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Technical Data Sheet

TDS-06

Generating Shock Pulses

Half-sine programmers may be provided to satisfy customer selected half-sine pulse.

Each half-sine pulse time duration requires a separate programmer which must be manually situated between the underside of the shock carriage and the machine base. Please specify precise pulses with typical payload(s) in order to provide a calibration chart with the shock machine.

The procedure to calculate the elastic medium to generate any half-sine pulse is first to determine from the time duration of the pulse the frequency (1/2T = f) of the pulse, where

T = time duration, seconds
f = frequency, Hz

Next, one must determine the static deflection of the elastic medium from the formula

X = 10/fsquared, where

X = deflection of the elastic medium for 1g, inches

Finally, multiply the above deflection by the acceleration of the pulse to determine the total deflection of the elastic medium. Normally, elastomer (rubber) pads are not deflected more than 20% of their unloaded height. If the deflections are large, i.e., > 2 inches, then other techniques such as bungee cords can be employed to generate soft, elastic mediums with large deflection capability.

Using 100g, 11 ms pulse as a model, the frequency from the above formula is 45 Hz and the static deflection is 0.005 inch. Thus, the deflection for 100g is .5 inch.

To generate sawtooth pulses the following steps are required:

a. place lead in oven and melt
b. place mold under oven and pour molten lead in mold
c. remove lead (solidifies almost immediately) from mold
d. place lead pellet(s) under shock carriage
e. perform shock test
f. remove used pellet and recycle per step a

Each sawtooth pulse time duration requires a separate mold. M/RAD shall provide the high temperature oven, lead and molds to perform the required sawtooth pulses.

To generate square wave/trapezoid pulses:

The programmer for the Square wave/trapezoid pulse consists of 1 or more high pressure air cylinders with a rubber pad mounted on the end of the piston shaft. These cylinders are located between the body of the shock machine and the drop table.

The cylinders are preloaded with air on the piston side so that the piston rod is fully extended prior to the shock. The air pressure determines the "g" level of the pulse. The impact velocity at which the shock table impacts the rubber pad determines the time duration of the pulse. The cylinders should be long enough so that the pressure in the cylinders does not change appreciably as the piston is depressed.

Because the cylinders are precharged, there is a force, which preloads the piston against the top of the cylinder. The piston cannot move until the impact force exceeds this preload force. Since a rubber pad is located on top of the piston rod, the initial shock pulse is the start of a half-sine pulse. This phenomenon accounts for the **RISE** time of the square/trapezoid pulse/ When the impact force reaches the preload force, the piston moves and the force on the piston is essentially constant while the piston is moving, hence, the shock acceleration during this period is constant. This accounts for the **CONSTANT ACCELERATION** portion of the pulse. Eventually, all the energy is dissipated from the drop table and the downward motion of the table stops. At this point, the air pressure pushes the table, via the piston, back to the zero deflection point of the cylinder. This accounts for the **DECAY** time of the pulse.