

Standard for frangible/deformable cross country fences – Version 2(.5)

March 2020

Foreword

This standard has been prepared by the Fédération Equestre Internationale (FEI) Eventing Committee according to the FEI Risk Management Policy and Action Plan. The FEI Eventing Committee wishes to thank all parties for their contribution in the development of this standard.

Research and experience has shown that frangible/deformable fence construction technology can help reduce the number of somersault falls that are induced by contact with a fence. Frangible / deformable fences work either by removing the fulcrum point on the fence that the horse rotates about, and/or by limiting the impulse that the fence exerts on the horse.

As part of its Risk Management Policy and Action Plan, the FEI Eventing Committee wish to allow the use of frangible/deformable fences with the goal of reducing the risk of rotational falls while striving to maintain the integrity of the 'Cross Country Test', i.e. jumping fixed fences. To fulfil this expectation, the following requirements for a frangible/deformable fence were identified. The fence should:

- Not expose rider or horse to a higher risk of injury than an equivalent current fixed cross-country fence, in particular when activated;
- Have a minimum strength to ensure that it is representative of a fixed fence;
- Have a maximum strength for release, to reduce risk of a rotational fall if impacted;
- Have a repeatable activation performance throughout the competition in order to be fair to all competitors, i.e. light contact of the fence by one horse should not lower the impulse and energy required to activate it by a following horse.

Frangible/deformable fences are one part of the bigger picture of the Eventing Risk Management Action Plan where the correct education of responsible riders and officials joined to the progressive training of horses are still expected to be the fundamental prerequisites of any effective risk management action.

This is the second version of the standard. The main changes compared to the previous version are:

- The addition of requirements for fence activation, i.e. pendulum impact energies that the fence shall activate at.
- The change of the 120 kg pendulum impactor to a 40 kg kettle-bell pendulum.

This update was agreed at the Eventing Risk Management (NSO) Seminar in Aintree (UK) Jan 24-26 2020. The reasons for these changes were:

For fence activation, recent research work indicated that an activation energy of 250 J for front rails and 400 J for back rails is required to further reduce the risk of somersault falls when the horse strikes the fence. Currently, the activation energies of typical frangible fences are up to circa 490 J measured with a 120kg pendulum. A major objective of the update is to drive the development of the 'state of the art' of frangible fences to provide better protection by, amongst other things, defining the maximum activation energy.

For the pendulum change, research work indicated that many somersault falls occur as a result of a horse forelimb strike. To more closely match a typical event horse forelimb in both energy and momentum when striking a fence, the lower mass kettlebell pendulum was proposed. This pendulum has the additional advantages that it is low cost and easy

to build. This should help enable the development of prototype fences because fence manufacturers will be able to easily make a kettlebell pendulum at low cost and trial new ideas that they have.

Finally, it should also be noted:

- That an immediate aim is to develop and trial prototype fences which meet the updated standard in competitions as soon as possible. To this end, manufacturers should contact FEI as soon as they have a prototype fence available, which meets the updated standard when assessed with the kettlebell pendulum. Actions can then be taken to arrange to trial the prototype fence in competitions.
- It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Contents

Foreword.....	1
1 Scope.....	3
2 Terms and definitions.....	3
2.1 Frangible/deformable fence	3
2.2 Product.....	3
2.3 Azimuth angle	3
3 Requirements.....	3
3.1 General	3
3.1.1 Information to be supplied by the manufacturer	3
3.1.2 Assessment of product for the various fence constructions listed in the instructions.....	4
3.1.3 Labelling of the product	5
3.1.4 Production conformity	5
3.1.5 Approval and Register of products.....	5
3.1.6 Inspection authority, qualification test report and	5
3.2 Should not present a greater and/or additional risk than a fixed fence.....	6
3.3 Minimum strength of fence without activation.....	6
3.4 Repeatable use without fatigue.....	7
3.5 Activation at specified (pendulum) strike angles and energies.....	7
3.6 Activation mechanism.....	7
4 Testing.....	8
5 Acknowledgements	8

1 Scope

This FEI standard specifies requirements for frangible/deformable fences used in FEI competitions.

