

The logo consists of the letters 'FLH' in a bold, sans-serif font. The 'F' is red, the 'L' is white with a blue outline, and the 'H' is blue.

HOCKEY BALL STANDARDS

Engineered for Hockey



Competition balls for use on Global category hockey turfs

2019 Edition

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1 INTRODUCTION

The *Rules of the Hockey* published by the FIH (www.fih.ch/inside-fih/our-official-documents/rules-of-hockey) establish requirements for the shape, mass, size, composition and colour of a hockey ball. However, to ensure balls used in higher level Global and international matches provide the required levels of performance and consistency players expect, the FIH has developed additional requirements for balls intended for use on Global Elite / Global category (as defined in the *FIH Hockey Turf and Field Standards*) Hockey Turfs. Two categories of ball are described.

Global Category Balls provide the very best levels of performance and are considered suitable for all levels of hockey but are particularly intended for top level international and national competitions and training by elite level players.

National Elite Category Balls provide acceptable levels of performance and are considered suitable for all lower level international and national competitions and training.

During the development of this Standard enhanced ball characteristics have been identified. These are referenced as 'FIH Preferences' and may be incorporated into future additions of this Standard. They are currently provided to assist those developing hockey balls.

This standard supersedes all previous editions of the FIH Ball Standards.

2 APPROVAL PROCESS

For a brand of ball to be registered as an FIH Approved Ball the following process needs to be followed:

1. The ball manufacturer shall become a member of the **FIH Quality Programme**. (see annex A for details)
2. The ball manufacturer shall submit representative samples of the ball they wish to have approved to a test institute able to undertake all the necessary tests to the standards of accuracy and reproducibility stipulated by the FIH.
3. The balls shall be tested by an independent test institute, accredited by, or agreed in advance with, the FIH. Ideally the test institute shall operate an ISO 17025 quality programme and the tests detailed in this Standard shall be within the scope of the ISO 17025 accreditation.
4. The test methods used by the test institute shall ensure the uncertainty of the measurements are within the accuracy bands detailed in this Standard. The uncertainty of each test method used shall be reported and compliance of a ball to this Standard shall be within the specified ranges when adversely considering uncertainty.
5. The results obtained shall be reported in English and be sent to the FIH by the test institute, for review.
6. Balls found to meet the quality levels detailed in this Standard shall be granted the right to be designated *FIH Approved Global Category Hockey Ball* or *FIH Approved National Elite Category Hockey Ball*, as appropriate.

7. A ball brand shall remain approved for four years providing the manufacturer remains a member of the FIH Quality Programme, no balls taken from any competition (see 3.2) are found to be non-compliant with this Standard and the specification and construction of the ball does not change. For a ball to be recertified after three years it shall be retested in accordance with this Standard.

3 SAMPLING

3.1 Manufacturer's production

3.1.1 Sampling

Manufacturer wishing to submit balls for approval testing shall send 30 balls, representative of at least four weeks production, to the selected test institute.

From every 30 balls sampled six shall be chosen at random by the test institute. One is retained as reference and the remaining five are tested to all aspects of this Standard.

3.1.2 Pass / fail criteria

To obtain a 'PASS' – all five tested balls must comply fully with the requirements of this Standard. Should any of the balls in the sample of five balls fail to meet all the requirements of the Standard, a further sample of six balls shall be taken from the same original batch of 30 balls and five of them tested for all aspects of this Standard. If more than one ball from the first set, or any one ball from the second set fails, the entire consignment shall be non-compliant and reported as failing to comply with this Standard.

3.2 Balls taken from competitions or purchased from commercial suppliers

3.2.1 Balls taken from competition

At a frequency determined by the FIH, or whenever concerns are expressed about the performance of a FIH Approved Hockey Ball a sample lot of unused balls may be taken from any FIH, continental federation or national association tournament.

A minimum of six unused balls shall be taken to form the test lot. The balls should be selected from the consignment by an on-site FIH Sport or Event Manager. The ball samples shall be selected so they are as representative as far possible of the entire consignment of balls. They should be delivered with appropriate security to the selected test institute.

