

ALPHA 70K TMA (Truck Mounted Attenuator)
GENERAL SPECIFICATIONS

I. GENERAL

- A. All ALPHA 70K Truck Mounted Attenuators (ALPHA 70K TMA) shall be designed and manufactured by Energy Absorption Systems, Incorporated, of Chicago, Illinois, in accordance with this specification.
- B. The ALPHA 70K TMA is a lightweight attenuator system designed for installation at the back of trucks with gross vehicle weight (GVW) ranges between 5000 kg (11,025 lbs) and 12 000 kg (26,460 lbs). To achieve optimum TMA performance, the traveling weight of the vehicle should be between 5000 kg (11,025 lbs) and 9000 kg (19,845 lbs). (Note: Any added ballast must be adequately anchored to prevent movement of the ballast during impacts.) Because the weight of the rearward protruding TMA is supported by the back end of the truck, care must be taken not to exceed the manufacturer's published maximum axle loads. The truck manufacturer's recommended center-of-gravity zone should also be adhered to in order to ensure that the driving characteristics of the vehicle are maintained.
- C. A minimum 5000 kg (11,025 lb) truck combined with TMA shall have a forward skid distance of less than 6 m (20 ft) during an impact by either an 820 kg (1,808 lb) or 2000 kg (4,410 lb) vehicle traveling at a design speed of 70 km/h (43 mph). The forward skid distance is dependent on the truck wheels being locked, the transmission in second gear, and the parking brake set with the truck situated on clean, dry pavement.

II. DESCRIPTION OF SYSTEM

- A. The ALPHA 70K TMA shall consist of three basic components: an aluminum cartridge with a Durashell[®] bumper, a backup, and a backup support structure properly designed for attaching the system to the truck. Total weight of the basic system shall be approximately 550 kg (1,213 lbs). The complete ALPHA 70K TMA shall be designed to make attachment or detachment from the truck simple and fast, with the major components listed above remaining together when detached from the truck. The underride portion of the backup support structure is designed to stay attached to the truck.

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- B. The ALPHA 70K TMA cartridge shall have a standard trailer lighting system, including brake lights, tail lights, turn signals, and ICC bar lights. The wiring from the rear lights shall be routed and secured inside the cartridge. A strain relief shall secure the wiring at the exit of the cartridge. Wiring through the cartridge shall pass through shock absorbing rubber grommets.
- C. The standard cartridge will also be equipped with one steel wheeled, rear-mounted jack, which in the retracted position shall act as a skid protector. The two-rear bottom, outside corners shall also be protected by plastic skid protectors.
- D. The exposed steel shall be primed and painted black. All welding shall be done by or under the direct supervision of a certified welder.
- E. The cartridge shall be painted yellow and the standard rear-facing surface of the cartridge shall have a 4" wide black on yellow inverted "V" chevron pattern.
- F. Two front hand crank jacks with swivel casters attached to backup for removing unit from truck for storage.
- G. The optional hydraulic package shall consist of a pump with a 12-volt DC motor, cylinder, hoses, switches, wiring, and necessary subcomponents to tilt the TMA cartridge to a 90° position from horizontal. The system shall have a mechanical locking device to secure the TMA cartridge in the 90° position.

The completed hydraulic system (including pump, hoses, and latching system) shall be factory assembled and mounted to the backup and backup support structure. Once assembled, each unit shall be operated through two complete cycles (horizontal, tilted to the latched 90° position and lowered back to horizontal is one cycle) to ensure proper operation of the pump, tilting mechanism, and the automatic latching system. The hydraulic system shall be shipped assembled.

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The "UP" operation of the hydraulic tilt may be actuated from either the cab of the truck or the hand held control switch at the end of a 6 foot long cord near the right rear corner of the truck. The "DOWN" activation from the 90° locked position can only be activated with the control at the right rear corner of the truck. The control has been positioned to allow the operator to first visually check the safety clearance behind and under the unit, prior to lowering the ALPHA 70K TMA cartridge to the horizontal travel position.

III. PERFORMANCE CRITERIA

- A. The ALPHA 70K TMA when mounted to a truck weighing up to 9,000 kg (19,845 lbs) (actual weight), with the transmission in second gear and the brakes locked, with the truck situated on clean, dry pavement, shall perform as follows:
1. For vehicles weighing up to 2000 kg (4,410 lbs) impacting straight into the rear of the TMA, a durable cartridge nose material shall prevent the TMA system from incurring damage at speeds up to 8 km/h (5 mph). The durable cartridge bumper will be capable of flexing up to 0.1m (4 in.) and returning to its original shape without affecting the energy absorbing capacity of the cartridge.
 2. For vehicles weighing 820 kg (1,808 lbs) impacting straight into the rear of the TMA at 70 km/h (43 mph), the calculated 0.6m flail space velocity shall be less than 12 m/s (39 fps), and the 10 millisecond average ridedown acceleration shall be less than 20 g's per NCHRP 350, Test 2-50.
 3. For vehicles weighing 2000 kg (4,410 lbs) impacting straight into the rear of the TMA at 70 km/h (43 mph), the calculated 0.6m flail space velocity shall be less than 12 m/s (39 fps), and the 10 millisecond average ridedown acceleration shall be less than 20 g's per NCHRP 350, Test 2-51.

