



**STANDARD  
FOR  
PROTECTIVE  
HEADGEAR**

**1970**

**SNELL MEMORIAL FOUNDATION**

DIRECTOR OF RESEARCH

GEORGE G. SNIVELY, M.D.

2315 STOCKTON BOULEVARD, SACRAMENTO, CALIFORNIA 95817

TREASURER

RODERICK H. AYA

5 LAKE SHORE CLOSE, NORTH TARRYTOWN, NEW YORK 10591

## FOREWORD

THE 1970 STANDARD for protective head gear represents an expansion of the criteria first established by the Snell Memorial Foundation in 1959 for the design of racing crash helmets. Since the 1959 Standard was published, numerous consumer groups with activities unrelated to the sphere of automotive racing have evinced interest in the field of head protection. The common concern of all these groups is the hazard of exposure of the head to the transfer of impact energy. 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, car interior or ski pole from that of a falling object dropped from a height. As a consequence, the basic problems of head protection are common to most of these interested groups. Certain consumer groups may have specialized, unique additional requirements. In such cases the necessary test criteria may be developed and issued in appropriate appendix from time to time.

The performance standard utilized by the Snell Foundation was revised upwards in 1962 and again in 1968, as the state of the art of helmet manufacture advanced; the 1970 Standard is even more demanding in the severity of its test requirements. It has been designed with the philosophy that where several test conditions might be employed for the same purpose, the most severe of such would be adopted on the premise that maximum possible protection should be the desired goal.

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. The Foundation does not presume to recommend specific products or to impose its specifications upon either manufacturer or consumer. It offers its test facilities to bona fide manufacturers and makes available to any interested consumer group a means of identifying those products which have successfully met its Standard. The Foundation neither has nor will accept any power of enforcement for any consumer group. Snell Foundation certification of protective headgear requires specific contractual agreement between the primary 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 head gear is necessarily less than complete, and that the wearing of such may not entirely prevent 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 seat belts, restraining harnesses, proper training and conditioning, 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 in the partial destruction of the helmet. This damage may not be readily apparent and it is strongly recommended by the Foundation that consumer groups require that any helmet involved in a significant accident be returned to the manufacturer for competent inspection. If such is not readily available, the helmet should be replaced.

## CONSTRUCTION

### A. GENERAL

The helmet shall consist of a hard, smooth shell lined with protective padding 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. The assembled helmet shall have a smooth external surface without reinforcing ridges or other rigid external projections greater than 3/16 inch (4.76 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 a ledge may be molded at the front edge to support a visor. Such ledge, if included, shall not project more than 3/8 inch (9.52 mm.) from the outer surface of the shell, and shall not extend more than 5 inches (12.7 cm.) from the midpoint in front towards either side.



#### B. SHELL

The shell of the helmet shall be as nearly uniform in thickness and strength as is possible using normal manufacturing methods and shall not be specially reinforced at test points. Ventilation holes, if used, shall not exceed  $\frac{1}{2}$  inch (12.7 mm.) in diameter. The heads of rivets, if used, shall not project more than  $\frac{1}{16}$  inch (1.6 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, i.e., 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, contact with skin, effect of sweat or of products applied to the skin or hair. 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 new type must be shown not to be the causation of skin irritation or disease.

#### D. FINISH

All edges 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.

## SAMPLING FOR CERTIFICATION

For qualification and routine 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 tests; but when it has been shown by qualification tests that the materials are equally protective in performance after exposure to temperature

and moisture conditioning, thereafter consideration shall be given in routine testing to possible relaxation of these requirements, provided there is no change in materials or manufacture.

All helmets certified by the Snell Memorial Foundation must pass the performance tests described in this Standard. In addition to the initial testing prior to certification, random samples may be obtained by the Foundation from the open market and these will be tested by the Foundation in similar fashion. Subsequent to certification, such random sample testing as is deemed necessary may be done by the Foundation or by an independent laboratory selected by the Foundation. Four helmets are required for qualification testing.

## 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.

2. This helmet is so constructed that the energy of a severe blow is absorbed through partial destruction of the shell and/or lining, though 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 discarded and replaced by a new one.

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 an agreed code on the inside of the helmet in a position where this marking is protected from obliteration.

