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1984
STANDARD
FOR PROTECTIVE
HEADGEAR

*For Use in Harness Racing
and Other
Equestrian Sports*

SNELL MEMORIAL FOUNDATION

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INTRODUCTION

The 1984 Standard for protective headgear for use in harness racing represents an extension of the Standards established by the Snell Memorial Foundation dating as far back as 1959 for the design of protective helmets. Since the first Standard in 1959, numerous consumer groups with activities that require protection of the head have requested that the Snell Foundation establish standards for their particular activity. A common concern of all of these groups is the hazard of exposure of the head to the transfer of impact energy from the external environment to the human head. The ill effects of such transfer are independent of the way in which the impact energy is generated; the inadequately protected head cannot distinguish the kinetic energy of an impact against a rock, tree, horse's hoof, track surface or an object dropped from some height. As a consequence, the basic problems of head protection are common to many interested groups. This Standard is designed to establish, in so far as possible, performance characteristics rather than to set forth construction and material limitations upon the designer and manufacturer except in so far as it requires that peripheral vision and hearing not be restricted. The Foundation does not presume to recommend specific products or to impose its specifications upon the manufacturer or consumer. It seeks to establish a realistic standard for protective headgear that may be manufactured within the economic and technological circumstances prevailing at the time the Standard is established.

The Foundation also offers its test facilities to bona fide manufacturers and makes them available to any interested consumer group as a means for identifying those products which have successfully met its standards. The Foundation neither has nor will it accept any power of enforcement for any consumer group. On the other hand, the Foundation will not act as a quality control mechanism for any manufacturer. The Snell Foundation certification of protective headgear requires specific contractual agreement between the manufacturer of the headgear and the Foundation. Information relative to the certification process may be obtained by interested manufacturers upon application to the Foundation.

It must be understood that the protection given by any protective headgear is necessarily less than complete and that the wearing of such may not entirely prevent injury, head injury or

death in certain severe accidents. The best helmet is but one link in a long chain of safety which may include such factors as proper training and conditioning, restraining harnesses and, most importantly, adequate safety education. The weakening of any one link in this chain tends to destroy the basic value of the entire chain.

The attention of the consumer must be called to the fact that of necessity helmets are constructed so that the energy of a severe blow is absorbed resulting in the partial destruction of the helmet. This damage is usually not apparent and therefore it is strongly recommended by the Foundation that consumers require that any helmet involved in a significant accident be returned to the manufacturer for competent inspection. If this is not available, the helmet should be replaced.

CONSTRUCTION

A. General

The helmet shall consist of a hard, smooth shell lined with energy absorbing material or fitted with other means of energy absorption. It shall be strongly attached to a retention system designed to fasten under the wearer's chin. It should be emphasized that the strength of the retention system does not necessarily reflect its ability to retain the helmet on the wearer's head. A Y type retention system may be preferable.

Since the function of the retention system is to keep the helmet on the wearer's head under all accident situations it shall not be possible for a second person to remove the helmet from the wearer's head. When tangential loads are applied anywhere on the shell they shall not cause appreciable displacement of the helmet relative to the head.

The assembled helmet shall have a smooth external surface without reinforcing ridges or other external projections greater than 7 mm above the outer surface of the helmet unless smoothly faired so as to offer no significant frictional resistance to tangential impact forces. A goggle clip may be used at the rear of the helmet if desired and attachment points for a visor may be located at the forward edge of the helmet.

The helmet shall not reduce peripheral vision below 109° in the horizontal plane. It also shall not restrict the hearing ability of the individual wearing the helmet and should not cover the ear with sound absorbing materials.

B. Shell

The shell of the helmet shall be as nearly uniform in thickness and strength as is possible using normal manufacturing processes. Particular care should be taken to reinforce, if necessary, the edge of the helmet to provide as much rigidity as is possible at the edge.

Ventilation holes, if used, shall not exceed 13 mm in diameter. The heads of rivets, if used, shall not project more than 2 mm above the outer surface of the helmet and shall show no sharp edges.

