

ALPHA 2001 MD<sup>®</sup> TMA (Truck Mounted Attenuator

GENERAL SPECIFICATION

I. GENERAL

- A. All ALPHA 2001 MD Truck Mounted Attenuators (ALPHA 2001 MD TMA) shall be designed and manufactured by Energy Absorption systems, Incorporated, of Chicago, Illinois, in accordance with this specification.
- B. The ALPHA 2001 MD TMA is a lightweight attenuator system designed for installation at the back of trucks with gross vehicle weight (GVW) ranges between 10,000 and 25,000 pounds. To achieve optimum TMA performance the traveling weight of the vehicle should be between 10,000 and 15,000 pounds. (note: Added ballast must be adequately anchored to prevent movement 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. To ensure that the driving characteristics of the vehicle are maintained the manufacturer's recommended center-of-gravity zone should also be adhered to.
- C. The truck and TMA combined shall have a forward skid distance during an impact by either an 1800 lb. or 4500 lb. vehicle, at a design speed of 45 mph, of less than 20 feet for trucks weighing greater than 10,000 lbs. This distance is dependent on the truck wheels being locked, the transmission in gear, and parking brake set, and the truck situated on clean, dry pavement

II. DESCRIPTION OF SYSTEM

- A. The ALPHA 2001 MD TMA shall consist of three basic components: a two-piece modular aluminum cartridge with a Durashell<sup>®</sup> 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 1400 lbs. The complete ALPHA 2001 MD TMA shall be designed to make attachment, or detachment from the truck simple and fast, with the major sub-assemblies listed above remaining together when detached from truck.
- B. The ALPHA 2001 MD 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 rear module of the cartridge. A strain relief shall secure the wiring at the exit of the rear module. Wiring through the front module 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 yellow. All welding shall be done by or under the direct supervision of a certified welder.
- E. The standard rear facing surface of the cartridge shall have a 4" wide black on yellow inverted "V" chevron pattern.

### III. OPTIONAL ACCESSORIES

#### A. Backup Jacks

Two front hand crank jacks with swivel casters attached to backup for removing unit from truck for storage.

#### B. Hydraulic. 90° Tilt System

The optional hydraulic package shall consist of a pump with a 12 volt DC motor, cylinder, hoses, switches, wiring, and necessary subcomponents to facilitate the tilting of the TMA cartridge to 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.

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 positioned to allow the operator to first visually check the safety clearance behind and under the unit, prior to lowering the ALPHA 2001 MD<sup>R</sup> TMA cartridge to the horizontal travel position.

### IV. PERFORMANCE CRITERIA

- A. The ALPHA 2001 MD<sup>R</sup> TMA when mounted to a truck weighing up to 15,000 lbs. (actual weight), with the transmission in second gear and the brakes locked, shall perform as follows:

- 1. For vehicles weighing up to 4500 lbs. impacting straight into the rear of the TMA, a durable cartridge shell

material shall prevent the TMA system from incurring damage at speeds up to 5 mph, remaining in service without repairs. The durable cartridge shell will be capable of flexing up to 4 inches and returning to its original shape without affecting the energy absorbing capacity of the cartridge.

2. For vehicles weighing up to 4500 lbs. impacting straight into the rear of the TMA, the front 50% of the cartridge must survive without damage after a 20 mph impact. The crushed 50% of the cartridge must be replaceable with a cartridge section in one hour by two workers.
3. For vehicles weighing up to 1800 lbs. impacting straight into the rear of the TMA, the front 50% of the cartridge must survive without damage after a 35 mph impact. The crushed 50% of the cartridge must be replaceable with a new cartridge section in one hour by two workers.
4. For vehicles weighing 4500 lbs. impacting straight into the rear of the TMA at 45 mph; the calculated 2 ft. flail space velocity shall be less than 40 ft./sec.; and the 10 millisecond average ride down deceleration shall be less than 20 g's. This is modified Test #50 of NCHRP #230 at 45 mph.
5. For vehicles weighing 1800 lbs. impacting straight into the rear of the TMA at 45 mph; the calculated 2 ft. flail space velocity shall be less than 40 ft./sec.; and the 10 millisecond average ride down deceleration shall be less than 20 g's. This is modified Test #52 of NCHRP #230 at 45 mph.
6. For vehicles weighing 4500 lbs. impacting the rear of the TMA at 45 mph at 10-15 degree impact angle 0-3 ft. offset from center; the calculated 2 ft. flail space velocity shall be less than 40 ft./set.; and the 10 millisecond average ride down deceleration shall be less than 20 g's. This test is modified Test #54 of NCHRP #230 at 45 mph.

