



Standard Performance Specification for Ice Hockey Helmets¹

This standard is issued under the fixed designation F 1045; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Ice hockey is a contact sport with intrinsic hazards. The use of protective equipment will not eliminate all injuries but should substantially reduce the severity and frequency of injury. Participation in the sport of ice hockey by a player implies acceptance of some risk of injury. The goal is to minimize this risk.

This performance specification for head protective equipment has been prepared after consideration of head protection relative to the following principle risks: high-mass, low-velocity impact (various playing situations), and fit. This performance specification may be modified as other risks are identified.

Performance requirements were determined after consideration of state-of-the-art of helmet design and manufacture and the demands of the sport.

1. Scope

1.1 This performance specification² sets performance requirements for ice hockey helmets.

1.2 The intent of this performance specification is to reduce the risk of injury to the head without compromising the form and appeal of the game.

1.3 This performance specification covers (1) performance tests for shock absorption properties of the complete helmet and strength and elongation of the chin strap and its attachment; and (2) requirements for dimension of the ear aperture.

1.4 The values as stated in inch-pound units are to be regarded as the standard. The values in parentheses are given for information only.

1.5 The following precautionary caveat pertains only to the test methods portion, Section 12, of this performance specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. 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.*

2. Referenced Documents

2.1 ASTM Standards:

F 513 Safety Specification for Eye and Face Protective

Equipment for Hockey Players³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 retention system:

3.1.1.1 *chin strap*—the chin strap, including a cup that covers the chin, (see Fig. 1) is affixed to both sides of the helmet and secures the helmet to the head when a Type II full face protector is not worn with the helmet.

3.1.1.2 *neck strap*—the neck strap that secures the helmet to the head is affixed on both sides of the helmet and passes under the lower jaw in close proximity to the jaw and the neck. Where the helmet is worn with a Type II full face protector, the neck strap serves as the attachment of the helmet to the head.

NOTE 1—For a description of the Type II face protector, see the Types of Protectors Section in Safety Specification F 513.

3.1.2 *crown*—a point in the median plane that is equal chord lengths from the anterior and posterior intersections of the median and reference planes.

3.1.3 *drop height*—the vertical distance between the lowest point (impact point) of the elevated helmet and the apex of the impact surface.

3.1.4 *g*—the dimensionless ratio of the acceleration of the headform during impact to the acceleration due to gravity.

3.1.4.1 g_{\max} —the maximum value of *g* encountered during impact.

3.1.5 *helmet*—the complete product, including the shell, liner, and chin strap, including the cup and associated attachment hardware, assembled with components supplied by the

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² This performance specification is subject to revision as indicated by subsequent injury statistics and subject to review at least every five years.

³ *Annual Book of ASTM Standards*, Vol 15.07.

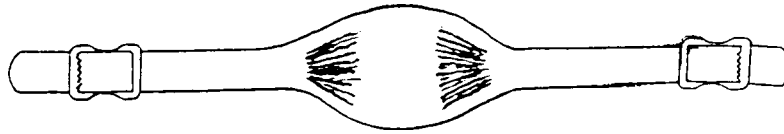


FIG. 1 Chin Strap (Includes a Chin Cup)

manufacturer. The helmet is intended to protect the wearer's head while participating in ice hockey.

3.1.6 *liner*—the material inside the shell for the purpose of shock absorption or comfortable fit, or both.

3.1.7 *reference index*—the manufacturer's recommended dimension from the lowest point of the helmet face opening to the basic plane of a reference headform, with both points located on the median plane of the helmet.

3.1.8 *reference planes*:

3.1.8.1 *basic plane*—a plane that is located at the level of the external openings of the ears and the inferior margin of the orbit (see Figs. 2 and 3).

3.1.8.2 *coronal plane*—a vertical plane that is perpendicular to the median and the reference planes and passes through the crown of the headform (lateral plane).

