BUREAU OF INDIAN STANDARDS
DRAFT FOR COMMENTS ONLY

Doc : PGD 41 (26046)WC
July 2025

भारतीय मानक मसौदा

जिम्नास्टिक में प्रयुक्त क्षैतिज बार — विशिष्टि

(IS 2462 *का दूसरा पुनरीक्षण*)

Draft Indian Standard

Parallel Bars Used in Gymnastics — Specification

(*Second Revision of* IS 2462)

ICS 97.220.30

Sports Goods Sectional Committee, PGD 41	Last date for comments: 60 days from the date of circulation of the wide circulation draft.

FOREWORD

(*Formal clauses will be added later*)

This standard was first published in 1963 and subsequently revised in 1982. This revision has been brought out to align the standard with the latest international rules of the game and taken up to keep pace with the latest technological developments and international practices.

In this revision the following major changes have been made:

a) Material specifications have been updated;
b) Performance parameters have been added; and
c) Manufacturing and workmanship clause have been updated.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

Draft Indian Standard

PARALLEL BARS USED IN GYMNASTICS — SPECIFICATION

(*Second Revision of* IS 2459)

1 SCOPE

This standard covers the requirements for parallel bars used in gymnastic competitions and training. It does not cover the specification for low parallel bars used for learning.

2 TERMINOLOGY

2.1 Bar Linkage — A rigid mechanical linkage between both bars of a parallel bars to exert equal forces simultaneously on both bars.

2.2 Static Tractive Force — The predetermined value of force (in N) exerted on the midpoint of the bar, pulling the bar vertically downwards.

2.3 Starting Position — The position of an unloaded bar or an unloaded bar linkage from which the total deflection in vertical direction is determined. The midpoint of the bar or the bar linkage shall serve as the point of reference for the measurements.

2.4 Deflection — The measured distance (in mm) between the starting position and the maximum displacement of the midpoint of the bar or the bar linkage in vertical direction.

2.5 Definition of Spatial Dimensions and Test Directions — For the determination of the vertical deflection of the midpoint of the bar or the bar linkage the spatial dimensions are defined as illustrated in Fig. 1 to Fig. 3. The test directions are defined as illustrated in Fig. 4.

2.6 Pendulum — Tubular test body of given dimensions and mass with an additional low-friction falling weight inside. The test body is attached to a bar or a bar linkage with the help of two inflexible grasping arms, each of which is at the same distance from the midpoint of the bar or the bar linkage, guaranteeing a low-friction rotation of the test body about the longitudinal axis of the bar or the bar linkage.

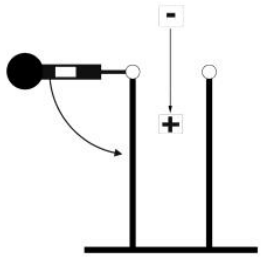


FIG. 1 SPATIAL DIMENSIONS TEST POSITION MIDDLE OF BARS (LATERAL), PENDULUM IN HORIZONTAL POSITION BEFORE RELEASE

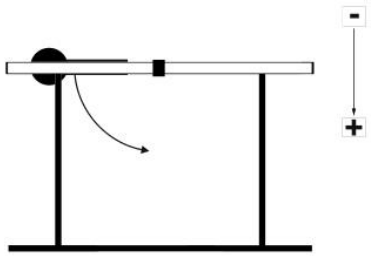


FIG. 2: SPATIAL DIMENSIONS TEST POSITION: MIDDLE OF BARS (TRANSVERSAL), PENDULUM IN HORIZONTAL POSITION BEFORE RELEASE

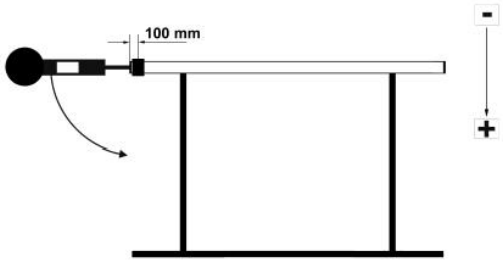


FIG. 3 SPATIAL DIMENSIONS TEST POSITION: END OF BARS (TRANSVERSAL)

