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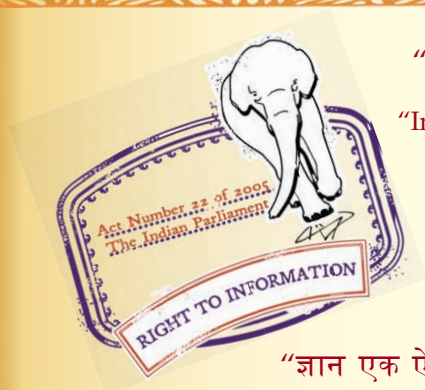
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मकानों के लिए लकड़ी की सीढ़ियों का निर्माण एवं  
डिज़ाइन — रीति संहिता

( दूसरा पुनरीक्षण )

*Indian Standard*

DESIGN AND CONSTRUCTION OF  
WOOD STAIRS FOR HOUSES —  
CODE OF PRACTICE

( *Second Revision* )

UDC 692'622 [ 674'03 ] : 69'05

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BUREAU OF INDIAN STANDARDS  
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## FOREWORD

This Indian Standard ( Second Revision ) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

Timber is an important structural material in building work, which is known for its decorative value with a reasonable amount of strength and durability. It has been used from time immemorial in the construction of dwellings. Timber construction has an important part to play in the extensive building activities that our country has undertaken. But, as the resources for timber are limited, it is necessary to rationalize the use of timber and conserve it to whatever extent possible consistent with the required performance. To serve this object, a series of standards in the form of code of practices for timber construction has been issued. This standard gives guidance for the use of timber, in stairs, which is a principal component of building construction.

The design of wood stairs is in no way complicated and most of the structural dimensions, such as thicknesses of planks, sizes of joists and railings, etc, as generally used are well above the strength requirements. But general dimensions, namely, the width of staircase, the rise and tread of steps, the pitch angle, the length of flight, etc, are related to several aspects of human comfort in the use of stairs, and they have been developed as a result of long experience. Several practices prevail in this respect, mainly in the form of thumb rules and these have been examined to arrive at the uniform practice laid down in this standard. Special consideration has been given to the question whether the number of steps or the height should be the criterion for design of a flight and after a careful study, the Sectional Committee responsible for the preparation of this standard has come to the conclusion that physical exertion relates to the dimensions of each step and the number of steps rather than to the total height of the flight.

This Indian Standard was first published in 1960 and subsequently revised in 1973, which included requirements relating to width of stairs, height of hand-rails and width of treads, number of risers, etc, aligned with the provisions in the National Building Code of 1970. Requirements related to construction of bull-nosed step, landing, etc, had also been incorporated. This revision has been aligned with the relevant provisions in National Building Code of India, 1983.

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.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# *Indian Standard*

## DESIGN AND CONSTRUCTION OF WOOD STAIRS FOR HOUSES — CODE OF PRACTICE

### ( *Second Revision* )

#### 1 SCOPE

**1.1** This standard lays down the requirements for material, design and construction of interior wood stairs for houses.

**1.2** This standard does not cover the design and construction of monumental, decorative and other special types of wood stairs.

#### 2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

#### 3 TERMINOLOGY

**3.0** For the purpose of this standard, the following definitions shall apply. Reference may also be made to Fig. 1 and 2 for explanation.

##### 3.1 Balusters

The vertical members which support the hand-rail and protect the open side or sides of a stair.

##### 3.2 Balustrade

The framed fence formed by an outer string or a horizontal supporting member, a hand-rail and the infilling.

##### 3.3 Bull-Nosed Step

A step with a quarter-rounded or half-rounded end, at the bottom of a flight.

##### 3.4 Carriage or Carriage Bearer

An inclined wooden member placed against the underside of steps to add support between the strings.

##### 3.5 Flight

A continuous series of steps extending from floor to floor, floor to landing, or landing to landing.

##### 3.6 Glue Blocks

The pieces of timber fixed from underneath as stiffeners at the junction of the tread and riser.

##### 3.7 Going

Going or run of the step is the horizontal distance between the faces of two consecutive risers.

