

Standard Specification for Pole Vault Landing Pits¹

This standard is issued under the fixed designation F 1162; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers minimum requirements of size, physical characteristics of materials, standard testing procedures, labeling and identification of pole vault landing pits.

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

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 8, of this 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. Terminology

2.1 *landing pit*—a device used to decelerate a free-falling human body from a maximum 23 ft (7 m) above the landing surface.

2.1.1 *Discussion*—A one-component landing pit consists of one continuous landing surface.

2.1.2 *Discussion*—A multi-component landing pit consists of several components held together with a binder so that a continuous landing surface is provided.

2.2 *landing surface*—the top surface and designated initial landing point.

3. Dimensions

3.1 Overall dimensions must be based on the kinematics of the human body and the shock-absorbing quality of the material.

3.2 If the human body impacts with a 100 % vertical force, the dimension must exceed the length and width of the body.

3.3 If the human body impacts with the horizontal component, the length and width of the landing surface must be

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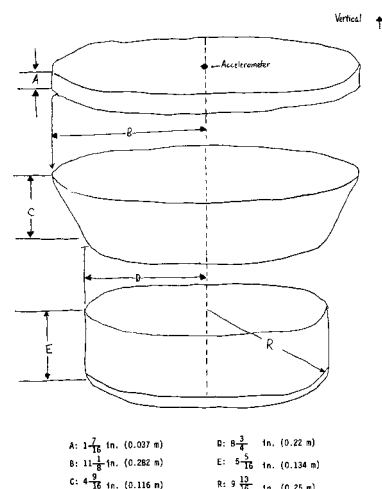


FIG. 1 Impacting Missile

derived mathematically based upon the kinematic variables involved in the performance.

NOTE 1—Several studies of pole vaulters indicate the following assumptions which were used to determine the pit dimensions. A vaulter reaching 20 ft (6 m) would have a push off horizontal velocity of 4 ft/s (1.2 m/s). This velocity plus the length of the body would not exceed the 12-ft (3.6-m) pit length. Less skilled vaulters reaching 10 ft (3 m) may have a push off horizontal velocity of 8 ft/s (2.4 m/s). This velocity plus the length of the body would not exceed the 12-ft pit length.

3.3.1 *Pole Vault Landing Pit*—The size and design will be as follows:

3.3.1.1 The minimum size and design are designated to be: 16 ft by 12 ft (4.8 m by 3.66 m) behind the vertical plane of the stop board with a uniformly high landing surface with a minimum height of 28 in. (0.71 m). The front portion of the pit that surrounds the planting box will also be 16 ft (4.88 m) wide and extend 6 ft (1.83 m) forward from the main landing pad, giving an overall pit size of 16 ft by 18 ft (4.88 m by 5.49 m). The height of the front unit may taper down to 18 in. (0.45 m), at the front in order to give the vaulter a clearer approach to the vaulting box.

3.3.1.2 The front unit shall be designed to have no contact with the pole during vaulting action when the pit is placed

within 8 in. (0.20 m) of the vertical plane of the stop board. The area around the pit to a perimeter of 6 ft (1.83 m) and a perimeter of 15 ft (4.57 m) in front shall be an obstacle-free surface bordering the landing pit. This area is not to be included in the overall landing pit area and is not intended as a landing surface.

4. Physical Characteristics of Material and Performance Specifications

4.1 The landing pit will be made of a material which will cause deceleration of the missile by landing pit deformation less than 75 % of the pit thickness during impact testing conducted in accordance with Section 10.

4.2 When impact testing is performed in accordance with Section 10 missile rebound shall not exceed 1.48 ft (0.45 m) above the surface of the nondeformed landing pit.

4.3 Rebound and deformation characteristics shall be $\pm 10\%$ throughout the 16 ft by 18 ft (4.88 m by 5.49 m) area to within 1 ft (0.304 m) of the edges.

4.4 Peak deceleration shall not exceed 20 g's when a landing pit is tested in accordance with Section 10.

5. Significance and Use

5.1 The dynamic data obtained with the procedures given in this specification measure the cushioning properties of the landing pits tested.

5.2 The size of the pole vault landing pit is specified with respect to the kinematics of body movement.

6. Testing Apparatus

6.1 *Testing Machine*—Any type of dynamic testing apparatus that impacts the specimen on a solid, rigid surface (typical of service conditions) with the prescribed missile at the prescribed impact velocity and monitors and records impact deceleration-time histories.