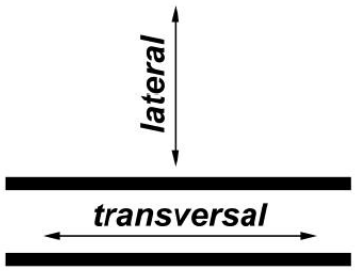


FIG. 4 DEFINITION OF TEST DIRECTION

2.7 Maximum Force (F_{max}) — The maximum value of the reaction force in the direction of the pendulum's centre of gravity measured as the sum of the forces exerted on both grasping arms during the pendulum swing, expressed in Newton.

2.8 Hanging Position — Stable equilibrium position of the hanging pendulum under gravity conditions only.

2.9 Horizontal Position — Position of the attached pendulum rectangular to the hanging position.

2.10 Additional Falling Weight — Cylindrical test body of given dimensions and mass inside the pendulum producing an additional impact stress on the gymnastic apparatus during pendulum swing.

2.11 Internal Drop Height — Predetermined sliding distance of the additional falling weight inside the pendulum.

2.12 Initial Tension — Predetermined value of the force (in N) exerted on the bar or the bar linkage, composed of the gravity of the attached pendulum and an additional tractive force pulling the bar-pendulum system vertically downwards.

2.13 Frequency of Oscillation — Reciprocal of the value determined by the duration of the half amplitude interval divided by the number of oscillations of the bar-pendulum system within the half amplitude interval. The frequency is expressed in Hertz. See Fig. 4 for illustration of the frequency determination.

2.14 Maximum Amplitude — Value of the amplitude (in mm) of the first oscillation of the bar-pendulum system after the release of the initial tension.

2.15 Half Amplitude — Value of the amplitude (in mm) of the first oscillation which is equal to or less than half the maximum amplitude.

2.16 Half Amplitude Interval — Duration of oscillation (in ms) between the passage of the maximum amplitude and the reaching of the half amplitude. *See* Fig. 5 for illustration.

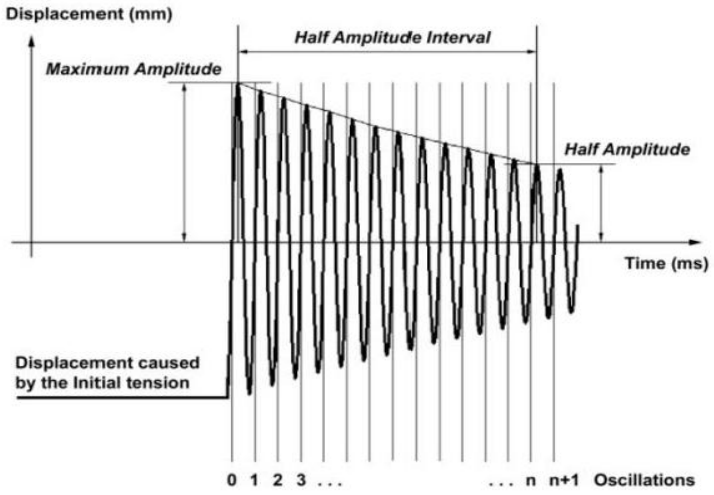


FIG. 5 OSCILLATION DAMPING PARAMETERS

3 CONSTRUCTION AND WORKMANSHIP

3.1 The parallel bars shall consist of two bars of equal dimensions, running parallel and at the same height. Each bar shall be supported by two upright supports, which stand on a stable base frame.

The uprights shall consist of a static and a mobile part, allowing for the height and width adjustment of the bars. The distance between the bars shall be adjustable from 42 cm to 52 cm. In cross-section, the bars present a drop-like profile, which remains unchanged for their entire length (*see* Fig. 6), and shall not include any kinks at the transitions from one radius to another. The upper surface of the bars must be water absorbent and not be slippery.

3.2 The seating of the bar on the supports shall be designed in such a way that the bar may swing freely and without noise in all directions. The bar shall be secured against rotation around its longitudinal axis.