C. Materials

The materials used in the manufacture of the various parts of the helmet shall be of durable quality; that is, their characteristics shall not undergo appreciable alteration under the influence of aging or of the circumstances of use to which the helmet is normally subjected, such as exposure to sun, rain, cold, dust, vibration, solvents and cleaning agents, contact with skin, effect of sweat or of products applied to the skin or hair. Appropriate tests for durability under these circumstances may be instituted by the Foundation. Materials commonly known to cause skin irritation or disease shall not be used for those parts of the assembly which come into contact with the skin. Materials of a new type must be shown not to be causative of skin irritation or disease before use in Snell approved helmets.

D. Finish

All of the shell shall be smooth and rounded and there shall be no metallic parts or other rigid projections on the *inside* of the shell which might injure the wearer's head in the event of impact. No part of the protective components of the helmet shall be inadvertently detachable, nor detach under test impact.

QUALIFICATION FOR CERTIFICATION

For qualification testing, helmets shall be taken in the condition as offered for sale. No helmet which has been subjected to any tests described in this Standard shall actually be offered for sale after testing. In qualification testing the helmets will be required to satisfy all of the safety performance criteria described in this Standard.

RANDOM SAMPLE TESTING

In addition to the initial testing prior to certification, random samples of certified helmets may be obtained by the Foundation from the open market. These will be tested by the Foundation in similar fashion that is described below and must meet the performance requirements of this Standard. When it has been shown by qualification tests that the materials used are equally protective after exposure to temperature and moisture conditions, thereafter consideration shall be given in routine random sample testing to the relaxation of these requirements, provided there is no change in materials or manufacturer.

LABELING AND MARKING

There shall be securely attached to each helmet offered for sale a label bearing an inscription to the following effect:

1. For maximum protection this helmet must be of good fit and the chin strap must be securely fastened when worn.
2. This helmet is so constructed that the energy of a severe blow is absorbed through partial destruction of the shell and/or lining, although the damage may not be visible to the naked eye. If it suffers such an impact, it should either be returned to the manufacturer for competent inspection or destroyed and replaced by a new helmet.

Helmets which comply with the requirements of this Standard shall be marked as follows:

- a. With the certification mark of the Snell Memorial Foundation, which may be used by the manufacturer only under license from the Snell Memorial Foundation. Particulars of the conditions under which licenses are granted may be obtained from the Foundation.
- b. The manufacturer's name or trade mark and the month and year of manufacture must be indelibly marked in a visible position (usually on the chin strap) where this marking is protected from obliteration.
- c. An external mark indicating that the helmet meets Snell H Standards in the lower rear center. The label shall be at least 2.5 cm by 2.5 cm. This decal is the manufacturer's responsibility.

EXTENT OF COVERAGE

The helmets prescribed in this Standard are referenced to the anatomical or basic plane delineated on a standard head. The basic plane is defined as a plane at the level of the external auditory meatus and the inferior margin of the orbit. A test line shall be marked on the helmet to be tested. This test line shall be parallel to and 60 mm above the basic plane as defined above, save in the posterior one-third of the helmet where the protective helmet must extend to the basic plane. The helmet shell shall be completely lined with energy absorbing materials and there shall be no unlined areas of the shell which could contact the head directly in an accident situation. Lining materials or energy absorbers should extend to the level of the test plane and shall cover the entire interior surface of the helmet shell and shall be of uniform thickness throughout within $\pm 10\%$.

The helmet described in this Standard shall allow a 109° peripheral vision to the sides. It should not interfere with wearer's ability to hear.

TESTING

1. Conditioning for Testing

a. Cold. In addition to testing at ambient temperature, generally considered between 16°C and 21°C, a second helmet shall be conditioned by exposing it to a temperature of -10°C \pm 2°C for not less than 4 hours, nor more than 24 hours, in a mechanically cooled apparatus.

b. Heat. A third helmet shall be conditioned by being exposed to a temperature of 50°C \pm 2°C for a period of not less than 4 hours, nor more than 24 hours.

c. Resistance to rain. A fourth helmet shall be conditioned by spraying the outer surface of the helmet with water at a temperature to 25°C \pm 5°C for a period of not less than 4 hours, nor more than 24 hours.

d. All testing shall begin within two minutes from the time of removal from the conditioning equipment as indicated in a, b, and c.