## TESTING

### 1. *Conditioning for Testing*

a. The helmet shall be conditioned by being exposed to a temperature of  $-10^{\circ}\text{C.} \pm 2^{\circ}\text{C.}$  for not less than 4 hours, nor more than 24 hours, in a mechanically cooled apparatus.

b. *Water Immersion.* A second helmet may be conditioned by immersion in water at a temperature of  $25^{\circ}\text{C.} \pm 5^{\circ}\text{C.}$  for a period of not less than 4 hours, nor more than 24 hours.

c. *Heat.* A third helmet shall be conditioned by being exposed to a temperature of  $50^{\circ}\text{C.} \pm 2^{\circ}\text{C.}$  for a period of not less than 4 hours, nor more than 24 hours.

d. All testing shall begin within five 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 is defined as a plane at the level of the external auditory meatus and the inferior margin of the orbit. A reference plane shall be marked on the helmet subjected to tests. This reference plane shall be parallel to and 2.36 inches (60 mm.) above the basic plane as above defined. All parts of the helmet above this reference plane shall attenuate shock transmission to at least the minimum requirements hereinafter specified under Shock Absorption Test.

### 3. *Test of Retention System*

a. The helmet shall be placed upon a test head form 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  $\frac{1}{2}$  inch (1.27 cm.) in diameter, at a distance of 3 inches (7.62 cm.) separation on center, which would serve to represent the jawbone.

b. A 300-pound (136 kilogram) weight or tension equivalent thereto shall be applied to the device retained by the chin strap. The strap and its attachments must support this weight without



parting and without greater than 1 inch (2.54 cm.) increase in the vertical distance of the chin strap from the helmet crown.

c. The test is designed to test the chin strap harness assembly only. If the helmet has a pad-type suspension that will allow the helmet to settle down over the head form, this settling should not be considered in determining elongation of the chin strap. The vertical movement should be recorded with respect to the strap and shell alone. It shall be tested for ultimate strength and for elongation under tension. A 50-pound (23 kilogram) pre-load shall be applied before beginning the measurement of elongation of chin strap.

#### 4. Penetration Test

The complete helmet shall be placed on a rigidly mounted standard head form which shall be covered with an electrically conductive material. If the helmet to be tested contains a "sling" or other adjustable sizing component, it shall be relaxed to its most extendable position.

The penetration test shall be conducted by dropping the penetration test striker onto the outer surface of the helmet anywhere above the reference plane, in a direction essentially perpendicular to the outer surface of the helmet. At least the tip of the striker shall be electrically conductive.

When tested in the above fashion, the helmet shall be rejected if demonstrable electrical contact is made between the penetrator and the conducting surface of the head form.

Conditions of penetration test:

The weight of the penetration test striker shall be 6 pounds 10 ounces  $-0 + .1$  pound (3.0 kilograms  $-0 + 45$  grams).

The point of the striker shall have an included angle of 60 degrees  $\pm .5$  degree, and an altitude of 1.5 inches  $\pm .015$  inch (3.8 cm.  $\pm 0.38$  mm.).

The radius of the striking point shall be .0197 inch  $\pm .004$  inch (0.5 mm.  $\pm 0.01$  mm.).

The hardness of the striking tip shall be 60 Rockwell (scale C)  $\pm 3$  points.

The height of the fall shall be 118.11 inches  $\pm .6$  inch (3 meters  $\pm 1.5$  cm.).

## 5. Shock Absorption Test

Shock absorption shall be measured by determining imparted acceleration to an appropriately instrumented standard head form dropped in guided fall upon a fixed, rigid steel anvil. Each helmet shall receive two impacts in each of not less than four sites. The impact sites shall be at any point above the reference plane and separated from each other by a distance not less than 1/6th of the maximal circumference of the helmet.

Two anvil configurations shall be used, one flat, the other hemispherical. Paired impacts shall be applied with each configuration. The flat impactor shall have a minimum surface of 19.6 square inches (127 square centimeters) i.e., 5-inch diameter face; the hemispherical impactor shall have a 1.9-inch (4.8 centimeter) radius.

The test head form shall be of low resonance magnesium alloy (K-1A), and shall weigh  $11 + 0.2 - 0.0$  pounds (5 kilograms  $+ 0.091 - 0$ ). This weight shall include the supporting arm.

The impact energy shall be 88 ft.-pounds (12.2 kilogram-meters) for the first blow (8 ft. or 244 centimeters drop) and 66 ft.-pounds (9.8 kilogram-meters) for the second blow (6 ft. or 183 centimeters drop) at each impact test site.

Any recorded peak acceleration of the helmeted head form exceeding 300 G's shall be cause for rejection of the helmet.

### N.B.

Impact energies quoted above refer to the headform *without* helmet, and are somewhat less than actually experienced with helmet in place, since in all testing the drop heights shall be maintained as stated.