All certified test results, associated test reports and films showing ground targets, car targets, and a method of timing for obtaining vehicle speed shall be submitted showing that the TMA cartridge assembly the vendor is providing has met all test and performance criteria as called out in these specifications. The report shall be in format of and evaluated by NCHRP #230 guidelines.

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

B. The ALPHA 2001 MD<sup>R</sup> 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 (attached) are to be used for recording the data required and shall be submitted with the bid. The complete TMA cartridge assembly, shall be weighed prior to and after each vibration test utilizing a certified scale. These certified TMA weights shall be recorded and submitted.

- a. Test No. 1: The TMA cartridge assembly shall be mounted to the vibration apparatus in its normal horizontal operation position (as shown in Figure 1). The indicated measurements shall be recorded prior to, at 20 hours, and on completion of this vibration test and recorded on the attached vibration data forms.
- b. Test No. 2: The TMA shall be mounted to the vibration apparatus in a position elevated to 90° (as shown in Figure 2). The indicated measurements shall be recorded prior to, at 20 hours, and on completion of this vibration test and recorded on attached 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 (Figure 1) and the 90° position (Figure 2) must be submitted, on and/or before the bid opening schedule.

The frequency of the vibration will be 5 Hz to 8 Hz for a period of 40 hours in each test (80 hours total). Excursion is to be .60 ± .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 as shown in

Figure 1 mounted in its normal operating position, and as shown in Figure 2 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 certified 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, that attenuator returned to its normal operating position, and the attenuator will be allowed to drain for 1 hour and then weighed. The weight after the test shall be the same as initially  $\pm$  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 on or before the bid scheduled opening.