It is not the intention of this standard to bar from consideration fences of improved quality or performance not known at the time of development of this standard.

2 Terms and definitions

2.1 Frangible/deformable fence

A frangible/deformable fence is defined as a fence that is designed to break and/or deform to help prevent somersault falls that are induced by contact of the horse with the fence. Frangible/deformable fences operate either by removing the fulcrum point on the fence over which the horse rotates, and/or by limiting the impulse that the fence exerts on the horse.

2.2 Product

The product is defined as the package supplied by the manufacturer. It may consist of a complete frangible/deformable fence and associated instructions. Alternatively, it may consist of the key components (e.g. frangible pins) and associated instructions required to build the frangible/deformable fence with non-key components supplied from other sources.

2.3 Azimuth angle

The azimuth angle is defined as the angle between the travel direction of the horse and a line along the installed frangible fence element.

3 Requirements

3.1 General

3.1.1 Information to be supplied by the manufacturer

Before a product can be assessed against this standard the manufacturer is to supply FEI experts and/or an approved inspection authority appointed by the FEI Eventing Committee with certain information. The scope and requirements for this information are described in the following sub-sections.

3.1.1.1 Instruction manual

The product shall be provided with a comprehensive and clear instruction manual written in English regarding its installation, use, maintenance, replacement and disposal.

This shall include as a minimum:

- A list, including diagrams, of the fence installations that the product is suitable to be fitted within. For each fence installation the following information shall be included:
 - Whether the frangible fence element comprises a front rail (which includes single fence elements) or a back rail.

- The angle of installation of the frangible element with reference to the travel direction of the horse
- The position laterally at which the frangible element is designed for the horse to jump.

Note: the product can be a complete fence.

- Clear instructions describing the installation procedure for the product, including for example, diagrams, visual aids, dimensions, mass and size limits.
- Clear information on how to assess if a product has been correctly installed
- Clear information regarding the concept of how the fence operates, how it should be used and what type of impacts it is designed to offer protection against to help ensure that it is used in an appropriate manner. (e.g. how it is activated and the location and direction of loads required to activate it)
- Clear information to ensure that users are aware of the implications of incorrect installation
 - Note: In order to minimise the risk of incorrect installation, manufacturers should consider how the product may be incorrectly installed and where practicable eliminate the risk of incorrect installation by, for example, altering the design to prevent incorrect installation and/or improvements to the instruction manual.

3.1.1.2 Information for testing

For all the fence installations listed in the instruction manual for which the product may be used, the manufacturer shall supply the following information:

- Installations that the manufacturer considers to be equivalent in terms that the mechanical load, impulse and mechanism by which the product is activated are the same.
- For different installations, such as a change in rail length and /or rail mass for a post and rail fence, critical cases recommended for testing, for example, for installations with a range of rail length, the shortest and longest rail length within the range.
- For each non-equivalent installation and each critical case:
 - Whether the frangible fence element comprises a front rail (which includes single fence elements) or a back rail.
 - The angle of installation of the frangible element with reference to the travel direction of the horse.
 - Note: This value is used to define the azimuth angle for pendulum testing
 - The position laterally at which the frangible element is designed for the horse to jump.
 - Note: This value is used to define the lateral impact point for pendulum testing

3.1.1.3 Information regarding Quality Control System and production conformity

Manufacturers shall supply details of the Quality Control System (e.g. ISO 9001) used (e.g. control of manufacturing processes, specification of materials used to make product, batch testing, etc.) including quality control procedures to ensure that all products supplied conform to the requirements of this standard.

3.1.2 Assessment of product for the various fence constructions listed in the instructions

The product shall be tested to demonstrate that the requirements of this standard are met for all the fence installations listed within the instruction manual.

For difference installations for which the mechanical load, impulse and mechanism by which the product is activated is the same, a test of one configuration is sufficient. For example, a post and rail fence fitted with a horizontally activated frangible element, where there is a lower rail attached to the fence that does not interrupt the fall of the upper rail when activated, for purposes of these instructions would be deemed as the same fence as one in which the lower rail was not fitted.