3.3 The entire apparatus must be stable. Incident vertical and transversal forces must not move the apparatus.

3.4 There shall be no protruding nails, projecting wire rope terminations or pointed or sharp-edged components. Rough surfaces shall not present any risk of injury. All welds shall be smooth. Protruding bolt threads within any accessible part of the equipment shall be permanently covered,

4 REQUIREMNETS

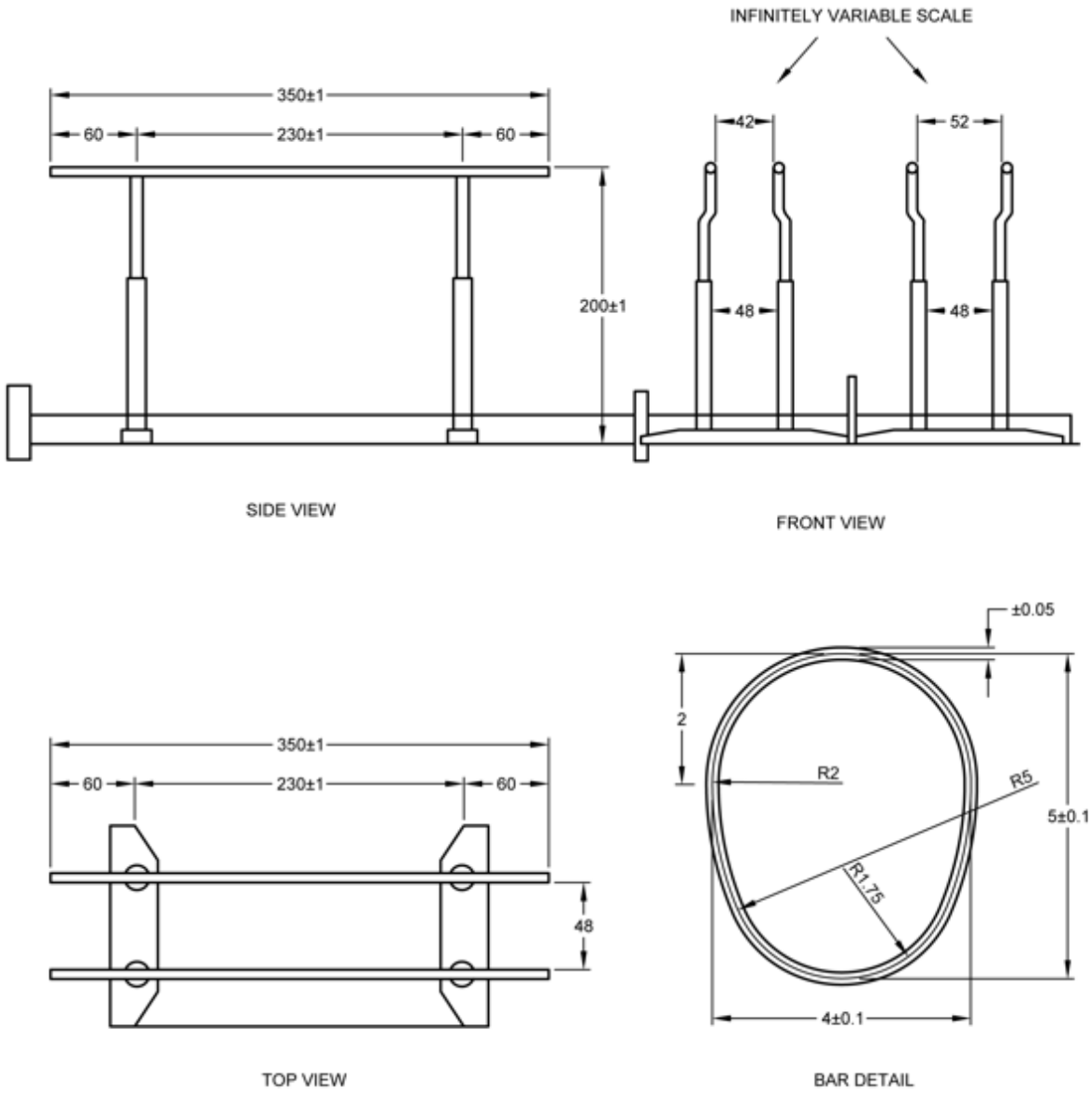
4.1 Materials

The surface of the bars shall be made of wood or of other material with similar behaviour (hygroscopic plastic with the same functional characteristics as wood). If it is made of wood, it shall be free of errors like knots and fissure. Recommended species of timber are:

