DRAFT TANZANIA STANDARD

Timber structures – Joints made with mechanical fasteners – General principles for the determination of strength and deformation characteristics

TANZANIA BUREAU OF STANDARDS

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0 NATIONAL FOREWORD

The Tanzania Bureau of Standards is the statutory national standards body for Tanzania, established under standards Act No. 3 of 1975, amended by Act No. 1 of 1977 and then Act No. 3 was replaced by the Act No. 2 of 2009.

This draft Tanzania Standard is being prepared by the Sawn timber, Sawn logs and Wood based Components Technical Committee under the supervision of the Building and Construction Divisional Standards Committee (BCDC).

In the preparation of this draft Tanzania Standard assistance was derived from ***ISO 6891: 1983, Timber structures – Joints made with mechanical fasteners – General principles for the determination of strength and deformation characteristics and ISO 554:1976, Standard atmospheres for conditioning and/or testing – Specifications*** published the International Organization for Standardization.

In reporting the results of a test made in accordance with this draft Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4:2009.

1 Scope

This Tanzania Standard lays down general principles for the determination of the strength and deformation (slip) characteristics of joints made with mechanical fasteners.

2 Field of application

This Tanzania Standard is applicable to joints made with mechanical fasteners used in statically loaded timber structures.

Detailed procedures appropriate to joints made with specific fasteners will be given in separate Tanzania Standards.

The principles can also be used for the testing of other joints. It is recognized that for some special types of joints not covered by Tanzania Standards, modification of the test procedure may be necessary.

3 Symbols

F: applied load, in Newtons

F_{est}: estimated maximum load, in Newtons

F_{max}: maximum load, in newtons

k: slip modulus, in newtons per millimetre

v: joint Slip, in millimetres

Subscripts for the joint slip, v, relate to load points in figure 2 and are defined in clause 7

4 Conditioning of test specimens

Attention should be paid to the conditioning of the timber before the manufacture of the joint and also to the conditioning of the joints as a whole before testing.

The conditioning should be conducted in such a way that the test conditions correspond in a realistic manner to the conditions in joints in structures as regards the influence of the moisture content on the strength properties of the timber and the occurrence of gaps, etc., through shrinkage.
Detailed requirements for specimens made with specific types of fasteners will be given in separate Tanzania Standards.[1)] Where the purpose of testing is to compare joints under similar conditions, the Standard atmosphere 20/65 (see annex) should be used for conditioning.

5 Form and dimensions of test specimens

The test joints shall be of such realistic form and dimensions that the necessary information about the strength and deformation of joints in service can be obtained.

Detailed information about the form and dimensions of the test specimens suitable for different types of mechanical fasteners will be given in separate International Standards.

6 Apparatus

In addition to equipment for measuring the geometry of the test specimens, moisture content, etc., the following shall be available:

a) a testing machine able to apply and record load with an accuracy of + 1 % of F_{est} or better;

[1]) Test methods for joints made with punched metal plate fasteners, nails and staples will form the subject of future Tanzania Standards.

b) equipment to measure joint slip under load with an accuracy of + 1 % of F_{est} or better, or for slips of less than 2 mm with an accuracy of + 0.02 mm. The equipment shall ensure that eccentricities, twist, etc. have no influence on the measurements.[2)]

7 Loading procedure

7.1 Estimation of maximum load

The estimated maximum load, F_{est}, for the type of joint to be tested shall be determined on the basis of experience, calculation or preliminary tests, and should be adjusted as required in 7.6.

7.2 Application of load

The loading procedure shown in figure 1 should generally be followed.

The load shall be applied up to 0.4 F_{est} and maintained for 30s. The load shall then be reduced to 0.l F_{est} and maintained for 30s. Thereafter the load shall be increased until the ultimate load or slip of 15 mm is reached.[3)]

Below 0.7 F_{est} a constant rate of load or Slip corresponding to 0.2 F_{est} per minute ± 25 % shall be used. Above 0.7 F_{est}, a constant rate of slip shall be used; so adjusted that the ultimate load or a slip of 15 mm is reached in 3 to 5 min additional testing time (total testing time about 10 to 15 min). The test may be stopped when the ultimate load is reached, or when the slip is 15 mm. For particular tests, the preload cycle up to 0.4 F_{est} may be omitted with a corresponding adjustment to the total testing time.

7.3 Measurement of Slip

The slip measurements v_{01}, v_{04}, v_{14}, v_{11}, v_{21}, v_{24}, v_{26} and v_{28} shown in figure 2 shall be recorded for each test specimen. The slip at maximum load, F_{max}, shall also be recorded. When a load/slip diagram is not available, measurements of slip should be taken at each 0.l F_{est} increment of load (see figure 1).