3.2.2 Retail sampling

A minimum of six balls shall be purchased by the FIH from a commercial retailer to form the test lot.

3.2.3 Sampling

From every 6 balls sampled, five shall be chosen at random by the test institute for testing and one is retained as a reference.

3.2.4 Pass fail criteria

To obtain a 'PASS' – all five balls tested shall comply fully with the requirements of this Standard.

Should one of the balls fail to meet all the requirements of the Standard, a full production test (see 3.1) shall be undertaken at the manufacturer's expense, within three months of notification. Failure to re-test within three months shall result in the ball being removed from the list of FIH Approved Balls.

Should two or more balls from the test lot fail to meet all the requirements of the Standard, FIH Approval of the ball will be suspended with immediate effect and a full production test (see 3.1) shall be undertaken at the manufacturer's expense, within three months of notification. Failure to re-test within three months shall result in the ball being removed from the list of FIH Approved Balls.

3.3 Testing

The balls shall be tested strictly in the following sequence:

1. Mass
2. Shape
3. Centre of gravity
4. Moment of Inertia
5. Ball Rebound
6. Hardness
7. Performance Retention

The cost of testing shall be agreed between the test institute and ball manufacturer.

Untested balls from a compliant lot shall be archived by the Test Laboratory and be accessible for a minimum period of four years from the date of test

Note: The availability of test institutes to undertake ball testing is outside the control of the FIH and manufacturers are advised to determine when such testing services may be offered by any specific test institute.

4 **NORMATIVE REFERENCES**

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

EN 12235 (2013): Surfaces for sports areas —Determination of vertical ball behaviour

BS 5993 (1994): Specification for cricket balls

RAL Colour Charts – www.RALcolor.com

5 **REQUIREMENTS**

Unless required to meet a higher quality level as defined in this Standard, Global category balls shall meet the requirements of a National Elite ball.

5.1 Colour

Balls shall be a single colour. Unless otherwise agreed with the FIH this shall be white or yellow (RAL 1016, 1018, 1026).

5.2 Composition

Balls shall be manufactured from materials that are known to be not harmful to human health or the environment. Specific attention shall be paid to international and national regulations such as the European Communities' REACH Regulations.

When submitting a ball type for approval the manufacturer shall provide a signed statement of conformity that they meet this requirement.

5.3 Shape & Mass

5.3.1 Spherical Size

5.3.1.1 Test method:

The dimensions of each specimen ball must be measured to an accuracy of ± 0.005 mm.

5.3.1.2 Requirements

Global Category Balls

The nominal outer ball surface (i.e. excluding excursions and incursions) shall lie on or outside a perfect sphere having a radius 35.625mm (diameter = 71.250 mm) and on or inside a second sphere having a radius 37.000mm (diameter = 74.000 mm) sharing the same centre as the first.

The maximum difference in radial distance from the centre of the spheres between any two points on the nominal ball surface shall be no more than 0.375mm.

FIH guidance

The radial deviation should be as small as possible.

National Elite Category Balls

The nominal outer ball surface (i.e. excluding excursions and incursions) shall lie on or outside a perfect sphere having a radius 35.625 mm (diameter = 71.250 mm) and on or inside a second sphere having a radius 37.375 mm (diameter = 74.750 mm) sharing the same centre as the first.

The maximum difference in radial distance from the centre of the spheres between any two points on the nominal ball surface shall be no more than 0.375mm.

5.3.2 Surface Irregularities

Global Elite and National Elite Category Balls

5.3.2.1 Moulded Seam

Any radial step from one hemisphere to the next shall be no more than 0.1mm in height.

FIH guidance

Radial steps should be as close to zero as possible.

5.3.2.2 Other permissible features, whether incursion or excursions

A permissible surface feature is any other (i.e. not the mould seam) significant continuous region of local positive or negative radial deviation from the nominal ball surface. To be significant the maximum chord length between any 2 points on the edge of the feature must be greater than 1mm.