Standard Trade Name	Botanical Name
Axlewood	*Anogeissus latifolia*
wBabul	*Acacia nilotica*
Benteak	*Lagerstroemia*
Bijasal	*Pterocarpus marsu~ium*
Dhaman	*Grewia tilii folia*
Hopea	*Hopea*
Kardhai	*Anogeissus pendula*
Laural	*Terminalia alata*
Lendi	*Lagerstroemia parvijlora*
Sandan	*Ougeinia oojeinensis*
Satinwood	*Chloroxylono swietenia*
Sissoo	*Dalbergia sissoo*
White cedar	*Dyso.xylum malabaricum*

4.2 Shape and Dimensions

The shape and dimensions shall be as given in Fig. 6. Where they are not specified, they are left to the discretion of the manufacturer.



(All dimensions are in cm)

FIG. 6 PARALLEL BAR

5 PERFORMANCE TESTS REQUIREMENT

5.1 Static Traction Stress Test

Parallel bar shall be tested in accordance with the procedures described in Annex B, ensuring that the measured deflection value is between 50 mm and 70 mm, inclusive.

5.2 Pendulum Swing Stress Test

Parallel bar shall be tested in accordance with the procedures described in Annex C, the mean values of the measured variables shall be within the figures of Table 1.

Table 1 Requirements for Pendulum Swing Stress Test
(*Clause* 5.2)

Sl No.	Requirements	Values
(1)	(2)	(3)
Middle of bars (lateral)		
i)	F_{max} (N)	$x \leq 2300$
ii)	Positive vertical deflection (mm)	$70 \leq x \leq 100$
Middle of bars (transversal)		
iii)	F_{max} (N)	$x \leq 2750$
iv)	Positive vertical deflection (mm)	$47 \leq x \leq 62$
End of bars (transversal)		
v)	F_{max} (N)	$x \leq 3000$
vi)	Positive vertical deflection (mm)	$48 \leq x \leq 58$

'x' represents the mean value of the measured variable.

5.3 Oscillation Damping Test

Parallel bar shall be tested in accordance with the procedures described in Annex D, the mean values of the measured variables shall be within the figures of Table 2.

Table 2 Requirements for Oscillation Damping Test
(*Clause* 5.3)

Sl No.	Requirements	Values
(1)	(2)	(3)
Middle of bars (lateral)		
i)	Frequency of oscillation (Hz)	$3.00 \leq x \leq 3.60$
ii)	Half amplitude interval (ms)	$400 \leq x \leq 2750$
Middle of bars (transversal)		
iii)	Frequency of oscillation (Hz)	$4.00 \leq x \leq 4.80$
iv)	Half amplitude interval (ms)	$400 \leq x \leq 2500$
End of bars (transversal)		
v)	Frequency of oscillation (Hz)	$3.80 \leq x \leq 5.00$
vi)	Half amplitude interval (ms)	$400 \leq x \leq 1200$

'x' represents the mean value of the measured variable.

5.4 Lateral Stability Test

The parallel bar shall be tested as per the procedures specified in Annex E, ensuring that the measured variable value is at least 900 Newtons.

6 PACKGING AND MARKING

6.1 Packing

The parallel bar shall be packed as agreed to between the purchaser and the supplier.

6.2 Marking

6.2.1 The parallel bar shall be marked with the following:

a) Manufacturer's name and trade-mark;
b) Batch number and Lot number; and
c) Month and year of manufacture.

7.2.2 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the standard mark.

ANNEX A
(*Clause* B-4, C-4, D-4, *and* E-4)

TEST SET-UP AND APPARATUS

A-1 TEST SET-UP FOR STATIC TRACTION STRESS TEST

Any type of test set-up is acceptable that is capable to stress the test specimen under prescribed conditions and monitoring and recording the displacement-time history of the midpoint of the bar.

