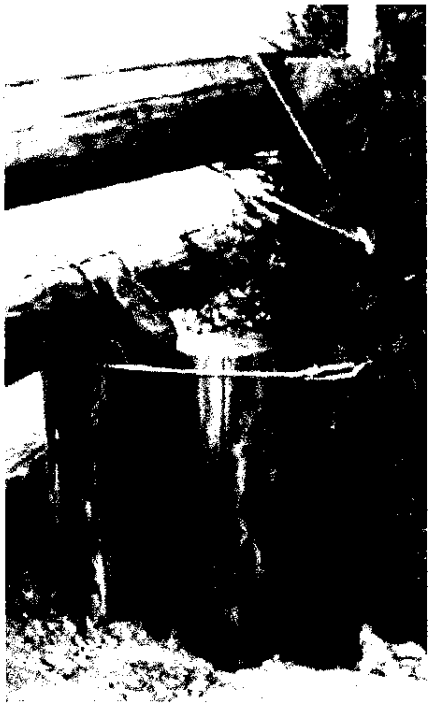
An Introduction to



Frangible Fences

11th Edition: March 21, 2010

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(618) 985-8086

1. BACKGROUND INFORMATION

An incident report form applying to all falls of horse and/or rider was developed and piloted during the 2000/2001 season. The Transport Research Laboratory (TRL) conducted film analysis of 100 accidents, including 75 cross-country fences and 25 show jumping fences. It was found that the potential for a crushing injury was related to the rotating motion and landing angle of the horse. A landing angle of more than 90 degrees was considered to provide a significant risk of crushing injury to the rider. This happened when the horse hit a fixed obstacle between its knee and elbow. Below this, the horse was able to scrabble over, but above this, the horse stayed behind the fence with the rider staying seated or ejected over the fence. A mathematical model was developed and a full-scale crash test horse was used to simulate the load conditions between a horse and fence. Based on the results of the test program, TRL established that if the rail anchorage was designed to break at a controlled load to ensure that the rail would fall, this would remove the vertical load between the horse and the fence.

TRL designed a breakable pin with the precise failure strength to allow the rail to drop, thereby stopping the horse from rotating or somersaulting. This means the horse can hit the rail fairly hard without the fence collapsing and still keep its footing, but if the critical load is reached, the pin would fail with the potential of minimizing risk of injury to both horse and rider. The final design and manufacture of the pins has been carried out by Barriers International, Ltd. A small team of British Eventing cross-country course builders and designers looked at the practicalities of the proposed system and how to implement it into the sport. Having tested the system, the pins were trialed throughout the 2002 season at 13 British Eventing from Training to Advanced; and at 14 FEI events across three continents. Video and eyewitness accounts confirm that the system is robust with fences installed with the pins having been hit in many ways, at all levels. Pins have broken twice during the 2002 season, and on both occasions, serious injury to both horse and rider was averted.

The first break was at Weston Park Prelim at the first rail of a rail-ditch-rail combination:

> The horse took off from a standstill. Momentum carried the horse over the fence to the critical position of downward pressure on the rail. The pin sheared at the point when downward pressure reached the pre-determined maximum. The rider was thrown free; horse was restricted to take-off side of the fence. The horse walked away uninjured. Fence repair crew replaced the pin in under 1.5 minutes and the course was not held. The horse and rider were fit to continue, but were awarded the appropriate penalties and compulsory retirement.

The second break was at Boekolo CCI***:

> A tired horse failed to make the back rail of an oxer. Both pins broke and both horse and rider escaped unharmed from an incident that eye-witness accounts suggested would have resulted in significant injury has the pins not been in use.

These two situations show that the system was immediately proven to contribute towards rider safety by reducing the chance of rotational and other potentially dangerous falls in certain circumstances.

The merits of the system include:

- Significant research and testing
- Maintains integrity of the cross-country phase
- Easy to install
- Easy and quick replacement of pins following activation (approx. 1-2 minutes)
- Affordable (approx. $68.00 pair of pins with sleeves. Cost currently covered by USEF.)

2. ROLL-OUT PLAN (U.S.A.):

HOW SOON MUST THE SYSTEM BE INSTALLED INTO FENCES?

