

Australian/New Zealand Standard™

Methods of testing protective helmets

Method 3.1: Determination of impact energy attenuation—Helmet drop test

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CS-097, Testing of Helmets and Visors, to supersede AS/NZS 2512.3.1:1999.

The objective of this revision is to incorporate changes to the specification of headform materials in Clause 5.

METHOD

1 SCOPE

This Standard sets out a method for determining the impact energy attenuation of a protective helmet.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS

2512 Methods of testing protective helmets

2512.1 Method 1: Definitions and headforms

2512.2 Method 2: General requirements for the conditioning and preparation of test specimens and laboratory conditions

SAE

J211 Instrumentation for impact tests

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 2512.1 apply.

4 PRINCIPLE

A complete helmet is mounted on an appropriately instrumented headform and dropped, in guided free fall, on to an anvil as specified in the product Standard. The acceleration imparted to the assembly is measured.

5 APPARATUS

The following test apparatus is required:

- (a) Headform of the dimensions and design specified in AS/NZS 2512.1 extending down to the HH' plane, made of Mg K1A material and instrumented as described in Item (e)(iv) below.

NOTE: A material with the following composition has been found suitable: magnesium/zirconium binary alloy with 0.3% to 0.8% zirconium, $d = 1.79 \pm 0.01 \text{ kg/dm}^3$.

- (b) Anvil, as specified in the product Standard, including the following:
- A flat steel anvil with a diameter not less than 127 mm.
 - A hemispherical steel anvil with a radius of 48 mm.
 - A steel v-anvil with a hardness of 60 Rockwell (Scale C) and a finish not coarser than $25 \mu\text{m}$ (see Figure 1).