A-2 TEST SET-UP FOR PENDULUM SWING STRESS TEST

Any type of test set-up is acceptable that can stress the test specimen with a pendulum swing under prescribed conditions and monitoring and recording the displacement-time history of the midpoint of the bar or the bar linkage and the reaction force-time history of the pendulum. It is optional, but desirable, that the pendulum is released from a magnet in the horizontal position.

A-3 TEST SET-UP FOR OSCILLATION DAMPING TEST

Any type of test set-up is acceptable that can stress a bar-pendulum system under prescribed conditions and monitoring and recording the displacement - time history of the midpoint of the bar or the bar linkage. It is optional, but desirable, that the bar-pendulum system is released from a magnet at the prescribed initial tension.

A-4 TEST SET-UP FOR LATERAL STABILITY TEST

Any type of test set-up is acceptable that is capable to stress the test specimen under prescribed conditions and monitoring and recording the tractive force-time history of the towing cable.

A-5 BAR LINKAGE

Any type of rigid mechanical linkage between the bars is acceptable which enables an attachment of the pendulum for all tests in transversal test direction. The bar linkage shall enable a distance between the bars of 52 cm ± 1 cm. The weight of the bar linkage shall be 3.0 kg ± 0.3 kg.

A-6 PENDULUM

The pendulum shall meet the following criteria:

A-6.1 Mass and Geometry

The tubular test body shall have a mass of (40.0 ± 1.2) kg (including load cells, grasping arms and appliances for additional weights) and a geometry as specified in Fig. 7. All the dimensions shall have tolerance of 3 percent. The load cells shall be located between the test body and the grasping arms. The weight of each grasping arm shall be (1.0 ± 0.03) kg.

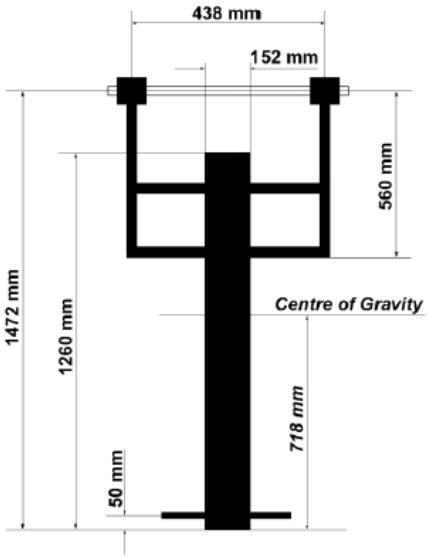


FIG. 7 PENDULUM DIMENSIONS

A-6.2 Pendulum Fixation

The pendulum fixation to the bar shall meet the following criteria

A-6.2.1 *Functional Properties*

The fixation shall allow an immediate transfer of forces between pendulum and bar and guarantee a low-friction rotation of the pendulum about the longitudinal axis of the bar (the use of roll bearings is recommended).

A-6.3 Additional Falling Weight

The additional falling weight shall meet the following criteria:

A-6.3.1 *Mass and Geometry*

The cylindrical falling weight shall have a mass of (20.0 ± 0.2) kg and a geometry as specified in Fig. 8. All the dimensions shall have tolerance of 3 percent.

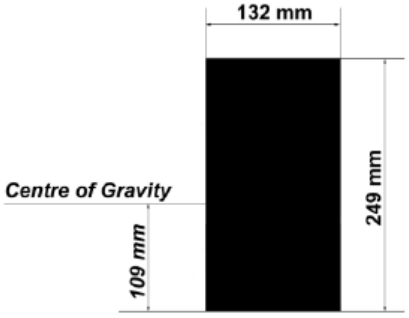


FIG. 8 GEOMETRY OF ADDITIONAL FALLING LOAD

A-6.3.2 Damping of the Additional Falling Weight at the Inside Bottom of the Tubular Test Body

The damping properties of the additional falling weight shall meet the following criteria: The additional falling weight (20 kg) shall produce an average peak force of (5800 ± 1500) N over 15 impact tests inside the tubular test body with a vertical drop height of (50 ± 1) mm. A chloroprene rubber at the bottom of the test body with a thickness of 8 mm, a density of 1.40 g/cm^3 and a tensile strength of 5.5 MPa is re-commended.