6.2 The missile described in 8.1 is constructed in three sections and is more clearly defined as follows: (see Fig. 2).

NOTE 2—The missile constructed for initial testing was of marine grade plywood. The missile could be made of various materials and methods provided it maintains the specific dimensions and weight.

6.2.1 Top disk with cross-sectional area 387.5 in.² (0.25 m²) outer radius 11 $\frac{1}{8}$ in. (0.282 m) height 1 $\frac{1}{16}$ in. (0.0371 m) and weight.

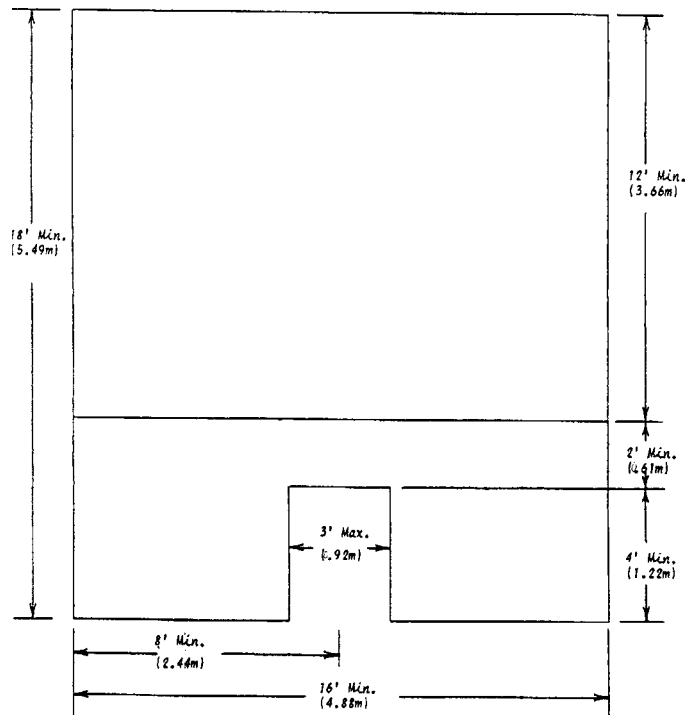
6.2.2 Inverted frustum of cone with major radius 11 $\frac{1}{8}$ in. (0.282 m), minor radius 8 $\frac{3}{4}$ in. (0.222 m), height 4 $\frac{9}{16}$ in. (0.1158 m) and weight.

6.2.3 Spherical segment with radius of curvature 9 $\frac{13}{16}$ in. (0.25 m), enclosed arc 124.8°, height 5 $\frac{5}{16}$ in. (0.1342 m) and weight.

6.2.4 The acceleration transducer shall be mounted within 5° of the vertical center of the impactor (see Fig. 2).

6.2.5 The total mass of the impactor with its associated mounting hardware shall be 29.5 $\pm$ 1.1 lb (13.6 $\pm$ 0.45 kg).

6.3 *Deceleration Time*—The selection of specific deceleration-time recording instrumentation, including transducers and recorders is discretionary. None-the-less, the recording system shall exhibit frequency response adequate for measurement of peak deceleration to an accuracy of $\pm 5\%$ of



NOTE 1—The Landing Pit cutout which surrounds the planting box should be tapered in such a way as to not interfere with the action of the pole.

FIG. 2 Landing Pit

the true value. The total system, including transducer and recording instrumentation, shall be capable of measuring deceleration pulses with amplitude at least equal to 200 g and frequencies ranging between 0 and 1000 Hz to an accuracy of $\pm 5\%$.

6.4 *Impact and Rebound Velocities*—The dynamic testing equipment must be capable of recording impact and rebound velocity to an accuracy of $\pm 5\%$ of the true value. Any velocity measurement method that does not physically interfere with impact conditions is acceptable.

6.5 *Displacement-Time*—Displacement-time history shall be recorded. The test equipment must have means for determination of the top plane (baseline) of the landing surface from which the total penetration (displacement) is determined.

7. Conditioning

7.1 Landing pits shall be tested under ambient conditions that match those of intended use.

8. Impact Testing Procedure

8.1 *Summary of Procedure*—Test specimens are impacted at a specified velocity by an impacting missile of prescribed mass and geometry. A transducer is mounted in the missile so that the deceleration-time history of impacts can be recorded. The procedure described in this test method employs a missile with geometry similar to that of the human back.

8.2 Prewarm the recording instrumentation as recommended by the manufacturer. Calibrate deceleration-time and displacement-time instrumentation in accordance with procedures recommended by instrumentation manufacturer.