##### 3.8 Hand Rail

A moulded member running parallel to the nosing line or landing.

##### 3.9 Landing

Landing is a platform between two flights provided to serve as a rest and, when required to make effective provision for turning a stair. This term is also applied to the portion of the floor adjacent to the top of a stair.

##### 3.10 Newel

A post placed at the junction between a flight of stairs with a landing or floor.

##### 3.11 Nosing

The projected edge of a tread, usually moulded.

##### 3.12 Pitch

The angle between the pitch-line and the horizontal.

##### 3.13 Pitch-Line

The line joining the intersection of the face of each riser and the top of each tread.

##### 3.14 Rise

Rise of a step is the vertical distance between the tops of two consecutive treads, and rise of a flight is the total height from floor to floor, floor to landing or landing to landing as the case may be.

##### 3.15 Riser

The front vertical portion of a step to which the tread is connected.

##### 3.16 Rough Brackets

Short pieces of board fixed to the carriage of a stair to give additional support to the treads.

##### 3.17 Stairs

A set of steps leading from one floor to another.

##### 3.18 Staircase

Stairs together with the part of the building accommodating them.

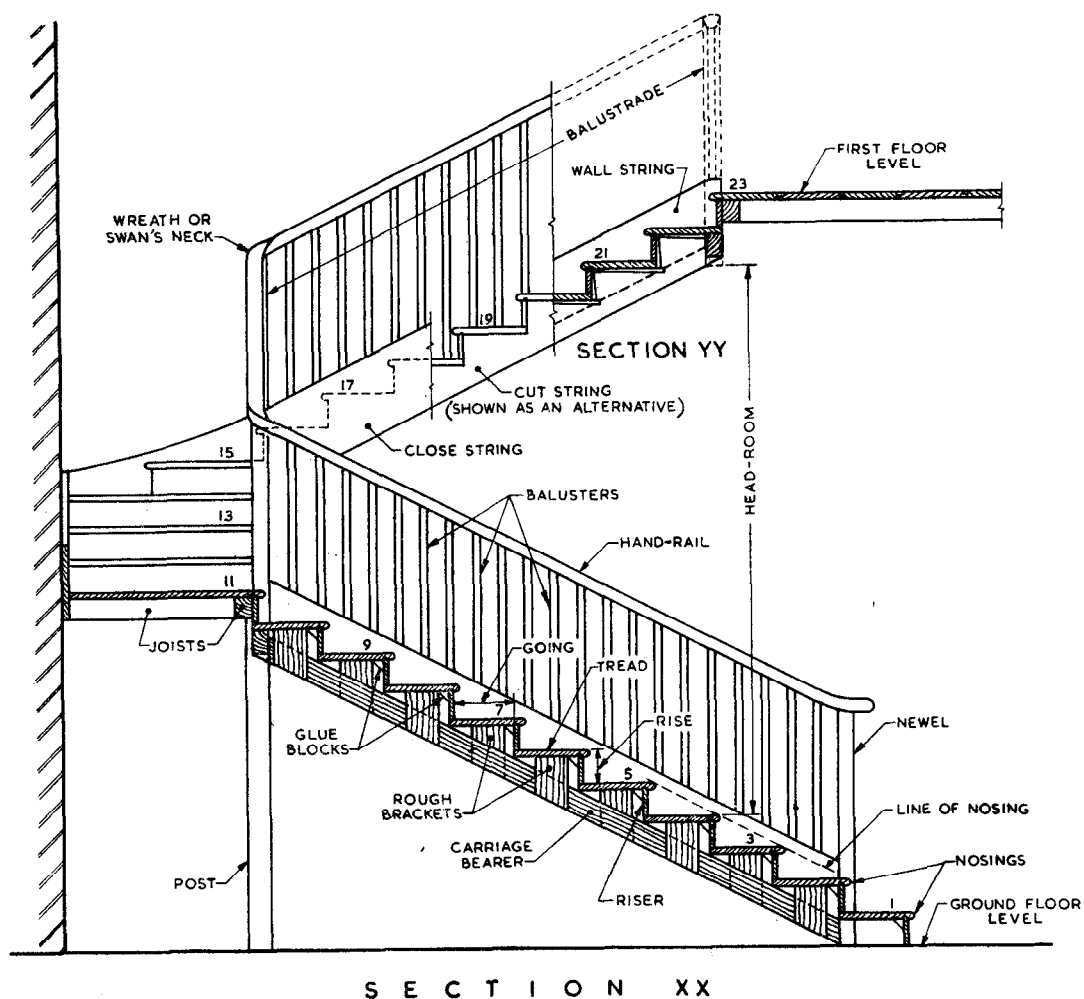
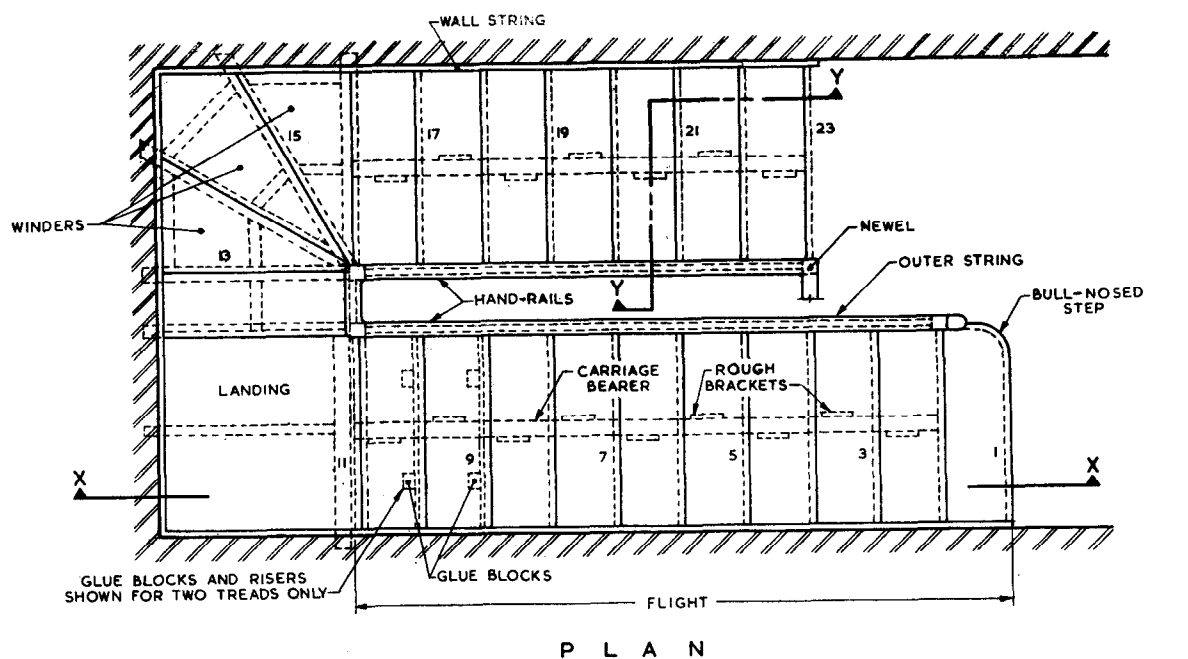