A-7 RECORDING EQUIPMENT

A-7.1 Displacement-Time

The selection of the specific displacement - time recording equipment, including transducers and recorders, is at the discretion of the test laboratory. However, the transducers shall provide linear signals proportional to the two-dimensional displacement of the midpoint of the bar. If displacement is recorded, the test equipment shall have means to determine and record the starting position of the bar from which the total deflections are determined. The total system, detection and recording, shall be capable of measuring displacements of up to 200 mm at frequencies from 2 Hz to 200 Hz to an accuracy of ± 1 percent. The minimum sampling rate of the data acquisition system shall be 500 Hz.

A-7.2 Reaction Force-Time

Any reaction force-time recording equipment, including load cells and recorders, which can monitor the reaction force exerted on the pendulum simultaneously with the displacement - time trace is acceptable. The total system, detection and recording, shall be capable of measuring reaction forces of up to 5 000 N at frequencies from 2 Hz to 200 Hz to an accuracy of ± 1 percent. The minimum sampling rate of the data acquisition system shall be 500 Hz.

A-7.3 Tractive Force

Any tractive force recording equipment, including load cells and recorders, which can monitor the tractive force exerted on the parallel bars is acceptable. The total system, detection and recording, shall be capable of measuring tractive forces of up to 5000 N to an accuracy of ± 1 percent.

ANNEX B

STATIC TRACTION STRESS TEST

(*Clause* 5.1)

B-1 TEST PRINCIPLE

A bar of a mounted apparatus is pulled vertically downwards with a predetermined static tractive force. A measuring device mounted on the bar monitors the displacement-time history of the midpoint of the bar caused by this force. The maximum deflection is recorded with the aid of a data acquisition system. After the release of the static tractive force the bar must return into the starting position.

B-2 TEST SPECIMEN

The test specimen submitted for testing shall consist of a complete parallel bar as it is intended to be used during training and/or competition.

B-3 CONDITIONING AND TEST TEMPERATURE

The parallel bars, mounted and assembled for use, shall be preconditioned at (50 ± 10) percent relative humidity and temperature of (27 ± 3)°C for a minimum of 24 h prior to the test. All testing shall be carried out under the same conditions.

B-4 TEST APPARATUS

Refer to Annex A.

B-5 TEST PROCEDURE

B-5.1 Mount the parallel bars to a height as prescribed for competitions. the parallel bars shall have a fixation to the floor to eliminate undesirable vibrations and movements of the apparatus.

B-5.2 Install the displacement measuring device on an unloaded bar and determine the starting position.

B-5.3 Pull the midpoint of one bar vertically downwards with a static tractive force of (1350 ± 20) N and capture, then record the resulting maximum deflection (mm) using recording equipment described in **A-7**.

B-5.4 After the release of the static tractive force verify whether the bar returns into the starting position.

ANNEX C

PENDULUM SWING STRESS TEST

(*Clause* 5.2)

C-1 TEST PRINCIPLE

A pendulum which is attached to a bar, or a bar linkage of a mounted apparatus is rotated from hanging position into horizontal position and then released. While it swings down, an additional falling weight inside the tubular pendulum slides down from a predetermined internal drop height until the weight strikes against the inside bottom of the pendulum, producing an additional impact stress on the gymnastic apparatus. A measuring device monitors the displacement - time history of the midpoint of the bar or the bar linkage. Load cells inside both pendulum grasping arms monitor the reaction force - time history of the pendulum. Both are recorded with the aid of a data acquisition system. The test measures the maximum reaction force in the direction of the pendulum's centre of gravity and the positive deflection of the bar or the bar linkage in vertical direction.

C-2 TEST SPECIMEN

Refer to B-2.

C-3 CONDITIONING AND TEST TEMPERATURE

Refer to B-3.

C-4 TEST APPARATUS

Refer to Annex A.