3.1.8.3 *median plane*—a vertical plane that passes through the headform from front to back and divides it into right and left halves (mid-sagittal plane).

3.1.8.4 *reference plane*—a plane that is located 2.36 in. (60 mm) above and parallel to the basic plane (Size C headform).

3.1.9 *shell*—the rigid outer material that gives the helmet its form.

4. General Requirements

4.1 *Materials*:

4.1.1 All materials used in the fabrication of helmets shall be known to be suitable for the intended application. For example, shell materials shall remain strong, semirigid, and firm, and shall not permanently distort during an exposure of at least 4 h to any temperature in the range from 0 ± 3.6 to $122 \pm 3.6^\circ\text{F}$ (-18 ± 2 to $50 \pm 2^\circ\text{C}$), nor shall the material be significantly affected by exposure to ultraviolet radiation, water, dirt, or vibration. All materials shall be rot-resistant. In addition, paints, glues, and finishes used in manufacture shall be compatible with the helmet shell and shock absorption system materials.

4.1.2 Materials coming into contact with the wearer's head shall not be the type known to cause skin irritation or disease, and shall not undergo significant loss of strength, flexibility, or

other physical change as a result of contact with perspiration, oil, or grease from the wearer's hair.

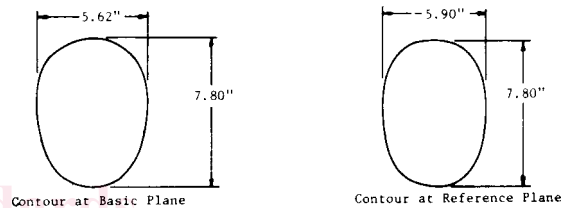
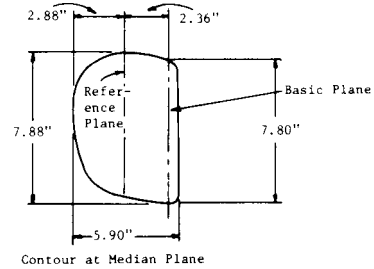
4.1.3 Any material used in the construction of helmets shall not be adversely affected by ordinary household soap and water, mild household detergent, or cleaners recommended by the manufacturer.

4.2 *Helmet Assembly*:

4.2.1 Any optional devices fitted to the helmet shall be so designed that they are unlikely to cause any injury to the wearer or other participants during contact.

4.2.2 All edges shall be smooth and rounded and there shall be no rigid projections on the inside of the helmet that could come in contact with the wearer's head.

4.2.3 All external projections shall be smooth and adequately faired to other surfaces. Split or bifurcated rivets shall not be used.



NOTE 1—All dimensions are in inches (1 in. = 25.4 mm).
FIG. 3 Contour Dimensions of Size C Test Headform

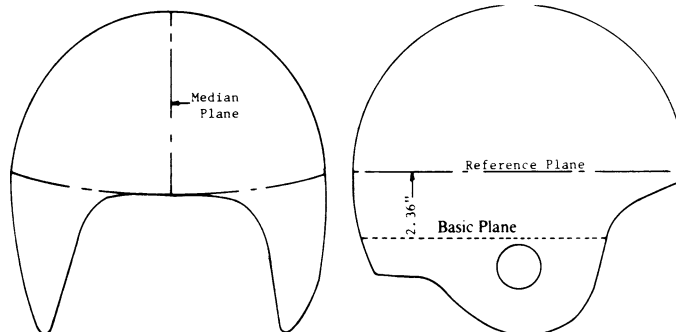


FIG. 2 Basic, Reference, and Median Planes

4.3 *Extent and Form of Protective Material*—All parts of the wearer’s head covered by the area of the shell shall be protected at least to the minimum impact requirements of 13.1 and 13.2. The extent of protection shall include at least all of the hatched area shown in Fig. 4. The hatched area selected shall correspond with the headform size with which the helmet is to be tested.