FIG. 1 DETAILS OF WOODEN STAIRCASE

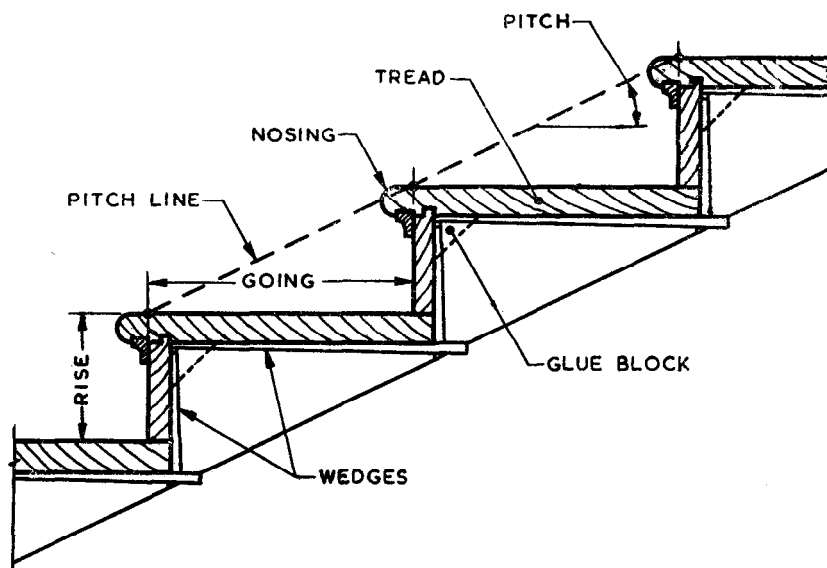


FIG. 2 DETAILS OF TREAD AND RISER SHOWING ALSO THEIR FITTINGS INTO A CLOSE STRING

### 3.19 String

The inclined member or board supporting risers and treads.

#### 3.19.1 Outer String

The end string of a flight of stairs which is not attached to the wall for supporting. The other type of end string attached to wall is 'wall string'.

#### 3.19.2 Close String

An outer string having its top and bottom edges straight and parallel.

#### 3.19.3 Cut String

An outer string with its upper edge cut to the profile of treads and risers.

### 3.20 Tread

The horizontal member which forms the upper surface of a step.

### 3.21 Winders

Radiating steps to form a change of direction from one flight of steps to another.

### 3.22 Wreath or Swan's Neck

A plane continuous curve formed in hand-rails at junctions where the flight changes direction.

## 4 MATERIAL

4.1 The species of timber used in the construction of wooden stairs shall be those suitable for 'constructional purposes' as given in IS 399 : 1963. However, for treads, timber of density not less than  $600 \text{ kg/m}^3$  as given in IS 399 : 1963 shall be

provided. The timber shall be treated in accordance with the relevant provisions of IS 883 : 1992 (*under revision*).

4.2 The plywood used in the construction of wood stairs shall be of BWR quality (*see* IS 303 : 1989).

## 5 GENERAL DIMENSIONS AND ARRANGEMENT

### 5.1 Headroom

The stairs shall be so designed as to provide for a headroom of at least 2.2 m as measured vertically from ceiling, soffit, etc, to the pitchline, and also provide for a clearance of at least 1.5 m at right angles to the line.

### 5.2 Pitch

The pitch shall be not more than  $37^\circ$ .

### 5.3 Going and Rise

5.3.1 The going shall be not less than 250 mm.

5.3.2 The height of riser shall not exceed 190 mm.

5.3.3 The rise and going shall be the same for all steps in any one flight.

5.3.4 The going and rise shall conform to the following empirical rules:

- The value ' $2R+G$ ' shall be between 530 and 630 mm; and
- The value ' $R \times G$ ' shall be between  $40 \times 10^3 \text{ mm}^3$  and  $50 \times 10^3 \text{ mm}^3$ ,  
where  $R$  is the rise, and  $G$  is the going.

**5.4 Treads** shall be not less than 270 mm in width. Their nosings shall project beyond the face of risers by not less than 15 mm and not more than the thickness of tread, and the profile of the nosing shall be rounded from the top surface. The radius of the nose should not exceed 100 mm. The treads shall be constructed and maintained in a manner to prevent slipping.

### 5.5 Width of Stairs

The width of stairs clear between inside to inside of the end strings shall be not less than 1.0 m.

### 5.6 Width of Landing

The width of landing shall be not less than the width of stairs.

### 5.7 Length of Flights

The number of risers in any one flight shall be not more than 12.

### 5.8 Winders

Winders shall be avoided as far as practicable. Winders, wherever provided, shall be at the bottom of the flight. Three winders shall be arranged to occupy a quarter space and six to occupy a half space.

### 5.9 Height of Hand-Rail

The vertical height from the pitch-line to the top of any sloping hand-rail shall be not less than 1.0 m.

## 6 CONSTRUCTION

**6.1** The design and construction of wooden members in the stairs shall conform to IS 883 : 1992 generally except for the requirements in 6.2 to 6.6.