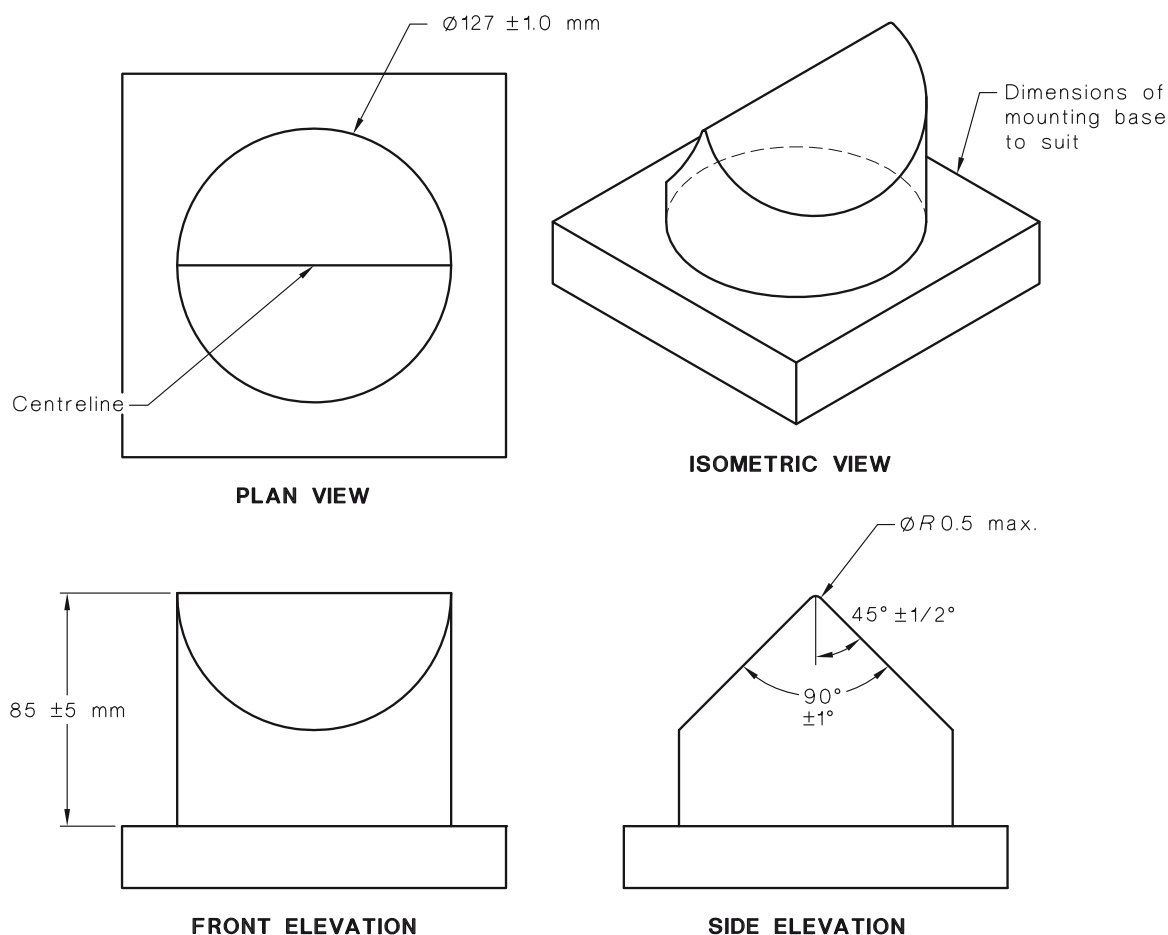


FIGURE 1 V-ANVIL

- Mount for anvil consisting of a solid mass of at least 450 kg faced with a steel plate of at least 25 mm thickness and having a lateral dimension of at least 300 mm.
- Release mechanism capable of smoothly releasing the drop assembly.
- A drop assembly complying with the following:
 - It shall consist of a headform and a supporting assembly, the combined mass of which shall be as specified in Table 1.

TABLE 1
MASSES OF IMPACT ENERGY ATTENUATION
TEST DROP ASSEMBLIES

Test headform size	Mass of drop assembly kg
AA	2.5 ±0.05
A	3.1 ±0.05
E	4.1 ±0.05
J	4.7 ±0.05
M	5.6 ±0.05
O	6.1 ±0.05

- (ii) The mass of the supporting assembly, which comprises the supporting arm and ball socket stem, shall not exceed 20 percent of the mass of the drop assembly.

NOTE: It may be necessary to obtain the mass of the ball socket stem by calculation.

- (iii) The centre of mass of the combined test headform and supporting assembly shall be within a cone having its axis vertical and forming a 10 degree included angle with the vertex located at the point on the external surface of the test headform which is vertically below the centre of the accelerometer. (See Figure 2).

NOTE: The combined centre of mass must be determined for all points on the headform above the test line. This is because, as the headform rotates, the combined centre of mass changes. This may be accomplished mathematically once the centre of mass of the headform and support assembly has been determined.

- (iv) An acceleration transducer shall be mounted at the centre of the ball socket, with the sensitive axis aligned to within 5 degrees of vertical when the test headform is in the impact position.
- (v) The acceleration data channel shall comply with the requirements for Channel Class 1000 of SAE J211 (1988) down to 1 Hz.
- (vi) A means to control the direction of the free fall.

Typical apparatus is shown in Figure 3.

6 VERIFICATION OF TEST APPARATUS

The velocity of impact shall not differ by more than 3 percent from the velocity of impact theoretically obtainable in free fall in vacuum, within 50 mm of the point of impact from the specified drop height.

NOTE: Increasing the drop height above the tolerance specified in the product Standard is not acceptable.

7 PROCEDURE

The procedure shall be as follows:

- Condition and prepare the helmet(s) in accordance with AS/NZS 2512.2.
- Ensure that the laboratory conditions are as specified in AS/NZS 2512.2.
- Position and secure the helmet as specified in AS/NZS 2512.2.

NOTE: If the helmet does not extend below the HH' plane, the retention system should be used to secure the helmet. If the helmet extends below the HH' plane, tape should be used to secure the helmet.