The edges of a feature are defined by the points at which the feature surface is within $\pm 0.05\text{mm}$ of the ball's nominal surface, and within which radial deviation exceeds $\pm 0.1\text{mm}$.

Any incursion or excursion from the nominal ball surface with a radial deviation greater than 0.1mm and maximum chord length less than 1mm is considered a surface blemish.

All unused tournament balls should be free from nominal surface blemishes.

5.3.3 Dimples (features that only exhibit incursion)

Global Category Balls

There shall be 300 or more dimples symmetrically distributed across the mould split plane of the ball. All dimples shall exhibit zero excursions.

The maximum chord length between any two edge points shall be 4mm and the difference in maximum chord length between dimple features shall be less than 0.5mm.

The maximum radial incursion depth shall be 0.5mm with respect to the nominal sphere.

National Elite Category Balls

Dimples shall be symmetrically distributed across the mould split plane of the ball. All dimples shall exhibit zero excursions.

The maximum chord length between any two edge points shall be 6mm and the difference in maximum chord length between dimple features shall be less than 0.5mm.

The maximum radial incursion depth shall be 0.6mm with respect to the nominal sphere.

5.3.4 Other features that exhibit excursion (e.g. moulding inlet marks)

Global Category Balls

There shall be a maximum of two symmetrically placed features on any ball.

Symmetry shall be maintained across the mould split plane (i.e. zero or two features, not one).

The maximum chord length between any two edge points shall be 12mm.

When measured along a chord between any two edge points:

- the maximum cumulative distance for any excursion(s) above 0.1 mm must be no more than 2 mm
- the maximum cumulative distance for incursion(s) above 0.1 mm must be no more than 2mm.

FIH guidance

- Excursions to be small diameter
- Zero protrusion

National Elite Category Balls

There shall be a maximum of two symmetrically placed features on any ball.

Symmetry shall be maintained across the mould split plane (i.e. zero or two features, not one).

The maximum chord length between any two edge points shall be 12mm.

The maximum radial excursion shall be 0.3mm with respect to the nominal sphere.

The maximum radial incursion shall be 0.3mm with respect to the nominal sphere.

5.3.5 Mass**5.3.5.1 Test method**

The mass of the ball shall be determined to an accuracy of 0.01 g.

5.3.5.2 Requirements**Global Elite and National Elite Category Balls**

The mass of the ball shall be in the range 156.00g and 163.00g.

Following immersion in water at $50 \pm 3^\circ \text{C}$ for 24 hours and after drying with a towel, the maximum weight change (measured within 5 minutes of the ball being removal from the water) shall be 0.1% of the ball's initial mass.

5.4 Centre of Gravity**5.4.1 Test method**

The centre of gravity of the ball shall be determined to an accuracy of 0.01mm.

5.4.2 Requirements**Global Elite and National Elite Category Balls**

The centre of gravity of the ball shall be within 0.5mm of its geometric centre.

Note: the calculation detailed in the method of test contained in previous editions of the FIH Ball Specification is incorrect and should not be used to determine this property.

5.5 Moment of Inertia**5.5.1 Test method**

The Moment of Inertia of the ball shall be determined to an accuracy of 0.01g. It shall be measured on three mutually perpendicular axes, with one perpendicular to the mould seam plane

5.5.2 Requirements

Global Category Balls

The Moment of Inertia when measured on three mutually perpendicular axes, with one perpendicular to the mould seam plane shall be between 750 grammes.cm² and 850 grammes.cm² for each axis. The variation between the three Moment of Inertia measurements on any single ball shall be ≤ 1% of the largest measurement.

National Elite Category Balls

The Moment of Inertia, when measured on three mutually perpendicular axes, with one perpendicular to the mould seam plane, shall be between 750 grammes.cm² and 950 grammes.cm² for each axis. The variation between the three Moment of Inertia measurements on any single ball shall be ≤ 2% of the largest measurement.