- It is required for use in obstacles after December 1, 2008 for which frangible technology is appropriate. Obstacles constructed prior to December 1, 2008 for which frangible technology is appropriate must be retrofitted prior to December 1, 2009.
- The use of the Frangible Fence Pin System is outlined in the newly revised "Guidelines for Cross Country Obstacle Design".

- The guidelines call for the use of the pin system in certain appropriate situations, namely: back rails of open oxers, triple bars, coffins, rails before sunken roads, bounces, and open corners at preliminary, intermediate, and advanced levels.
- The Technical Delegate, in discussion with the Course Designer, will be responsible for determination of obstacle appropriateness, as usual.

3. DESIGN & BUILDING SPECS:
INTO WHICH FENCES CAN THE PIN SYSTEM BE INSTALLED? Specification of fences to which the system should be installed:

- Post and rail construction using timber of appropriate specification (see Construction Specs below)
- All top rails of 15-inch diameter or less.
- Back and front rail of all oxers (square and ascending)
- Back rail only of any triple bar type construction
- Any rail that measures at least 37.5 inches (0.95 m) in height from the BASE of the fence (not measured from point of take-off). It may be installed in fences of a lower height if you choose only if the rail can drop 16-inches. This should be discussed with the Course Designer.
- Corners of post-and-rail construction: both rails that form corner, if all of standard post-and-rail construction; back rail only if front is of solid construction (i.e. palisade, see section 4 and Appendix diagram).

Construction Specifications:

- No more than 16 feet between pin centers
- Rail not to exceed 550 pounds (SEE APPENDIX B)
- Diameter of rail at each pin to be 6.5 to 15 inches.
- Timber of greater diameter can be used as long as the center of the log sits on the setting marker on the pin, and that the overall weight does not exceed 550 pounds. This could be achieved by notching the rail back onto the posts, but MUST be discussed with, and approved by, the Course Designer.

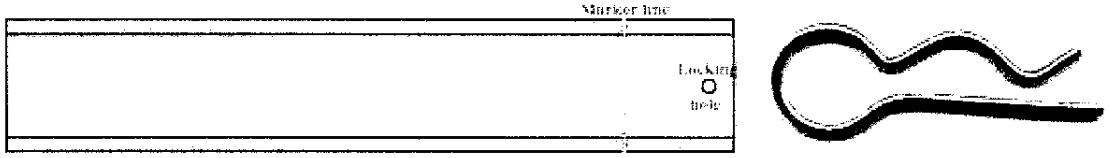
- Once installed, the rail must be free to drop at least 16 inches (40 cms) at each pin position, and be retained by roping.
- All back rails (oxers, triple bars, etc.) should have no lower rails or filling.
- Uprights and front rails with pins installed can have lower rails and/or filling. Suggested methods of achieving this are shown in the Appendix.
- For full construction methodology and supporting diagrams, see section 4 and the Appendix

Prior to installation, the Technical Delegate should approve the use of the pin system in the chosen fences, and MUST be satisfied that the course builder is adequately experienced to carry out the installation.

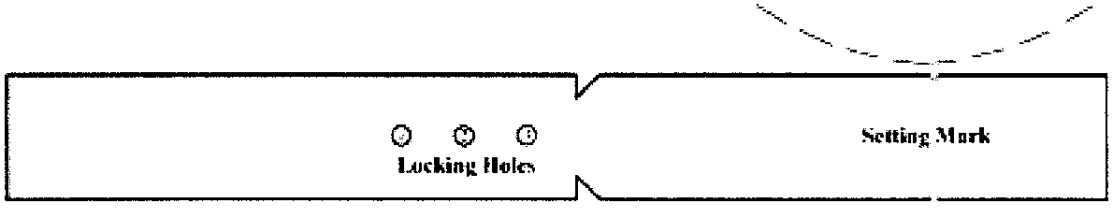
4. CONSTRUCTION AND INSTALLATION: HOW DO I INSTALL THE PIN SYSTEM?

