stall board lights or pavement lights or by way of shafts.

Alternatively, a system of air inlets should be provided at basement floor level and smoke outlets at basement ceiling level.

Inlets and extractors may be terminated at ground level with stall board or pavement lights as before, but ducts to convey fresh air to the basement floor level have to be laid.

Stall board and pavement lights should be in positions easily accessible to the fire brigade and clearly marked “SMOKE OUTLET”, or “AIR INLET” with an indication of area served at or near the opening.

11.2 The staircase of basements should be of enclosed type having fire resistance of not less than 2 hours and should be situated at the periphery of the basement to be entered at ground level only from the open air and in such positions that smoke from any fire in the basement should not obstruct and exit serving the ground and upper storeys of the building and should communicate with basement through a lobby provided with fire resisting self-closing doors of 1 hour fire resistance. If the travel distance exceeds 18.50 m, additional star cases should be provided at proper places.

11.3 In multi-level basements, intake ducts may serve all basement levels, but each basement and basement compartment should have separate smoke outlet duct or ducts.

Mechanical extractors for smoke venting from low basement levels should also be provided, with provision of automatic and manual operation of system actuation of heat/smoke detectors or sprinklers.

Mechanical extractors shall have an inter-locking arrangement, such that extractors continue to operate and supply fans stop automatically with the actuation of fire detectors.

Mechanical extractors shall have an alternative source of supply. Ventilating ducts should be integrated with the structure and made out of brick masonry or RCC as far as possible and when this duct crosses the transformer area or electrical switch board, fire dampers should be provided.

Basement:/sub-basement should not be used for storage, cooking purposes, garage and shop unless provision is made for sprinkler system. If cut out, openings in the basements should be protected by automatic spray in the event of a fire.

12 Chimneys

Over and above the provisions given in 4.2, the following provisions should be followed:

a) a clearance of at least 4 cm between the outer surface of the chimney and any adjacent combustible material forming part of a wall lining enclosing the chimney;

b) the fire resistance of any structure surrounding a flew or flew pipe should be not less than that for external walls. In the case of flew pipe there should be an air space between it and the surrounding structure of sufficient width to permit access to the pipe for inspection and repair;

c) when a flue pipe passes though any other room or an enclosed roof space it should be protected by structure having a fire resistance equal to the external walls;

d) the chimney excluding the pot should be carried to a minimum height of 1 m above the highest point of its junction with the roof;

e) the outlet of a flue from domestic appliance having a roof covering should be at least 2.5 m in a horizontal plain from the roof of any structure built upon the roof or at least 0.6 m higher than any ridge within 2.5 m;

f) if the roof covering is not fire resistant, no flue outlet should be lower than the ridge for the highest point of the roof or less than 1 m above any ridge within 2.5 m; and

g) where a metal chimney passes through a roof covering which is not fire resistant, it shall be guarded by a suitable iron or metal thimble extending not less than 22.5 cm above and below roof construction and of a size to provide not less than 15 cm clearance on all sides of chimneys.

13 Staircases and lifts

13.1 Staircases

The details with regard to the provisions of staircases have been given in RS 186-5.

13.2 Lifts

13.2.1 The general requirements for the provision of lifts should be as follows:

a) walls of lifts and enclosures should have a fire rating of 2 h; lift shaft should have a vent at the top of area not less than 0.2 m^2;

b) lift motor room should be located preferably on top of the shaft and separated from the shaft by the floor of the room;

c) landing doors in lifts and enclosures should have a fire resistance of not less than 1h;

d) the number of lifts in one lift tank should not exceed 4. Individual shafts in a bank (of two rows) should be separated by a wall of 2 h fire rating;

e) lift care door should have a fire resistance rating of not less than 1 h;

f) collapsible gates should not be used for lifts and if used should have doors with fire resistance of at least 1 h;

g) in opening other than the lift job by door in the lobby enclosure wall should also have the minimum fire resistance of one hour;

h) exit from the lift lobby, if located in the core of the building should be to a self-closing stop door of minimum 1 h fire rating;

i) lifts should not normally communicate to the basement;

j) suitable arrangements, such as providing slope in the floor of lift lobby should be made to prevent water used during fire fighting on any landing from entering the lift shaft; and

k) the sign should be posted and maintained at every floor at or near the lift indicting that in case of fire occupants, should use the stairs unless instructed otherwise. The sign should also contain a plan for each floor showing the location of staircase.