For changes in configuration such as a change in rail length and / or rail mass for a post and rail fence, critical cases shall be identified and tested. For example, for changes in rail length, both the shortest and longest rail length listed within the instruction manual shall be tested. In any case, however, rails for post and rail fences shall not exceed 90kg in mass.

3.1.3 Labelling of the product

Each product must be marked indelibly with the following information so that it is legible to the user and likely to remain legible throughout the life of the product:

- Country of manufacture
- Manufacturers name
- FEI registration number

3.1.4 Production conformity

Manufacturers shall have quality control procedures in place to ensure that all products made conform to the requirements of this standard. Manufacturers shall supply details of these procedures to the FEI approved inspection authority as mentioned previously in Section 3.1.1.3.

The FEI reserves the right to test a product at any time to ensure that it still meets the requirements of this standard.

3.1.5 Approval and Register of products

The FEI Eventing Committee shall be responsible for evaluation of the product application, to determine approval or rejection. The result of this evaluation shall be documented and provided to the applicant.

The FEI shall maintain a register of all products which have been approved by the FEI to meet the requirements of this standard and therefore are eligible to be used in FEI governed events. Approved products will be added to this register and a registration number issued.

The FEI reserves the right to remove a product from the register, and therefore its eligibility to be used in FEI governed events, if evidence shows that a product poses a greater and/or additional risk than a fixed fence or if it performs in other fashion not in accordance with this standard. In this event manufacturers will have a right to appeal the decision to remove the product, according to FEI legal procedures (FEI General Regulations).

Manufacturers shall have a system in place to recall their product from the market if the FEI removes the product from the register.

3.1.6 Inspection authority, qualification test report and FEI review

Qualification tests shall be witnessed or performed by a FEI approved inspection authority. Video recordings shall also be made of them. The inspection authority will be responsible for ensuring that a valid qualification test report is completed, which is accompanied by video recordings of all tests.

The qualification test report should contain as a minimum:

- A copy of the information supplied by the manufacturer.
- An assessment that the information for testing supplied by the manufacturer (see Section 3.1.1.2) is complete and correct made by the inspection authority.
- A list of all the tests performed which includes the test configuration and the results of these tests for each of the non-equivalent installation and critical test cases defined in section 3.1.1.2 for the requirements defined in sections 3.3, 3.4 and 3.5.
- A statement of whether or not the fence meets this standard consisting of:
 - Whether or not the proposed fence likely presents no greater and/or additional risk than a fixed fence
 - Whether or not the product meets all the requirements of this standard

The FEI frangible working group (WG) shall review the application package, including installation instructions, the test results, the test report and the video recordings to determine if the frangible product meets the requirements of this standard.

3.2 Should not present a greater and/or additional risk than a fixed fence

The manufacturer shall ensure that the product, when activated, is unlikely to present a greater risk to the rider or horse than that of an equivalent fixed fence. This includes, but is not limited to, the time period over which the device is being activated as well as immediately thereafter. For instance, in a post and rail fence construction, once a frangible element has been activated, the released upper rail should not become free to roll away from the uprights, because it may become entangled with the horse and rider following activation.

The FEI reserves the right to approve, or not approve, the argument proposed by the applicant as to whether or not the product presents a greater risk than an equivalent fixed fence.

3.3 Minimum strength of fence without activation

Each type of frangible / deformable fence construction that the product is registered for shall meet the following requirements to ensure that it is representative of a cross country fence, i.e. the product shall not be activated if lightly clipped by a horse.

For each non-equivalent installation and each critical case defined in Section 3.1.1.2, for the defined azimuth angle and lateral impact position, **the fence shall not activate** for the strike angles and energies defined in the table below.

No.	Pendulum elevation strike angle (deg)	Pendulum drop height with respect to impact point (mm)	Nominal pendulum energy (J)
1. Front rail	27 ± 5 degrees upwards	420 ± 5 mm	165
2. Back Rail	27 ± 5 degrees downwards	420 ± 5 mm	165

-Pendulum: tests should be carried out using a 40kg kettlebell pendulum impact tester as specified in Section 4.

Note: The activation of a fatigue indicator is deemed acceptable, provided the fence does not activate.