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

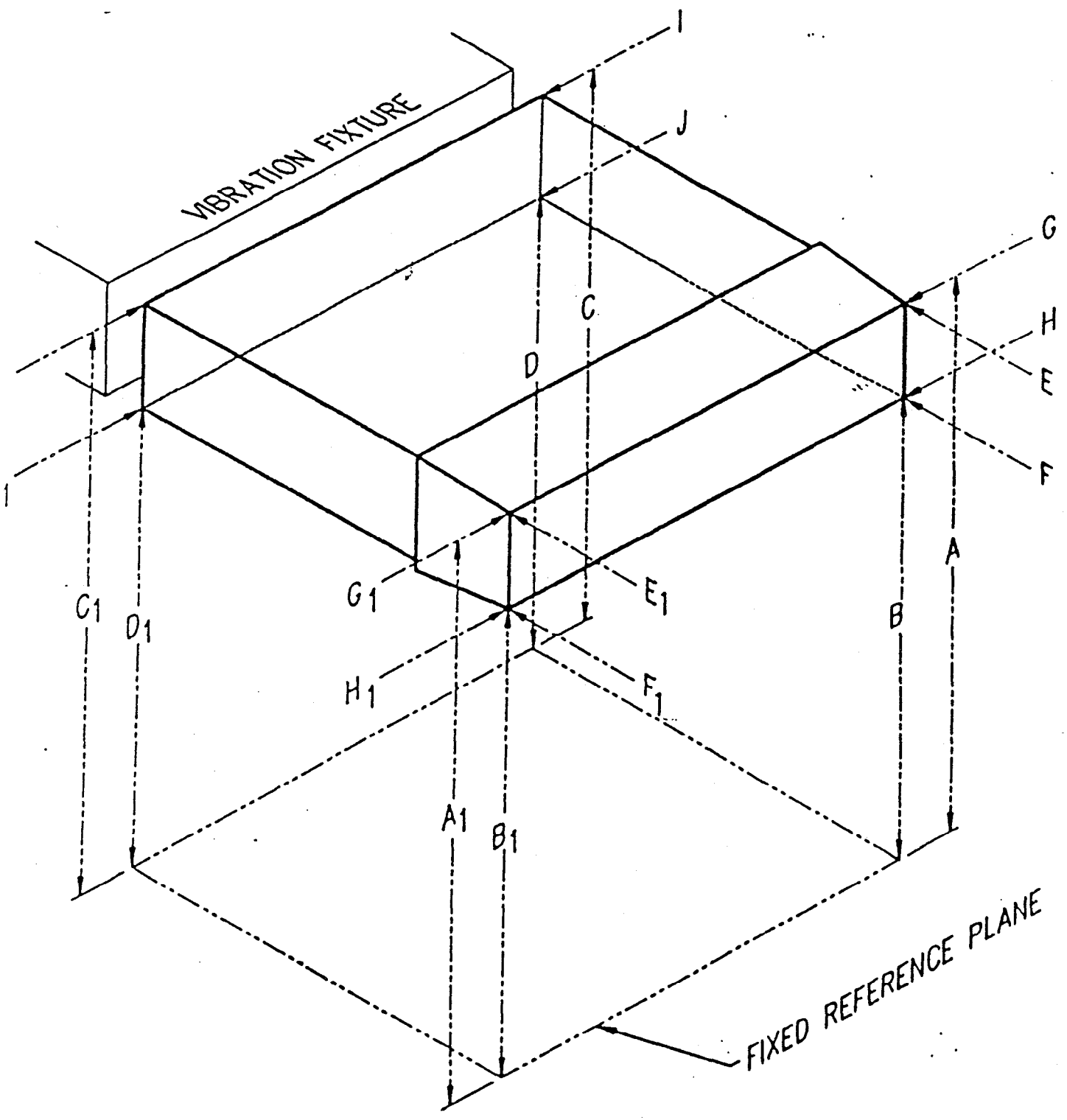
3. Corrosion Test:

A sample of attenuator energy absorbing cell 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 taken of the cell structure shall consist of a section with a minimum dimension of 4 cubic inches, and must include any adjacent bonding material. Photographs of the sample cell structure will be made prior to and after removal from the TMA cartridge assembly. Also, photographs will be made of this same cell sample prior to and after the corrosion test. All photographs listed above will be submitted with the corrosion test results.