13.2.2 Where applicable, fire lifts should be provided with a minimum capacity for 8 passengers with floor area of not less than 1.4 m^2 and fully automated with emergency switch on the ground level. In general, building over 15 m in height should be provided with fire lifts. Each fire lift should be equipped with suitable inter-communication equipment communicating with the control room on the ground floor of the building. The number and location of fire lifts in a building should be decided after taking into consideration various factors like building, population, floor, areas, section of building, etc. The words 'fire lift' should be conspicuously displayed in illuminous paint on the lift landing door at each floor level.

14 Refuge area

In case of buildings more than 24 m in height, refuge area of 15 m^2 or an area equal to 0.25 m^2 per person to accommodate the occupants of two consecutive floors, whichever is higher, should be provided as under. Refuge area should be provided on the periphery of the floor and open to air at least on one side protected with suitable railings:

a) For floors above 24 m and up to 39 m — one refuse area on the floor immediately above 24 m.

b) For floor above 39 m one refuse area on the floor immediately above 39 m and soon after every 15 m.

15 Refuse chutes

Refuse chutes should have an enclosure wall of non-combustible material with fire resistance of not less than 2 h. They shall not be located within the staircase enclosure or service shafts, or air-conditioning shafts. Inspection panel and doors should be tight fitting with 1 h fire resistance; the chutes should be as far away as possible form exits.

16 Drainage

16.1 It is essential to make provision for drainage of any such water on all floors to prevent or minimize water damage of the contents.

16.2 The drain pipe should be provided on the external wall for drainage of water from all floors. On large area floors several such pipes may be necessary which should be spaced 30 m apart. The pipe should conform to relevant Rwanda Standards.

17 Electrical Services

The electrical services should conform to the following:

a) The electric distribution cables/wiring should be laid in a separate duct. The duct should be sealed at every alternative floor with non-combustible materials having the same fire resistance as that of the duct. Low and medium voltage wiring running in shaft and above false ceiling should run in separate conduits.

b) Water mains, telephones lines, inter-comeliness, gas pipes or any other service line should not be laid in the duct for electric cables.

c) The inspection panel doors and any other opening in the shaft should be provided with fire doors having fire resistance of not less than 1 h.

d) Medium and low voltage wiring running in shafts and within false ceiling should run in metal conduit.; the false ceiling including all fixtures used for its suspension should be of non-combustible material.

e) An independent and well-ventilated service room of a 2h minimum fire resistance should be provided on the ground floor with direct access from outside or from the corridor for the purpose of termination of electric supply..

f) Transformer bays H.T. and L.T. supply rooms, air-conditioning plant systems and boiler rooms shall be in separate fire resisting rooms and shall conform to RS 186-2 and Rwanda Building Control regulations

18 Finishes

18.1 The use of flammable surface finishes on walls (including external façade of the building) and ceilings affects the safety of the occupants of a building. Such finishes tend to spread the fire and even through the structural elements may be adequately fire resistant, serious danger to life may result. It is, therefore, essential to have adequate precautions to minimize spread of flame of wall, facade of building and ceiling surfaces. Any materials used for various surfaces and décor should be such that the flame spread rating should not be more than the recommended values and in addition should not generate toxic smoke/fumes.

18.2 Susceptibility to fire of various types of wall surfaces is determined in terms of flame spread

18.3 Based on the rate of spread of flame, four classes are determined as follows:

Class 1: Surfaces of very low flame spread

Class 2: Surfaces of low flame spread

Class 3: Surfaces of medium flame spread

Class 4; Surfaces of rapid flame spread

18.3 In case of buildings more than 15 m in height, the interior finish material should not have rating exceeding Class 1.

18.4 The situation under which materials falling into various classes should be used in building construction is given below:

a) **Class 1** may be used in any situation

b) **Class 2** may be used in any situation except on walls facade of the building, and ceilings of staircases, walls and partitions, and corridors;

c) **Class 3** should be used only in living rooms, and bedrooms (but not in rooms on the roof) and only as a lining to solid not on staircases or façade of the building.

NOTE Panelling (lining) should be permitted in a limited area. It should not be permitted in a vestibule.

18.5 When frames, walls, partitions or floors are lined with combustible materials the surfaces on both sides of the material should conform to the appropriate class.

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