- The careful and accurate installation of the pins is key to the successful activation of the system.
- The post must be vertical -- the system CANNOT be installed in a post set at an angle.
- Temporarily set the rail in the traditional way on prop-blocks. Next, fine-tune to satisfaction of the designer and TD.
- Remove or lift rail out of the way.
- Attach prop-block to post (i.e. with timber-lock screws). Mark post for bottom of rail. Cut off catch-block 16" below rail mark.

- Mark the position for the hole so the top of the hole will be at the bottom edge of rail. (centered 3/4" below rail / 19 mm). The pin cannot be adjusted by less than 2-3 inches once the hole for the sleeve has been drilled.
- Drill a 1 ½ inch hole HORIZONTALLY all the way through the post.
- The hole must not exceed 1 ½ inch, as an insufficiently tight fit will cause significant variation in the load required to break the pin, and the system will not perform correctly.
- Drive the sleeve into the post using the driving tool that is supplied with the sleeves, so as not to damage the sleeve. Alternatively, if post diameter allows, drive sleeve from back of post.
- Leave the 'pin locking hole' about 1/4 inch outside the post on the 'rail' side.
- Accurate positioning of the sleeve: The sleeves are now being produced with a marker line (groove) just behind the locking hole. The sleeves should be inserted into the posts as far as possible, just allowing enough protrusion to insert the "R" clip through the locking hole. In any case they must be inserted at least so that the marker line is no longer visible.



- Determine correct pin length (short pins: up to 12.5" diameter; long pins: up to 15.5" diameter).
- Insert the pins into the sleeves at each end of the rail.
- Set the rail onto the pins and adjust the pins using one of the three 'locking holes', thus ensuring the 'setting mark' is at the center point of the rail.
- Accurate positioning of the rail on the pin: It is vital that the pin breaks under the load for which
- it has been designed. Therefore, the rail must be positioned onto the pin so that the contact point of the rail is DIRECTLY over the setting mark (groove) on the pin. If the rail center is off the setting mark (groove) by 4-3/16 inches (30 mm), the effective strength or weakness of the pin will be 43% greater or less than with the rail installed on the groove. The 'locking holes' are positioned to help you achieve this. If the locking holes do not allow you to position the rail
- correctly, you must either pack the rail out from the post, or notch the rail back onto the post.



- If the rail bottom contact point is not obvious (flat), a dowel can be attached to create a clear contact point.
- Lock the pin in position in the sleeve with the retaining clip.

- Rope the rail to the post ensuring that the rail is free to drop at least 16 inches (40 cms) at each pin position when the pin breaks. Roping must be as tight as possible and fixed 8 inches below pin.
- Measure down 16 inches (40 cms) from the bottom of the rail and secure catch block with its top at this point.
- See Appendix for styles.
- Once installed, remove the pin and check that the rail can drop freely, including where the pin is installed at the joints. To prevent the rail from snagging on the pin residue (stub), the rail must be able to rotate as it drops.
- Middle Posts: There may be a post in the middle of a fence for aesthetic reasons. There is a possibility of a rotation occurring directly over this post. The top of the post could take the resulting force, and thus stop this force being exerted on the rail itself and hence the pins. Therefore, where a middle post is used without a joint and pin, the top of the post should be cut flat just above the mid-point of the rail.
- The Technical Delegate is responsible for checking the correct installation of the system prior to the start of competition.
- Currently, the pins and sleeves are manufactured from an aluminum alloy. To minimize the potential for corrosion, it is recommended that:
- 1. The pins ARE removed during the closed season, lightly oiled and stored in a dry place. They should then be cleaned and lightly oiled prior to setting up the jump for the next season.
- 2. The sleeves ARE NOT removed from the jumps during the closed sea son. They should be oiled at the end of each season, then cleaned and oiled again prior to setting up the jump for the next season.
- The latest information and recommendations for proper installation may be viewed at www.barriersint.com.

5. REPLACING PINS:

WHEN MUST THE PINS BE REPLACED AND WHO IS RESPONSIBLE?