C-5 TEST PROCEDURE

C-5.1 Mount the parallel bars to a height as prescribed for competitions. the parallel bars shall have a fixation to the floor to eliminate undesirable vibrations and movements of the apparatus.

C-5.2 Install the displacement measuring device on an unloaded bar (tests in lateral test direction) or the unloaded bar linkage (tests in transversal test direction) and determine the starting position.

C-5.3 Attach the pendulum (60 kg, that is, 40 kg pendulum with additional 20 kg falling weight) to a bar or the bar linkage in hanging position.

C-5.4 Move the pendulum from hanging position into horizontal position and move the additional falling weight inside the pendulum to the (50 ± 1) cm internal drop height position. For the direction of the pendulum swing at the different test positions see Fig. 1 to Fig. 3.

C-5.5 Release the pendulum and capture the displacement - time history of the midpoint of the bar or the bar linkage and the reaction force - time history of the pendulum, using recording equipment described in **A-7**.

C-5.6 The parallel bars shall be stressed at each of the following test positions by repeating the pendulum swing five times: End of bars (transversal), Middle of bars (transversal), Middle of bars (lateral). *See* Fig. 1 to Fig. 4 for illustration of the locations and the directions of the test positions.

C-5.7 Immediately following each test, record the following measurements: F_{max} (N) and positive vertical deflection (mm).

C-5.8 All five tests per test position shall be used to determine the arithmetic mean values of the measured variables.

ANNEX D

OSCILLATION DAMPING TEST

(*clause 5.3)*

D-1 TEST PRINCIPLE

A pendulum which is attached to a bar or a bar linkage of a mounted apparatus is pulled vertically downwards until a predetermined initial tension is reached. The abrupt release causes a damped oscillation of the bar-pendulum system. A measuring device monitors the displacement - time history of the midpoint of the bar or the bar linkage which is recorded with the aid of a data acquisition system. The test measures the frequency as well as the half amplitude interval of the oscillation.

D-2 TEST SPECIMEN

Refer to B-2

D-3 CONDITIONING AND TEST TEMPERATURE

Refer to B-3

D-4 TEST APPARATUS

Refer to Annex A.

D-5 TEST PROCEDURE

D-5.1 Mount the parallel bars to a height as prescribed for competitions. the parallel bars shall have a fixation to the floor to eliminate undesirable vibrations and movements of the apparatus.

D-5.2 Attach the pendulum (60 kg, that is, 40 kg pendulum with additional 20 kg falling weight at the inside bottom of the pendulum) to a bar (tests in lateral test direction) or the bar linkage (tests in transversal test direction) in hanging position.

D-5.3 Pull down the pendulum vertically until the initial tension of 1000 N ± 30 N is reached.

D-5.4 Release the pendulum and capture the displacement - time history of the midpoint of the bar or the bar linkage using recording equipment described in **A-7.**

D-5.5 Immediately following test, record the Frequency (Hz) and half amplitude interval (ms) of the oscillation.

ANNEX E

LATERAL STABILITY TEST

(*clause 5.4)*

E-1 TEST PRINCIPLE

One bar of a parallel bars which is ensured against sideward slipping is pulled horizontally in lateral direction until a predetermined inclination of the parallel bars is reached. A load cell inside the towing cable monitors the tractive force - time history which is recorded with the aid of a data acquisition system. The test measures the tractive force in the predetermined inclination position of the parallel bars.

E-2 TEST SPECIMEN

Refer to B-2

E-3 CONDITIONING AND TEST TEMPERATURE

Refer to B-3

E-4 TEST APPARATUS

Refer to Annex A.

E-5 TEST PROCEDURE

E-5.1 Mount the parallel bars to a height as prescribed for competitions. the parallel bars shall have a fixation to the floor to eliminate undesirable vibrations and movements of the apparatus.

E-5.2 Ensure the parallel bars against sideward slipping with a barrier at the base frame.

E-5.3 Mount the towing cables to one bar at the top of the uprights and pull horizontally in lateral direction until the test specimen tilts to an inclination of 10 degree. Capture, then record the tractive force (N) using recording equipment described in **A-7**.

E-5.3 Calculate the values of all required variables rounded to the decimal places of the corresponding figures.