All certified test results, associated test reports and films shall be submitted showing that the TMA cartridge assembly provided by the vendor has met all test and performance criteria as called out in these specifications. The report shall be formatted and evaluated according to NCHRP 350 guidelines.

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All tests shall be certified by a registered professional engineer. This engineer's certification document shall be sealed with a Professional Engineer (P.E.) seal and shall be submitted with the bid to supply TMAs.

B. The ALPHA 70K TMA shall be capable of passing the following accelerated endurance and weathering tests. One (1) truck mounted attenuator (TMA) cartridge shall be subjected to the three tests listed in the following sequence:

1. Vibration Test
2. Moisture Test
3. Corrosion Test

1. Vibration Test:

Two vibration tests will be conducted with a standard TMA cartridge. No extra tie-downs, dampeners, or supports, not included in the production model, will be allowed. Vibration data forms and vibration test time log forms are to be used for recording the data required and shall be submitted with the bid.

- a. Test No. 1: The TMA cartridge assembly shall be mounted to the vibration apparatus in its normal horizontal operation position. The indicated measurements shall be recorded prior to, at 20 hours, and on completion at 40 hours of this vibration test and recorded on vibration data forms.
- b. Test No. 2 The TMA shall be mounted to the vibration apparatus in an elevated position 90° to the horizontal. The indicated measurements shall be recorded prior to, at 20 hours, and on completion at 40 hours of this vibration test and recorded on vibration data forms.

The test fixture will be free of springs or dampeners, and shall have a vertical pivot point that is located 139 inches ± 9 inches from the TMA support structure and capable of inducing the required frequency and excursion into the attenuator through a mechanically positive system. Photos of the TMA box assembly mounted to the test fixture in the horizontal operating position and the 90° position must be submitted with the bid.

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The frequency of the vibration will be 5 Hz to 8 Hz for a period of 40 hours in each test position (80 hours total). Excursion is to be $.60 \pm .05$ inch, measured peak to peak vertically at the location where the attenuator is attached to the back support. Measurements prior to, at 20 hours, and on completion of the vibration tests will be recorded with the TMA cartridge assembly mounted in its normal operating position, and mounted in its 90° elevated position. A variance of .50 inches of any component dimension, damage to the energy absorbing cells that would affect their performance, or damage to the back support, exterior skin, light bracket attachment, or rear jack attachment, will constitute failure of the device.

2. Moisture Test:

The moisture test shall be conducted with the complete TMA cartridge equipped as per paragraph 1 of the Vibration Test of these specifications. The complete TMA cartridge shall be weighed prior to and after the moisture test, utilizing a certified scale. These TMA cartridge weights will be a part of the test data submitted with the bid. The above attenuator will be placed in its normal horizontal operating position and subjected to precipitation equivalent to 6 inches of water per hour delivered from nozzles with spray cones mounted so that the required precipitation is evenly distributed over the entire area of the cartridge top, sides, and ends. After a period of 24 hours, the attenuator will be turned over on its top side and the same precipitation rate continued on its bottom side for 24 hours. The water shall be turned off, the attenuator returned to its normal operating position, and the attenuator will be allowed to drain for one hour and then weighed. The weight after the test shall be the same as initially ± 5 lbs. The attenuator will then be examined. The complete outer covering of the TMA cartridge assembly shall be removed and the energy absorbing cells shall be examined and photographs of the energy absorbing cells shall be submitted with the moisture test data.

The cells shall be free of moisture and retain 100% of their energy absorbing qualities. The results of the examination of the energy absorbing cells for moisture retention shall be submitted with the bid.

Attenuator cells showing retention of moisture or any damage whatsoever will constitute failure of the device.

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3. Corrosion Test:

A sample of attenuator energy absorbing material shall be subjected to a salt spray (fog) test in accordance with ASTM B117-73, Method of Salt Spray (fog) Testing, for a period of 50 hours and consisting of two (2) periods. Each period shall consist of 24 hours exposure and one (1) hour drying time.

The sample of the structure shall consist of a section with a minimum dimension of 100mm [4 in] x 100mm [4 in], and must include any adjacent bonding material. Photographs of the sample structure will be made prior to and after removal from the TMA cartridge assembly. Also, photographs will be made of this same sample prior to and after the corrosion test. All photographs listed above will be submitted with the corrosion test results.

Immediately after the device has been subjected to the corrosion test, there shall be no evidence of corrosion which would effect the energy absorbing qualities of the sample.

All of the above tests shall be conducted prior to bidding. All test data recorded and test procedures certified by a professional engineer shall be submitted with the bid and must show that the TMA cartridge assembly has met all the test requirements in these specifications. Only units tested and certified by a professional engineer as having been properly tested and passing these tests will be accepted as meeting this specification. A written copy of test results shall accompany the bid. Failure to provide thorough test procedures, test data and prints traceable to the tested TMA assembly and components, shall be cause for rejection and/or cancellation of the order.

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