7.4 Measurement of load

The load reached before or at a slip of 105 mm, shall be recorded as the maximum load, F_{max}, for each specimen.

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[2]) Equipment that can continuously record load and slip is recommended; exceptionally, slips may be measured at chosen load levels provided the measurements can be made without significantly influencing the continuity of load application. A sufficient number of load levels should be chosen to ensure that the calculations (sec 7.5) and the adjustments (sec 7.6) can be made

[3]) The requirement that the load be maintained constant for 30 s at 0.4 and 0.l F_{est} is to permit adequate time for the loading to be reversed, it is not intended to provide information on creep behavior.

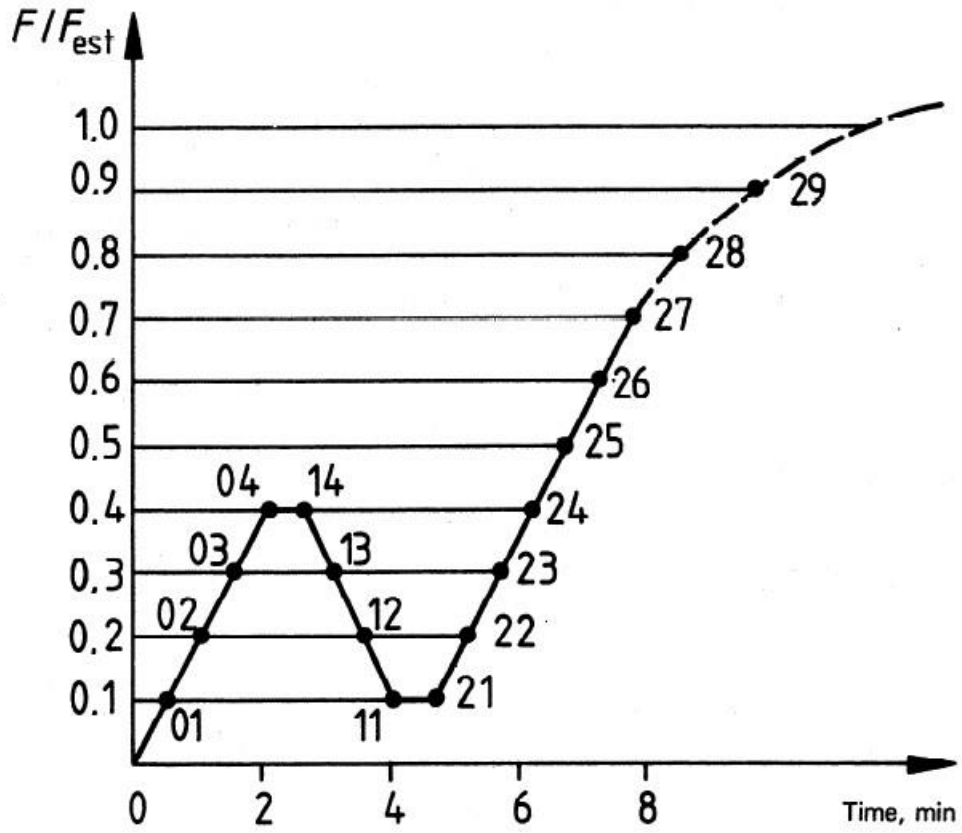

Figure 1 – Loading procedure

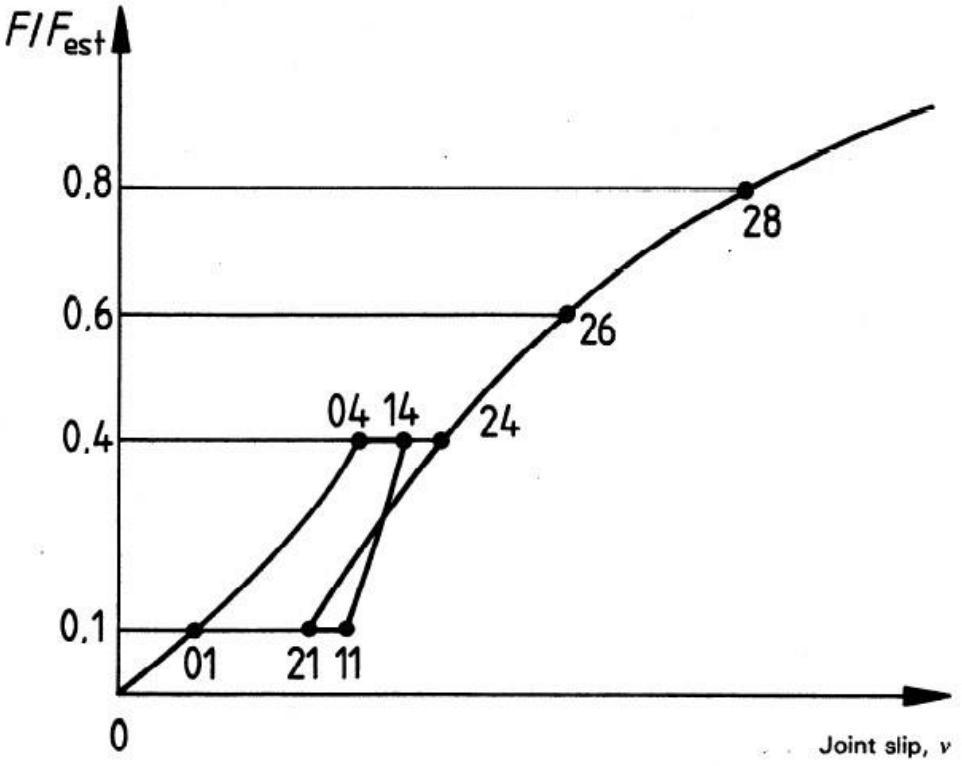

Figure 2 – Idealized load-deformation curve and measurements

7.5 Calculations

From the recorded measurements, the following values, if relevant, shall be determined for each test:

1) Maximum load F_{max}

2) Estimated maximum load F_{est}

3) Initial slip $V_i = V_{04}$

4) Modified initial slip $Vi, mod = 4/3(V_{04}-V_{01})$

5) Joint settlement [4] $V_s = V_i-V_{i,mod}$

6) Elastic slip $V_e = 2/3(V_{14} + V_{24} – V_{11}-V_{21})$

7) Initial slip modulus $K_i = 0.4\ F_{est}/V_i$

8) Slip modulus $K_s= 0.4\ F_{est}/\ V_{i,mod}$

9) Slip at 0.6 F_{max} $V_{0.6}$

10) Modified slip at 0.6 F_{max} $V_{0.6,\ mod} = V_{0.6} - V_{24} + V_{i,\ mod}$

11) Slip at 0.8 F_{max} $V_{0.8}$

12) Modified slip at 0.8F_{max} $V_{0.8,mod} = V_{0.8} - V_{24} + V_{I,\ mod}$

If practical, the complete load/slip diagram should also be given.

NOTE–-The values calculated for 9) to 12) above relate to the actual value of F_{max} for each of the tests. If a continuous load/slip diagram is available, these values may be obtained directly at the required load level. If only readings of slip at increments of F_{est} are available, the values should be obtained by interpolation.