- The obvious answer is that the pin must be replaced when broken. However, a pin will bend (not shear) if the fence is hit with a force approaching the pre-determined level at which the pin is designed to shear.
- All pins should be checked regularly throughout the day of competition, and must always be checked immediately after the fence has been hit. This should be done initially by the Fence Judges, having been briefed by the Technical Delegate prior to the start of competition.
- A pin must be replaced as soon as there is any sign of bending.
- The Organizer must be sure that extra pins are present at competition
- The Event should also ensure that all broken or bent pins are forwarded to the USEF.

6. SHEARED PINS

In National Level Events, if a pin is broken, it is treated as any other fence. No penalty is issued if forward momentum is maintained and no fall of horse or rider occurs. The fence must be pulled from the course if supply of spare pins is exhausted.

7. GETTING THE PIN SYSTEM:

WHO SUPPLIES THE PIN SYSTEM AND HOW DO I ACQUIRE FRANGIBLE PINS?

Mick Costello will be distributing the pins free of charge on behalf of the USEF as a service to the sport at no profit to himself. Shipping can be arranged by contacting Mick.

Mick Costello
Lexington, Ky.
Phone: 859-312-8193

[redacted]
MAY BE DIRECTED
P.O. Box 84
Palmetto, GA 30268
e-mail: jumpbuilder@
cell phone: 618-201-

Appendix A

Drawings based on diagrams originally provided by British Eventing.

Diagram 1 - Post and Rail with suggested method of retaining lower rail

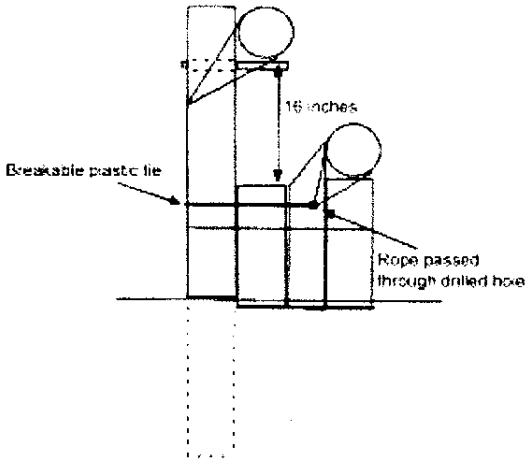


Diagram 2 - Flower Box

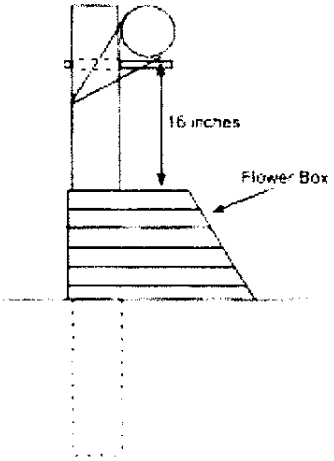


Diagram 3 - Triple Bar

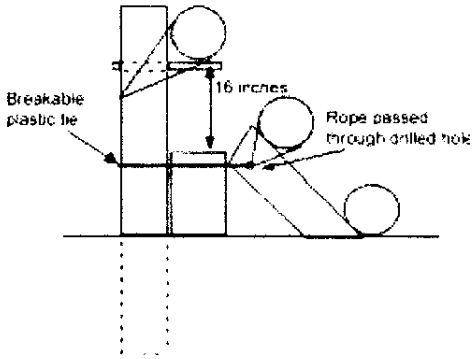


Diagram 4 - Post and Rail with brush fill

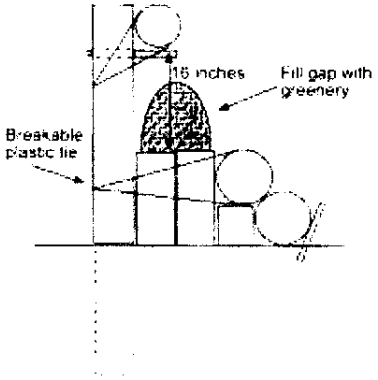


Diagram 5 - Joint

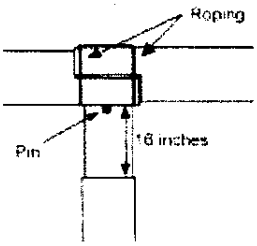


Diagram 6 - Corner Layout (from above)