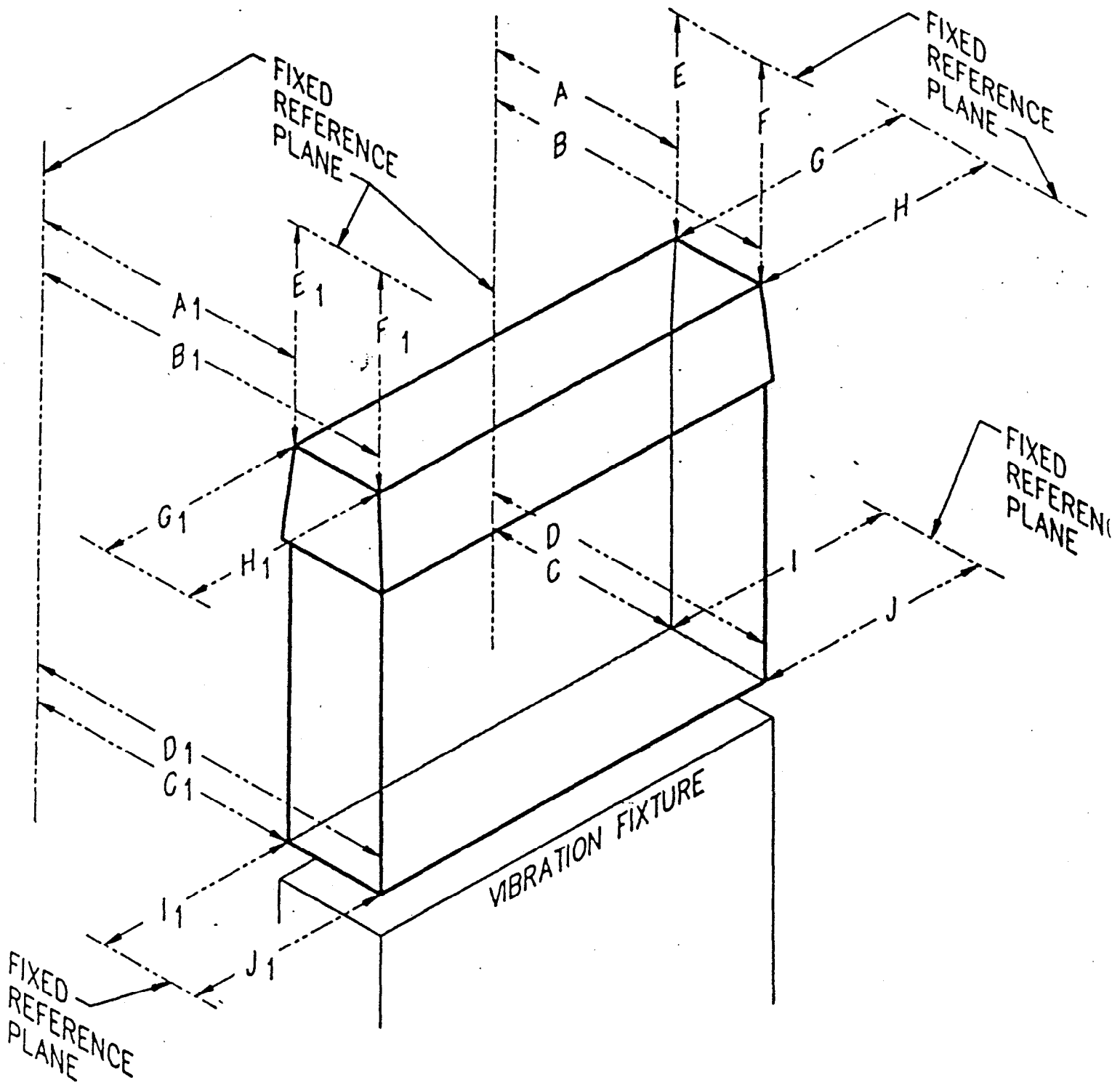
Immediately after the device has been subjected to the corrosion test, there shall be no evidence of corrosion which would effect the-energy absorbing qualities of the sample.

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 and must show engineering proof that the TMA cartridge assembly has met all the test requirements under "Tests" 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.



ATTENUATOR. CARTRIDGE IN NORMAL HORIZONTAL OPERATING POSITION.

FIGURE NO. 1



ATTENUATOR CARTRIDGE IN 90 DEGREE POSITION

FIGURE NO. 2





Part No.: \_\_\_\_\_

Serial No.: \_\_\_\_\_

**VIBRATION TEST  
TIME LOG FORM  
NORMAL OPERATING POSITION (HORIZONTAL)**

Date/ Initials	Start	Stop	Hours	Date/ Initials	Start	Stop	Hours

Total Hours \_\_\_\_\_

Total Hours \_\_\_\_\_

Part No.: \_\_\_\_\_

Serial No.: \_\_\_\_\_

## TMA CARTRIDGE ASSEMBLY VIBRATION DATA FORM

Test No. 1

Test No.2

Dimension in Inches	Before Test	20 Hours	40 Hours	Before Test	20 Hours	40 Hours
A						
A <sub>1</sub>						
B						
B <sub>1</sub>						
C						
C <sub>1</sub>						
D						
D <sub>1</sub>						
E						
E <sub>1</sub>						
F						
F <sub>1</sub>						
G						
G <sub>1</sub>						
H						
H <sub>1</sub>						
I						
I <sub>1</sub>						
I <sub>2</sub>						
J <sub>1</sub>						
WEIGHT						