**6.1.1** The design of wooden members in the stairs shall be based on IS 875 (Part 1) : 1987 and IS 875 (Part 2) : 1987.

### 6.2 Thickness of Members

When the width of stairs is not more than 1.2 m, the finished thickness of the members shall be not less than the following:

<i>Member</i>	<i>Finished Thickness, mm</i>
a) Tread	32
b) Riser { for wood for plywood	16 9
c) String	28

NOTE — Where the width of staircase exceeds 1.2 m, the thickness of treads and risers may be increased appropriately as required by design; or carriage and rough brackets may be used for additional support of the steps.

**6.2.1** The other details shall be in accordance with 6.3.

### 6.3 Treads, Risers and Strings

Treads and strings shall be of solid timber; and when of more than one piece in width, they shall be joined with tongued and grooved joint. In joints like 'tongued and grooved' or 'mortice and tenon' where crevices are likely to occur, the surface of wood in both pieces that will remain hidden after 'joining' shall be treated with a suitable preservative; or the crevices shall be sealed with an approved material such as 'white lead compound' to prevent access to moisture. Each piece of timber shall be not less than 80 mm wide on the finished face of the work. In a tread, the front piece on which the nosing is formed shall be not less than 90 mm wide.

**6.3.1** Risers shall be of solid timber or of plywood. The top of the risers shall be tongued and fitted, or their full thickness housed to a minimum depth of 6 mm into the underside of the treads.

**6.3.2** Risers and treads shall be glue-blocked with angle blocks not less than 80 mm long and 40 mm wide glued in position. The spacing between glue blocks shall not be less than 250 mm.

**6.3.3** The lower edges of risers shall be fixed to treads with No. 10 wood screws conforming to IS 451 : 1972 at intervals not exceeding 250 mm. The length of screws shall be at least equal to twice the thickness of the material through which they are fixed, and in any case not less than 32 mm.

**6.3.4** In the case of close strings, the treads and risers shall be housed to a depth of not less than 15 mm into tapered housings in the strings and securely wedged and glued (see Fig. 2).

**6.3.5** Strings shall be of not less than 250 mm in nominal depth. They shall be tenoned and prepared for pinning to newels where these occur. The tenons shall be not less than 15 mm thick and 50 mm long.

**6.3.5.1** Tie rods connecting the strings at suitable intervals may be provided if considered necessary.

**6.3.6** The curved portion of riser in the lower steps may be bullnosed or semi-circular and shall be built from solid blocks dowelled, cross-tongued and glued as given in 6.4.

### 6.3.7 Carriage Bearers

Where carriage bearers are used, they shall not be cut but the treads and risers shall be fixed on to them by means of small angle blocks or rough brackets. The size of the carriage bearer may be 50 mm × 180 mm for a width of 1.4 m, and the size may be appropriately increased for larger widths in accordance with requirements of design. Where the width of staircase exceeds 2.4 m, two carriage bearers shall be provided.

## 6.4 Shaped Ends to Steps

**6.4.1** Where a bull-nosed or similar shaped end to a riser is constructed with a block against which the end or ends of one or two straight parts of the riser abut, the following details shall be satisfied:

- a) The grain of the block shall be horizontal. The faces of block and straight riser where they meet shall be flush with one another unless the design otherwise requires;
- b) The meeting edges of block and straight riser on the face of the work shall form a closely fitted vertical joint; and
- c) The ends of block and straight riser shall be so fitted and fixed, together by tonguing and grooving, rebating, blocking, gluing, nailing, screwing and/or other means, as to secure adequate strength and rigidity.

**6.4.2** Where a bull-nosed, half round or similar shaped end is formed by cutting away material from the back of a solid riser to leave a veneer which can be bent to the required shape, the following details shall be satisfied:

- a) The veneer shall be fitted with a solid backing block. The back of veneer and the face of the block shall be so prepared and fitted and glued together as to secure adequate adhesion over the whole area of the veneer; and
- b) The block shall be so fixed to the straight (unreduced) parts of the riser as to secure adequate strength and rigidity.