4.4 Except for ear apertures, the area around the ear shall be completely covered by the helmet shell. No ear aperture shall have any dimension exceeding 1.5 in. (38 mm). The ear aperture shall be entirely surrounded by the helmet. This part of the helmet shall also have protective padding. The distance from the edge of the ear aperture to any edge of the helmet shall not be less than 0.8 in. (20 mm).

4.5 *Attachments*—The components of the fasteners for securing attachments to the shell shall be so attached that the degree of protection afforded the wearer by the protective padding or cushioning material of the helmet is not thereby reduced.

4.5.1 When a face protector is to be attached to the helmet, the manufacturer of the face protector shall supply a template designating the position on the helmet where holes should be bored for the attachment screws or bolts.

4.6 *Size of Helmets*—Helmets shall be sized in accordance with Table 1.

4.7 *Chin Strap or Neck Strap*:

4.7.1 The chin strap, including the cup, or the neck strap, shall be attached to the helmet so that the helmet remains in its normal position on the player’s head during play and impact conditions.

4.7.2 The chin strap or the neck strap used in combination with the face protector shall satisfy the requirements in 3.1.1.

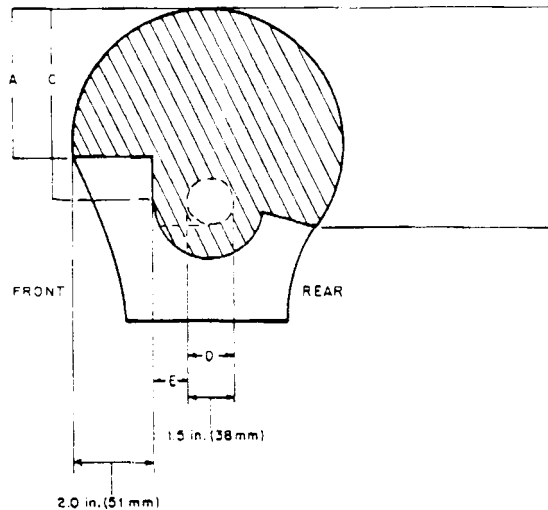
4.7.3 The minimum width of the chin strap exclusive of the cup shall be 0.5 in. (13 mm).

5. Performance Requirements

5.1 *General*—Helmets shall be capable of meeting the requirements in this performance specification throughout their full range of adjustment. They shall be capable of meeting the requirements in Sections 11 and 12 at any temperature between 0 and 122°F (−18 and 50°C).

5.2 *Shock Absorption*—The helmet is mounted on a headform that is oriented in different positions and dropped at a specific velocity onto an impact surface. A linear accelerometer mounted at the center of gravity of the headform monitors the acceleration and the time history of impact that are recorded

Metric Units (millimetres)			
Size	A	B	C
6¼	81	132	123
6⅞	89	140	132
7⅜	97	147	141
7¾	104	155	150
Inch-Pound Units (inches)			
Size	A	B	C
6¼	3.20	5.20	4.84
6⅞	3.50	5.50	5.20
7⅜	3.80	5.80	5.56
7¾	4.10	6.10	5.92



NOTE 1—The distance *e* is optional to the manufacturer. However, it shall be not less than 0.8 in. (20 mm).

NOTE 2—Not design restrictive.

FIG. 4 Minimum Areas of Head Requiring Protection (Cross-Hatched)

TABLE 1 Hat Sizes and Head Fittings

NOTE 1—These are U.S. and Canadian hat sizes.

Hat Size	Circumference of Head	
	in.	mm
6	19	483
6 1/8	19 3/8	492
6 1/4	19 3/4	502
6 3/8	20 1/8	511
6 1/2	20 1/2	521
6 5/8	20 7/8	530
6 3/4	21 1/4	540
6 7/8	21 5/8	550
7	22	559
7 1/8	22 3/8	568
7 1/4	22 3/4	578
7 3/8	23 1/8	587
7 1/2	23 1/2	597
7 5/8	23 7/8	606
7 3/4	24 1/4	616
7 7/8	24 5/8	625
8	25	635

with appropriate instrumentation. Maximum acceleration and time duration data obtained by the specified procedures are intended to determine the shock absorption characteristics of the helmet.