5.6 Ball Rebound

5.6.1 Test method

The rebound of the ball shall be measured in general accordance with EN 12235 but ignoring the correction factor (K^1) in the specified formula (which is incorrect) and to an accuracy of ± 0.1mm.

Balls shall be conditioned at the specified temperature for a minimum of 240 minutes prior to testing. Following removal from the conditioning chamber tests shall be made within 3 minutes, ensuring the ball temperature does not change by more than the specified tolerance.

5.6.2 Requirements

Global Category Balls

Test temperature		
5 ± 1°C	23 ± 2°C	40 ± 2°C
750 mm to 1000 mm	700 mm to 950 mm	650 mm to 900 mm
Maximum variation in (mean) ball rebounds across test temperatures	≤ 175 mm	
Maximum variation in ball rebounds at 23 ± 2°C	≤ 50mm	

National Elite Category Balls

Test temperature		
5 ± 1°C	23 ± 2°C	40 ± 2°C
750 mm to 1000 mm	700 mm to 950 mm	650 mm to 900 mm

5.7 Hardness

5.7.2 Test method

The Hardness of the ball shall be determined BS 5993: 1994: Annex G. Balls shall be conditioned at the specified temperature for a minimum of 240 minutes prior to testing. Following removal from the conditioning chamber tests shall be made with 3 minutes, ensuring the ball temperature does not change by more than the specified tolerance.

5.7.2 Requirements

Global Category Balls

Test temperature	Hardness (g)
5 ± 1°C	130 - 220
23 ± 2°C	130 - 200
40 ± 2°C	130 - 180

National Elite Category Balls

Test temperature	Hardness (g)
5 ± 1°C	120 - 220
23 ± 2°C	120 - 200
40 ± 2°C	110 - 180

5.7 Performance Retention

5.7.1 Conditioning test method

The ball shall be subjected to 200 repetitive impacts using the apparatus detailed in of BS 5993: Annex G over a period of 25 ± 5 minutes, the ball being free to rotate between impacts. The ball shall be allowed to recover for 5 minutes and then tested within the next five minutes for shape and rebound. The balls shall then be then left to cool for a minimum of 3 hours and then the hardness test shall be carried out but at a temperature of +23°C.

5.7.2 Shape

Global Category Balls

The nominal outer ball surface (i.e. excluding excursions and incursions) shall lie on or outside a perfect sphere of radius 35.625mm and on or inside a second sphere of radius 37.000mm sharing the same centre as the first.

The maximum difference in radial distance from the centre of the spheres between any two points on the nominal ball surface must be no more than 0.375 mm.

National Elite Category Balls

The nominal outer ball surface (i.e. excluding excursions and incursions) must lie on or outside a perfect sphere radius 35.625mm and on or inside a second sphere radius 37.375mm sharing the same centre as the first (as above)

The maximum difference in radial distance from the centre of the spheres between any 2 points on the nominal ball surface must be no more than 0.875 mm.

5.7.3 Rebound

Global Category Balls

The maximum decrease in the mean ball rebound after conditioning shall be 40 mm.

National Elite Category Balls

The maximum decrease in the mean ball rebound after conditioning shall be 80 mm.

5.7.4 Hardness**Global Category Balls**

The maximum change in ball hardness after conditioning shall be $\pm 15\%$.

National Elite Category Balls

The maximum change in ball hardness after conditioning shall be $\pm 25\%$

FIH guidance

- It is possible the FIH will adopt a high-speed one-sided impact test to determine retention of ball rebound, hardness and shape in the future

ANNEX A

MEMBERSHIP OF FIH QUALITY PROGRAMME - MANUFACTURERS OF HOCKEY BALLS

The **FIH Quality Programme** provides consistent and dependable industry standards for a range of equipment and facilities used by the game of hockey.

As a manufacturer of FIH Approved Balls a company becomes part of an exclusive group that is working in partnership with the FIH to ensure the quality and performance of hockey equipment.