**6.4.3** Where a riser with a bull-nosed, half round or similar shaped end is formed with thin plywood bent to shape during manufacture of the stairs the following details shall be satisfied:

- a) The face of the complete riser shall consist of one piece of plywood or, alternatively, of a solid straight portion with plywood for the curved portion, and with plywood close jointed to the edge of the straight portion and properly secured to the solid backing; and
- b) The straight parts of the riser shall have solid backings not less than 20 mm thick. The curved part of the riser shall be backed either with a solid block or with three shaped horizontal backing pieces each not less than 20 mm thick. The various parts shall be so prepared, fitted and fixed together by gluing and screwing as to secure adequate strength and rigidity.

**6.4.4** The top edge of every riser shall be housed or tongued into the underside of the tread as specified in 6.3 and shown in Fig. 2 along the whole of the straight part of its face.

**6.4.5** The shape of the front edge of the tread of any step shall properly agree with that of the riser or otherwise satisfy the requirements of the design and the nosing shall be of proper section throughout.

**6.4.6** Where so desired, wooden boarding may be fixed to the underside of the soffit to give a flat appearance.

## 6.5 Landing

Landing shall be formed of timber planks supported over a system of timber joists. The construction of landing shall conform to IS 3670 : 1966 and IS 5389 : 1969.

## 6.6 Newels

A newel shall be placed at every angular change of the direction of the hand-rail. Outer newels shall have nominal cross-sectional area of not less than  $6.0 \times 10^3 \text{ mm}^2$ . Wall newels if any shall have a cross-sectional area of not less than  $2.5 \times 10^3 \text{ mm}^2$ . Treads, risers, winders and ends of steps shall be housed into newels to a depth of not less than 15 mm. Newels shall be mortised and draw bored, where required, to receive the strings, and mortised to receive the hand-rails by means of dowels.

## 6.7 Hand-Rails and Balustrades

Hand-rails and balustrades shall be so designed and constructed as to provide a proper degree of safety and rigidity in use. Hand-rails may, preferably, be provided with wreath and curve wherever there is a change in direction for the flight. Hand-rails shall be of at least 100 mm top width. The space between the hand-rail and the string shall be occupied by open or solid balustrade or other filling as may be required. On the wall side, the hand-rail may be rigidly fixed to the wall, and it shall be at the same level as the hand-rail on the outside. No balustrades shall be fixed to it.

**6.8** Special features of construction of wood stairs for fire safety shall conform to the relevant provisions of IS 1642 : 1989 and IS 1643 : 1988.

## 7 FINISHING

**7.1** Staircase may be suitably polished or painted where so specified [ see IS 2338 ( Part 1 ) : 1967 and IS 2338 ( Part 2 ) : 1967 ].

# **ANNEX A** ( *Clause 2* )

## **LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
303 : 1989	Specification for plywood for general purposes ( <i>third revision</i> )	883 : 1992	Code of practice for design of structural timber in building ( <i>third revision</i> )
399 : 1963	Classification of commerical timbers and their zonal distribution ( <i>revised</i> )	1642 : 1989	Code of practice for fire safety of buildings ( <i>General</i> ); Details of construction ( <i>first revision</i> )
451 : 1972	Technical supply conditions for wood screws ( <i>second revision</i> )	1643 : 1988	Code of practice for fire safety of buildings ( <i>General</i> ); Exposure hazards ( <i>first revision</i> )
875 ( Part 1 ) : 1987	Code of practice for design loads ( other than earthquake ) for buildings and structures: Part 1 Dead loads — Unit weights of building material and stored materials ( <i>second revision</i> )	2338 ( Part 1 ) : 1967	Code of practice for finishing of wood and woodbased materials: Part 1 Operations and workmanship
875 ( Part 2 ) : 1987	Code of practice for design loads ( other than earthquake ) for buildings and structures: Part 2 Imposed loads ( <i>first revision</i> )	( Part 2 ) : 1967	Schedules
		3670 : 1966	Code of practice for construction of timber floors
		5389 : 1969	Code of practice for laying of hardwood parquet and wood block floors

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