1985 STANDARD FOR PROTECTIVE HEADGEAR

For Use with Motorcycles and Other Motorized Vehicles

SNELL MEMORIAL FOUNDATION

P.O. Box 733
Wakefield, RI 02880
U.S.A.

FOREWORD

The 1985 Standard for protective motorcycling headgear is an expansion of that first designed by the Snell Memorial Foundation in 1959 for racing crash helmets. Since 1959, many consumer groups unrelated to automotive racing have expressed an interest in protecting the head from injury due to impact. The effects of such an impact are independent of the source; the inadequately protected head is similarly affected regardless of whether it strikes a rock, a tree, the car interior, ski pole or is struck by an object dropped from some height.

The first performance standard was revised in 1962 and again in 1968, 1970, 1975 and 1980 as helmet manufacturing technology advanced. The 1985 Standard has even more demanding test requirements. The basic premise of the helmet standard is that the circumstances representing the greatest potential hazard will be reproduced under test conditions.

The 1985 Standard includes several new aspects of testing. First, the retaining harness test is now dynamic rather than static. Second, the chin piece used in full-face helmets will be tested. Third, the method of testing a helmet's resistance to penetration by materials found in and on the highway is more rigorous and accurate. Finally, the International System of Units (SI units) is employed to make the Standard internationally useful.

This 1985 Motorcycle Helmet Standard is designed to establish *performance characteristics* rather than set forth construction and material limitations for the designer and manufacturer. The Foundation neither recommends specific products nor imposes its specifications on manufacturers or consumers. It offers test facilities to bona fide manufacturers and consumer groups and makes available to anyone the identity of those products which successfully meet the standard. The Foundation neither has accepted nor will accept any power of enforcement from any consumer group. Snell Foundation certification of protective headgear requires a specific contractual agreement between the primary headgear manufacturer and the Foundation. Certification information may be obtained by interested manufacturers upon application to the Foundation.

The protection given by any headgear is, by nature, less than complete and may not entirely prevent head injury or

death in severe accidents. The best helmet is but one link in a long chain of safety measures which may include such factors as proper training and conditioning and, most importantly, adequate safety education. The value of the entire chain of safety is lessened by the weakness of any link.

The consumer must understand that helmets are deliberately constructed so that the energy of a severe blow is absorbed by and partially destroys the helmet. The damage may not be readily apparent and the Foundation strongly recommends that consumer groups require that any helmet involved in a significant accident be returned to the manufacturer for competent inspection. If it is not possible to do so, 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 another means of energy absorption and be strongly attached to a chin strap. Since the purpose of the retention system is to keep the helmet on the wearer's head under all accident situations, during testing it must not be possible for a second person to remove the helmet from the wearer's head while the chin strap is adjusted to a wearable tension. 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 with no reinforcing ridges or other rigid external projections greater than 7 mm above the outer surface of the helmet, unless smoothly faired with no significant frictional resistance to tangential impact forces. A goggle clip may be used at the rear of the helmet and a ledge, if included, shall not project more than 10 mm from the outer surface of the shell and not extend to either side more than 120 mm from the midpoint in front. The helmet shall not reduce peripheral vision below 109° in the horizontal plane.

The construction material shall be nonflammable and self-extinguishing.

B. Shell

The shell of the helmet shall be as nearly uniform in thickness and strength as possible under usual manufacturing

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

C. Materials

The manufacturing materials used for various parts of the helmet shall be durable and not change appreciably due to aging or exposure to normal circumstances such as sun, rain, cold, dust, vibration, solvents and cleaning agents or contact with skin, sweat, or products applied to the skin or hair. Appropriate tests for durability under these circumstances may be instituted. New materials or those commonly known to cause skin irritation or disease shall not be used for parts which contact the skin.

D. Finish

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

QUALIFICATIONS FOR CERTIFICATION

For qualification testing, helmets shall be in the same condition as those on the market. No helmet shall be offered for sale after it has been subjected to any tests described in this Standard. In qualification testing, the helmets must satisfy all of the safety performance criteria described in this Standard.

RANDOM SAMPLE TESTING

In addition to the initial testing, random samples of previously certified models may be obtained by the Foundation from the open market. These also will be tested by the Foundation and must meet the performance requirements of this Standard. When these tests show that the materials used are equally protective after exposure to temperature and moisture conditions, these performance requirements may be re-

laxed, provided that there is no change in either the materials or manufacturing techniques.

LABELING AND MARKING

Each helmet offered for sale shall have a securely attached 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. The helmet, when fitted, shall not be removed easily under this condition.

2. The helmet is constructed so that the energy of a severe blow is absorbed by the helmet, causing the shell and/or lining to be partially destroyed, although damage may not be visible to the naked eye. If such an impact occurs, the helmet either should be returned to the manufacturer for competent inspection or destroyed and replaced.

3. The manufacturer's name or trademark and month and year of manufacture must be indelibly marked and placed in the helmet where it is protected from obliteration. The certification mark of the Snell Memorial Foundation may be used by the manufacturer only under license from the Snell Memorial Foundation. Conditions for licensure may be obtained from the Foundation.