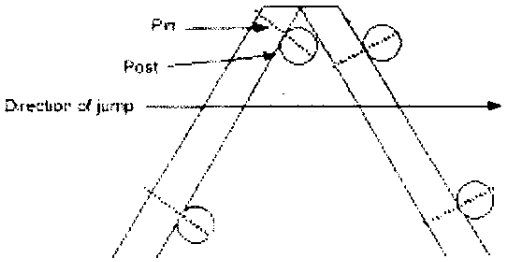
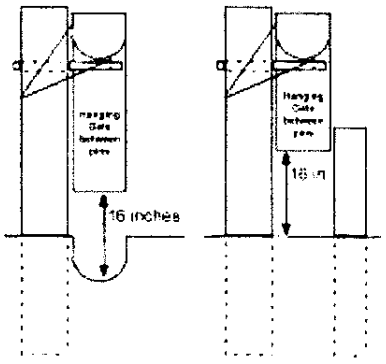


Diagram 7 - Square Timber or Gate



Appendix B
APPROXIMATING THE WEIGHT OF LOGS

METHOD A:
1. Cut known length of log from end.
2. Weigh cut off section.
3. Divide rail length to be used by length of cut section.
4. Multiply that number by weight of cut section.

METHOD B:
1. Find the volume of log in cubic feet:
0.0795 x length in feet x average girth in feet x average girth in feet.
2. Multiply by weight per cubic foot (from chart).

EXAMPLE:
Freshly cut sycamore log = 16 feet long
Circumference around mid-point of log = 31.5 inches (10 inch diameter) (pi x diameter)*
Convert girth to feet: 31.5 inches divided by 12 = 2.625 feet
Formula:
0.0795 x 16 x 2.625 x 2.625 = 8.765 cubic feet
Multiply times density from chart:
x 63.7 pounds per cubic foot = 558.3 pounds **TOO HEAVY!!**
On-line calculator available at: shagbarkfarms.com/LmbCalc/VolCalc_Q2.html * pi = 3.14

DENSITY OF SPECIFIC WOODS IN POUNDS PER CUBIC FOOT

SPECIES	GREEN	DRY
Apple	60.6	48.6
Ash, Green	52.3	41.1
Ash, White	49.4	43.4
Basswood	41.3	24.7
Birch, Paper	53.9	37.4
Boxelder	44.9	32.9
Buckeye	52.6	24
Catalpa	57	29.5
Cedar, Eastern Red	36.9	32.9
Cherry, Black	46.2	36.6
Cottonwood	58	28.4
Elm, American	55.7	35.9
Fir, Douglas	41.5	37
Hackberry	49.8	38.1
Hickory, Shagbark	63.8	49.4
Iron Wood	57.4	50.2

SPECIES	GREEN	DRY
Kentucky Coffeetree	48.4	38.9
Locust, Black	57.7	50.2
Locust, Honey	58	47.9
Maple, Hard	58.7	41.9
Maple, Silver	48.8	34.4
Mulberry	58.9	46.4
Oak, Red	61.1	44.1
Oak, White	69.7	52.5
Osage Orange	64	59.1
Pine, Jack	45	29.2
Pine, Ponderosa	45	29.2
Pine, White	34.7	28
Spruce	35	28
Sycamore	63.7	35.1
Walnut, Black	57.3	39.6
Willow	54	31.7

HIGHLIGHTS FOR OFFICIALS

- It is very difficult to change the height of pinned rails, so we are recommending that rails be set temporarily on prop blocks (traditional method) until checked by TD and/or CD. Ideally this would be done at an early course inspection.

- Rail must contact pin at line on pin.

- Pins must be rigid in posts. This may be difficult to check with weight of rail on pins, but if sloped, should be checked closer.

- Pins must be perpendicular to posts

- Maximum 16 feet between pins.

- Maximum 550 pounds per rail. Ask builder if checked or figure using formula.

- Rail must have 16 inches of free fall space below.

- Must be roped to not restrict fall.

- Ensure that Organizer has spare pins on site.

- Repair crew knowledgeable.

- Jump Judges briefed to check pins for damage after hits.