16: Falling Weight Impact Testing Equipment
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INTRODUCTION

Fig. 1 shows the elements of an instrumented falling weight impact (IFWIM) testing system (see Falling Weight Impact Testing Principles). The equipment usually includes

(a) a tower, consisting of a rigid base and top plate, connected by two polished columns on which the striker carriage and release platform slide
(b) an instrumented striker or tup (fitted with a force transducer)
(c) a striker velocity measuring system
(d) a striker carriage arrest system
(e) the data acquisition system
(f) specimen support and clamping attachments.
(g) Optional extras can include (i) an energy ‘assist’ system to increase the impact velocity (ii) environmental chambers for testing at different temperatures and (iii) alternative base stands for testing large components.

In the basic test, the release platform with striker carriage and striker is raised to a predetermined height, $h$, to obtain a particular incident impact speed, $v_0$, where $v_0 = \sqrt{2gh}$. The striker carriage is then released to fall freely under gravity so that the striker hits the specimen at the required speed. Practical limitations on the height of the tower limit the ‘free fall’ impact velocity to about 4.5 m/s. The impact velocity can be increased by using an energy ‘assist’ system, which stores energy in a compressed spring or equivalent as the striker carriage is raised to the top of the tower. The striker carriage is then ‘fired’ on release, to achieve impact speeds between 4 - 20 m/s, depending on the initial ‘assist’ energy stored.

The incident energy available for the test is determined by the total mass of the striker carriage and striker, $m$, and the incident impact speed, $v_0$.

$$E_0 = \frac{1}{2} m v_0^2$$

INSTRUMENTED STRIKER

The striker (tup or dart) comprises a cylindrical tube or rod, commonly fitted with a hemispherical tip, and incorporates a force transducer (see Transducers) to measure the force during the test. The cylindrical section must be smooth and of sufficient length to punch through the specimen, without damage to the transducer, before the striker
carriage hits the stops.

Figure 1: Schematic of the IFWIM system. 1 Data acquisition system, 2 Striker with force cell, 3 Specimen support system, 4 Velocity measuring system, 5 Striker carriage, 6 Striker carriage arrest system, 7 Carriage release link, 8 Release platform, 9 Striker winch system, 10 Energy ‘assist’ system.

Two types of transducer are used, based on either strain gauge or piezoelectric transducers. The essential requirement is a high natural frequency for the system, since