4. The numbered Snell decal shall be permanently affixed inside the helmet.

5. An authorized manufacturer may place a Snell marker on the exterior of the helmet.

TESTING

1. Conditioning before Testing.

a. Cold. One helmet shall be tested at ambient temperature and a second helmet shall be exposed 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 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. Rain. A fourth helmet shall be sprayed with water at a temperature of $25°C \pm 5°C$ 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. Extent of Protection

The extent of protection and the areas of the helmet subject to test shall be referenced to the anatomical or basic plane delineated on a standard head. This plane is at the level of the external auditory meatus and the inferior margin of the orbit. A test line shall be marked on the helmet and shall be parallel to and 60 mm above the basic plane, but in the posterior one-third of the helmet it shall be at the basic plane. All parts of the helmet above this test line shall absorb shock to at least the minimum requirements specified under Shock Absorption Test.

3. Dynamic Test of Retention System

a. The helmet shall be placed on a rigid fixture supported upright by the base of the shell with the chin strap fastened over a device which approximates the shape of the bony structure of the lower jaw. This device shall consist of two metal rollers, each 12.7 mm in diameter, separated by 76.2 mm on center which would serve to represent the jaw bone.

b. A 23 kg ± 0.5 kg preload shall be applied to the retention harness for 2 minutes before the dynamic loading takes place. It must be removed from the loading system immediately prior to the dynamic test loading so that it is not additive to the test load. The preload mass removal shall occur as part of the test drop and be completed before the test mass loads the retaining system.

c. A 38 kg ± 0.5 kg mass shall be dropped in a vertical guided fall a distance of 120 mm ± 2mm so as to load the retaining system abruptly. The strap and its attachments must withstand this dynamic loading without parting and without greater than 30 mm increase in elongation.

4. Shell Integrity Test

a. A randomly selected helmet from a test series may be conditioned at −30 °C ± 2 °C as previously described and tested for penetration resistance within one minute after removal from the conditioning equipment, under the penetration test conditions described below.

b. A randomly selected helmet from a test series may be conditioned with a solvent mix of 50% toluene and 50% isooctane. A cotton cloth, or something as suitable, which is 15 cm square and has been soaked in the solvent, may be used as an applicator for the solvent. The solvent will be applied to the shell first in an area within 50 mm of the chin strap fixings for not less than 5 seconds on each side and not less than 10 seconds to the remainder of the surface. At least 30 minutes shall elapse before further conditioning and testing.

5. Shock Absorption and Penetration Test

a. Shock absorption and penetration resistance shall be measured by determining imparted acceleration to an appropriately instrumented standard headform dropped in a guided fall upon a fixed rigid steel anvil. Each helmet shall receive two impacts on each of four sites against the flat and the hemispherical anvil surfaces and one impact against a vertical steel plate 0.63 cm in width and 18 cm in length. The impact site shall be at any point above the test line and the impacts separated from each other by a distance of not less than one-sixth of the maximum circumference of the helmet.

b. Three anvil configurations shall be used, one flat, one hemispherical and one with a 0.63 cm $\times$ 18 cm $\pm$ 1 cm face. Paired impacts shall be applied with the flat and hemispherical configurations. The flat anvil shall have a minimum surface of 0.127 m^2, i.e., 127 mm diameter face; the hemispherical anvil shall have a 48 mm $\pm$ 0.5 mm radius.

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 0.3m^2.

The test headform shall be of rigid, low resonance material such as magnesium alloy (or a dynamically functional equivalent material).

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

At each flat anvil test locus, the first and second impacts shall be 150 J and 110 J, respectively.

The impact against the hemispherical anvil shall be 150 J and 100 J, respectively. The impact against the edge penetration shall be 150 J's.

The tolerance of the impact energy shall not exceed + 1 J −0.5 J.

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

The acceleration transducer shall be mounted at the center of gravity of the combined test headform and support assembly. The sensitive axis shall be 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.

Approximately sized headforms of similar configuration shall be used for different sized helmets. None of the several sized headforms, however, shall have a total mass in excess of 6.5 kg, including the supporting arm, but without the helmet.

The peak acceleration of the helmeted headform for the nine (9) impacts shall have an arithmatic average not exceeding 285 g's and no single impact shall exceed 314 g's. If either of these conditions is exceeded, it will be cause for rejection.

6. Chin Bar Test

Full-face helmets using an integral extension of the shell anterior to the chin of the wearer shall be subjected to a dynamic test of the chin bar.

The helmet shall be firmly mounted on a rigid base with the chin bar facing up and the helmet base at 90° of the anvil's horizontal plane.

A mass of 5 kg −0 +0.2 kg having a flat striking face of 0.1 m^2 minimum area, shall be dropped in guided fall and strike the central portion of the chin bar. The instantaneous maximum downward deflection of the inner surface of the chin bar shall be recorded.

The test mass shall be dropped a distance of 0.6 m −0 +5 mm. Downward deflection exceeding 60 mm shall be cause for rejection of the helmet.