2. Dynamic Test of Retention System

a. The helmet shall be placed on a suitable rigid fixture so that it is supported upright by the base of the shell, with the chin

strap fastened over a device approximating the shape of the bony structure of the lower jaw. This shall consist of two metal rollers, each 12.27 mm in diameter, separated by 76.2 mm on center, which would serve to represent the jaw bone.

b. A 23 kg \pm .5 kg preload shall be applied to the retention harness for 2 minutes before the dynamic loading described in c takes place. This load shall be arranged in such a fashion so as to be removed from the system immediately prior to the dynamic test loading and, thus, will not represent an additive to the test load. This removal of the preload mass shall occur as part of the test drop and will be completed before the test mass loads the retaining system.

c. A 38 kg \pm 0.5 kg mass shall be dropped in a vertical guided fall a distance of 120 mm \pm 5 mm so as to abruptly load the retaining system. The strap and its attachments must withstand this dynamic loading without parting and without greater than 30 mm increase in elongation.

3. Shock Absorption Test

a. Shock absorption shall be measured by determining the imparted acceleration to an appropriated instrumented standard* headform (usually made from K-1 magnesium alloy) dropped in a guided fall upon a rigid steel anvil. The rigid mount for the anvils shall consist of a solid mass of at least 135 kg, the upper surface of which shall consist of a steel plate with minimum thickness of 25 mm and minimum surface area of 0.3 m². Each helmet shall receive an impact in each of four sites against a flat, hemispherical and hoof shoe simulation anvil. The impact site shall be at any point above the test line, but in general the test will be conducted at points 40 mm above the test line on the front of the helmet, 30 mm above the test line on the sides and -25 mm below the test line in the rear of the helmet. A line to these points may be drawn on the helmet. The impact site shall be at any point along this line. The impacts must be separated one from each other by a distance not less than one-sixth maximal circumference of the helmet.

b. Three anvil configurations shall be used: one flat, one

* The head form shall contain an acceleration transducer mounted at the center of gravity of the combined test headform and supporting assembly with the sensitive axis aligned to within 5° of the vertical when the test headform is in the impact position. The acceleration data channel must comply with SAE recommended practice J 211 requirements for channel class 1000.

hemispherical and one simulating a horse's hoof. The flat anvil shall have a minimum surface area 0.127 m^2 , that is, $127 \text{ mm} \times 10 \text{ mm}$ diameter face; the hemispherical anvil shall have a $48 \text{ mm} \pm 0.5 \text{ mm}$ radius. The horseshoe anvil shall have a radius of $63.5 \text{ mm} \pm 0.5 \text{ mm}$ inclined at an angle of $45^\circ \pm 10$. In use this latter anvil shall be positioned to as to impact the helmet horizontally.

c. For each helmet, the calculated impact energy shall be established using the basic drop test mass of headform and supporting arm without helmet, as confirmed by measured impact velocity. Impact velocity shall be measured during each test.

The weight of the drop assembly shall be the combined weight of the instrumented test headform and supporting assembly for the drop test. The weight of the supporting assembly shall not exceed 25% of the weight of the drop assembly. The center of gravity of the combined test headform and supporting assembly shall lie within a cone with its axis vertical and forming a 10° included angle with the vertex as the point of impact.

At each test locus of impact against the flat or hemispherical or horseshoe anvil, the impact under this requirement shall be $145 \text{ J} \pm 15$ representing approximately a 3 meter drop height with 5 kilo mass (a drop of approximately 9.8 ft with a mass of 11 pounds).

Appropriate sized headforms of similar configuration may be used for helmets of different sizes. The impact energy in all cases shall be as above noted relative to the test drop mass without the helmet. With none of the several sizes of headforms shall the total mass of the supporting arm and test head, without helmet, exceed 6.5 kg.

The recorded peak acceleration of the helmeted headform under the four (4) impacts shall not average more than 300 g's arithmetically. In no case may any single impact exceed the 300 g level by more than 10%. If such is the case it shall be cause for rejection, or alternatively if the average of the set of impacts exceed 300 g, this will also be cause for rejection.

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