3.4 Repeatable use without fatigue

Each type of frangible / deformable fence construction that the product is registered for shall meet the following requirement to ensure that it has a repeatable use performance, i.e. contact of the fence by one horse should not lower the impulse and energy required to activate it by a following horse.

For each non-equivalent installation and each critical case defined in Section 3.1.1.2, for the defined azimuth angle and lateral impact position, for the strike angles and energies defined in the table below, five consecutive tests shall be performed unless a visual fatigue indicator activates in which case no further tests are performed. **The fence shall not activate** during the test series.

No.	Pendulum elevation strike angle (deg)	Pendulum drop height with respect to impact point (mm)	Nominal pendulum energy (J)
1. Front rail	27 ± 5 degrees upwards	420 ± 5 mm	165
2. Back Rail	27 ± 5 degrees downwards	765 ± 5 mm	300

-Pendulum: tests should be carried out using a 40kg kettlebell pendulum impact tester as specified in Section 4.

3.5 Activation at specified (pendulum) strike angles and energies

Each type of frangible / deformable fence construction that the product is registered for shall meet the following requirements to ensure that it will activate when appropriate to help prevent somersault falls:

For each non-equivalent installation and each critical case defined in Section 3.1.1.2, for the defined azimuth angle and lateral impact position, the fence shall activate consistently (i.e. for three consecutive tests) for the strike angles and energies defined in the table below.

No.	Pendulum elevation strike angle (deg)	Pendulum drop height with respect to impact point (mm)	Nominal pendulum energy (J)
1. Front rail	27 ± 5 degrees upwards	637 ± 5 mm	250
2. Back Rail	27 ± 5 degrees downwards	1784 ± 5 mm	700

-Pendulum: tests should be carried out using a 40kg kettlebell pendulum impact tester as specified in Section 4.

3.6 Activation mechanism

Each type of frangible / deformable fence construction that the product is registered for shall meet the following requirements to ensure that it activates in a manner that will help prevent somersault falls and not pose additional risks.

- Upon activation, the fence shall reduce in height by a minimum of 200 mm due to the activated element (for example the front or back rail) moving out of the way of the horse's motion at the location of impact, with minimum resistance. (height reduction determined by suitable measurement before and after activation with tolerance +/- 5 %).
- The deployed rail in rest position shall have a ground clearance of at least 200mm to prevent limb entrapment. Tolerance of +/- 5%
- The fence may extend horizontally in the jumping direction up to a maximum of 400 mm (determined by suitable measurement before and after activation with tolerance +/- 5%).
- All activated elements of the fence must be constrained to not separate from the fence after activation. For example, an activated rail must be free to move out of the way of the horse upon activation, but must be constrained with hinges, ropes or other means to remain attached to the fence so as to not fly free and become entangled with the horse and/or rider after deployment.

4 Testing

Refer to kettlebell testing procedure V2.3, March 2020.

5 Acknowledgements

The following organisations contributed to the development of this standard:

- MIM Construction AB
- Transport Research Laboratory (TRL)
- University of Kentucky
- Bristol University
- Dutch Federation
- Jonathan Clissold
- Wayne Copping
- Giuseppe Della Chiesa
- Mike Etherington Smith
- David O'Connor
- Mark Phillips
- Hugh Thomas
- Eric Winter
- David Vos
- Geoff Sinclair

Disclaimer:

Although the FEI has taken all reasonable care to ensure that the information contained in this Standard is accurate at the time of publication, no representation or guarantee (including liability towards third parties), expressed or implied, is made as to the accuracy, reliability or completeness of the Standard. The FEI disclaims all representations and warranties, including by way of example but no limitation, all representations and warranties as to the fitness of anything contained in the Standard for a particular purpose, to the fullest extent permitted by applicable laws.

Therefore, the FEI assumes no liability for the use or interpretation of the information contained herein. Any use of the information contained herein is on an "AS IS" and "AS AVAILABLE" BASIS AND AT YOUR SOLE RISK, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES AND TERMS AND CONDITIONS OF MERCHANTABILITY, SUITABILITY AND

FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY RIGHTS.

Any product that meet the FEI requirements and that is listed as such is not an endorsement of a particular product and/or company, but is provided for informational purposes only