In addition to demonstrating their commitment to hockey and showcasing industry best practices, they benefit from:

- The **right to use FIH Approved Ball logos** on their approved balls and packaging
- **Input into industry development** through attendance at FIH technical meetings and the ability to provide feedback on any changes made to the *FIH Hockey Ball Standards*.
- **Increased worldwide exposure and marketing** through recognition by the FIH of your balls and your presence on the FIH's website. Information will include, company name a, website and a list of FIH Approved Balls you manufacture.



Membership criteria

Either manufacturers or brand owners¹ of hockey balls satisfying the requirements of this Standard may apply to join the FIH Quality Programme, subject to the following conditions:

1. The hockey ball is manufactured under a quality management system (ISO 9001 or similar) at the time of application and for the duration of the ball's approval.
2. The manufacturing company complies with all national and local employment laws and the *United Nations Convention on the Rights of the Child*.
3. Payment of the appropriate annual licensing fee, as advised by the FIH.

Notes:

1. Brand owners are defined as companies that own the intellectual properties rights to a ball, but outsource the manufacturing to a third-party company

Information to be included in an application for a ball to be approved:

1	Applicant's company name	
2	Company address	
3	Company website	
4	Company email	
5	Company contact	
6	Contact phone	
7	Contact email	
8	Name and address of ball manufacturer (if different to applicant)	
9	Copy of manufacturer's ISO 9001 certification or similar quality assurance programme	
10	Copy of test institute report showing ball's compliance with FIH Hockey Ball Standards	
11	Signed statement of conformity that the ball is manufactured from materials that are known to be not harmful to human health or the environment.	

Property		Units	Global		National Elite (NE)		Result	Pass / Fail	
			Min	Max	Min	Max		Global	NE
Colour			White or Yellow		White or Yellow				
Spherical Size		mm	35.625	37.000	35.625	37.375			
Surface Irregularities		Moulded Seam	≤ 0.1		≤ 0.1				
Dimples	Symmetry		Symmetry shall be maintained across the mould split plane						
	Number of dimples		≥ 300		Dimples required				
	Maximum dimple depth	mm	0.5		0.6				
Other features that exhibit excursion or incursions			There shall be a maximum of two symmetrically placed features on any ball.						
			The maximum chord length between any two edge points shall be 12mm.						
			Symmetry shall be maintained across the mould split plane (i.e. zero or two features, not one).						
		mm	Maximum cumulative distance of excursions above 0.1mm	2mm					
		mm	Maximum cumulative distance of incursions below 0.1mm	2mm					

Property	Units	Global		National Elite (NE)		Result	Pass / fail		
		Max	Min	Max	Min		Global	NE	
Other features that exhibit excursion or incursions	mm			Maximum radial excursion with respect to the nominal sphere	0.3mm				
	mm			Maximum radial incursion with respect to the nominal sphere.	0.3mm				
Mass	Absolute	g	156.00	163.00	156.00	163.00			
	After water immersion	% change	< 0.1						
Centre of Gravity		mm	To be within 0.5mm of geometric centre						
Moment of Inertia		g/cm ³	750	850	750	950			
	Variation between axis		≤ 1%		≤ 2%				
Ball rebound	5 ± 1°C	mm	750	1000	750	1000			
	23 ± 2°C		700	950	700	950			
	40 ± 2°C		650	900	650	900			
	Max variation across temp range	mm	≤ 175 mm		N/A				
	Maximum variation in ball rebounds at 23 ± 2°C	mm	≤ 50mm		N/A				

Property		Unit	Global		National Elite (NE)		Result	Pass / Fail	
			Max	Min	Max	Min		Global	NE
Hardness	5 ± 1°C	G	130	220	120	220			
	23 ± 2°C		130	200	120	200			
	40 ± 2°C		130	180	110	180			
Performance Retention	Shape	mm	35.625	37.000	35.625	37.375			
	Maximum difference in radial distance	mm	≤ 0.375		≤ 0.875				
	Hardness	G	< 15% change		< 25% change				
	Ball rebound	Max. reduction (mm)	40mm		80mm				