5.3 *Chin Strap*—When tested in accordance with 12.7, the force to separate the strap shall be not less than 11 lbf (50 N) nor more than 124 lbf (500 N) and the maximum displacement

of the strap shall not exceed 1 in. (25 mm) at a load of 24 lbf (109 N). The requirements of 12.7 shall be met at 73°F (23°C).

6. Apparatus

6.1 *Shock Absorption Test*: The apparatus for the shock absorption test shall consist of the following:

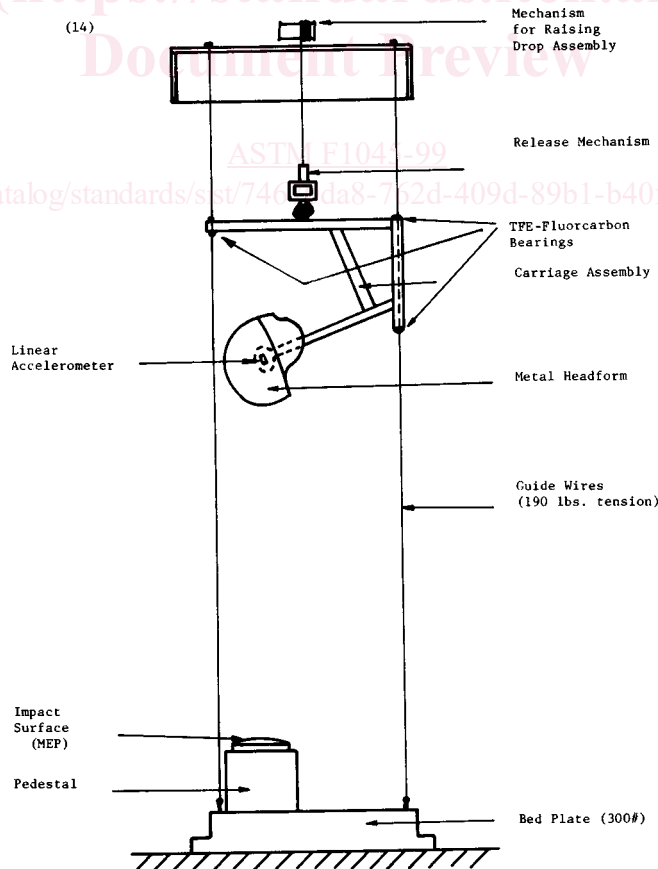
6.1.1 *Guide Assembly*—The headform shall be attached to the free fall drop assembly carriage by an adjustable mounting that will allow impacts to be delivered to any prescribed point on the helmet (see Fig. 5). The carriage shall be free to slide on vertical guides. If wires are used they must be placed under at least 190 lbf (845 N) tension (see 12.4 for guide assembly specifications and allowable weight of drop assembly).

6.1.2 *Recording Equipment*—The recording equipment shall meet the following criteria:

6.1.2.1 *Acceleration Transducer*—The linear accelerometer is mounted at the center of gravity of the combined test headform and carriage assembly with the sensitive axis aligned to within 5° of the vertical when the helmet and headform are in the impact position. This transducer shall be capable of withstanding a shock of 1000 g without damage and shall have a frequency response (variation ±1.5 %) over the range from 5 to 900 Hz.

6.1.2.2 *System Accuracy*—The impact recording system shall be capable of measuring shocks of up to 500 g peak acceleration with an accuracy of ±5 %.

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NOTE 1—Rail-guided drop assemblies are also permissible.

FIG. 5 Schematic of Typical Drop Assembly