7.6 Adjustment

If, during the execution of the tests, the mean value of the maximum load of the tests already carried out deviates by more than 20 % from the estimated value, F_{est}, then F_{est} should be adjusted correspondingly for subsequent tests. The values of maximum load already determined may be accepted without adjustment as patt of the final results. In this case, the values of slip and slip moduli determined in 3) to 8) of 7.5 should be adjusted to correspond to the adjusted values of F_{est}.

8 Test report

The test report shall include the following information:

a) species, density and relevant strength properties of the timber;

b) quality, strength properties and surface finish of the materials of the fasteners (including anti-corrosive protection);

c) dimensions of the joints, size and number of fasteners, details of gaps between members;

d) conditioning of timber and test specimens before and after manufacture, moisture content of the timber at manufacture and at test, fissures etc;

[4]) It should be noted that many load-slip curves are initially convex upwards so that v_s will be negative.

e) the loading procedure used (by reference to this Tanzania Standard) and a statement of any deviations;

f) individual test results and any relevant information regarding adjustments, mean values and standard deviations, and descriptions of the modes of failure.

Annex

(Normative)

A.1 Standard atmospheres for conditioning and/or testing

Designation	Temperature	Relative Humidity	Pressure	Remarks
	^{o}C	%	kPa	
23/50	23	50	Between 86 And 106	Recommended atmosphere
27/65	27	65		For tropical countries
20/65	20	65		Used in certain fields Of application

A.2 Tolerances

Tolerances	Temperature	Relative humidity
	^{o}C	%
Ordinary (normal) tolerances (wide torelances)	±2	±5*
Reduced tolerances (close tolerances)	±1	±2*

* The resultant limits of relative humidity are therefore: - ordinary (normal) tolerances: (45 to 55 %) and (60 to 70 %); - reduced tolerances: (48 to 52 %) and (63 to 67 %).