

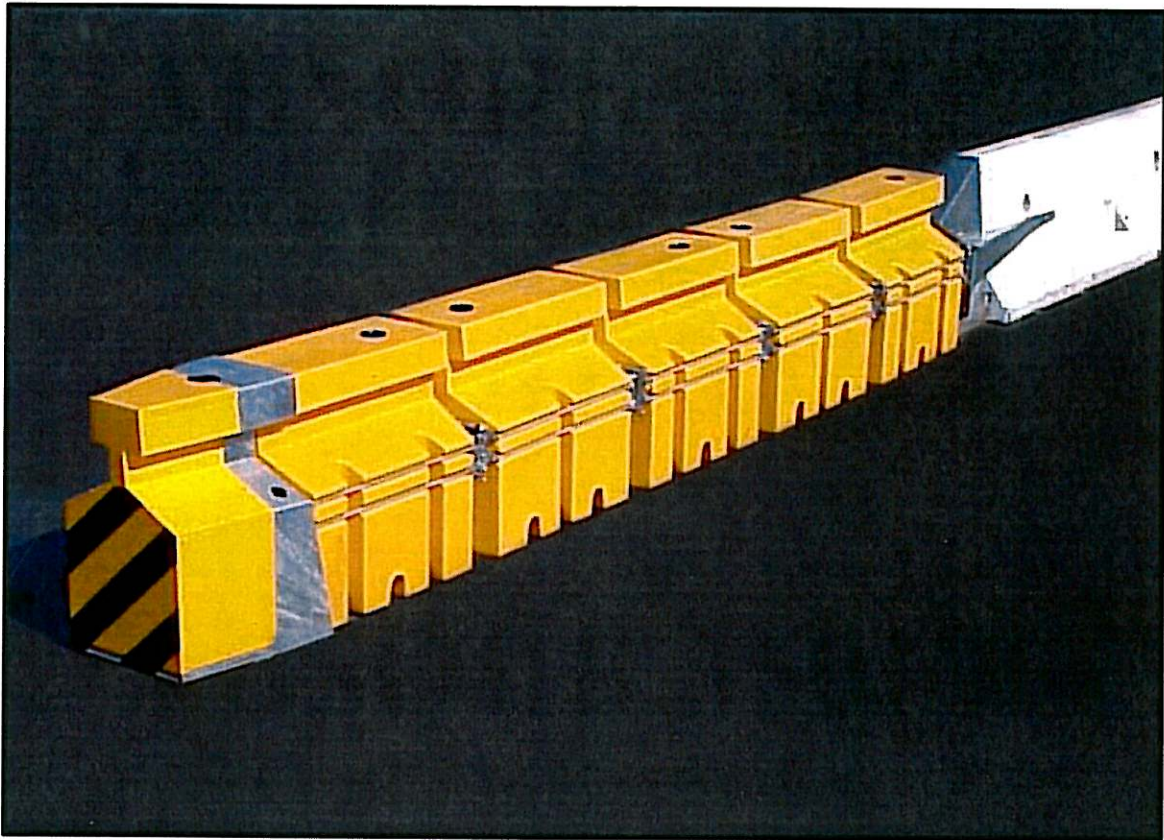
ABSORB 350™

Crash Cushion System

Installation and Maintenance Manuals

Test Levels 2 (70km/h) and 3 (100km/h) Applications

Attached to Portable and Permanent Concrete Barriers



BARRIER SYSTEMS INC

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ABSORB 350™ BENEFITS

ABSORB 350™ is a Water filled, Non-redirective, Gating Crash Cushion that is approved to NCHRP Test Level 2 and Test Level 3 criteria. It attaches to portable, permanent and moveable concrete barrier.

- **It is easy to install and requires no foundation or anchoring**
- **It restores in minutes and is easy to maintain- with no sand clean-up**
- **The narrow profile is ideal for permanent or temporary sites**
- **It has superior overall performance to sand barrels for narrow hazard protection with similar performance characteristics to other redirective-gating crash cushion systems**

ABSORB 350™ is an excellent cost-effective alternative that helps you to treat more sites with fewer dollars

WHERE TO USE ABSORB 350™ CRASH CUSHION SYSTEM

When selecting location and type of crash cushion systems, agencies generally consider risk factors to the vehicle occupant(s) upon impact and post-impact hazards to other motorists.

Performance differences between Non-redirective, and Redirective Gating systems are negligible for most impacts. Agencies have in the past, relied on “other factors” to help determine which crash cushion system to use at a particular site.

Other factors include:

- Cost
- Foundation requirements
- Affects of front angled, side angled and “hard point” impacts
- Vehicle trajectory and debris exposure to other motorists
- Post impact cleanup
- Exposure of maintenance crews to traffic hazards

If we compare crash cushion systems relative to the above factors, it becomes readily apparent that **ABSORB 350™** offers tangible and cost effective advantages.

The ABSORB 350™ is designed to use on narrow hazards:
(permanent, portable and moveable concrete barrier ends)

- **Exits**
- **Wide medians**
- **Edge of road locations**
- **Where other non-redirective or partially redirective systems are often used**

Frequently Asked Questions About

ABSORB 350™ Crash Cushion

1. What type of equipment is needed to fill the modules with the water and antifreeze mix? If special equipment is needed does that come with each unit?
 - No special equipment is required for filling the ABSORB 350™ units. The hole in the top of the ABSORB 350™ element is three inches (3") in diameter. A standard water truck with a two and one-half inch (2.5") diameter hose is completely adequate for filling ABSORB 350™ elements.
2. How long does it take to fill a module?
 - To fill an ABSORB 350™ element with a standard two and one-half inch hose, using gravity drain from a water truck will take approximately one minute. It requires approximately 70 gallons of water to fill each unit. If the water is transferred via a power pump, it will take less than one minute to fill each element.
3. Does your company provide spare parts? In what time frame can the parts be shipped?
 - Spare parts are available at local distribution or through the manufacturer and can be shipped within 24 hours after acceptance of order.
4. Does your company teach installers to service and repair the ABSORB 350? On average how long does this take?
 - Barrier Systems, Inc. will train installers to service and repair the ABSORB 350 system. ABSORB 350™ has been designed with the customer in mind. For most impacts, the ABSORB™ system should be able to be refurbished in less than one-half hour. . In many cases, local distributors of the ABSORB 350™ system can provide assistance in this regard.
5. Does your company provide a separate maintenance and repair contract to service the ABSORB 350 units?
 - Barrier Systems, Inc. (BSI) does not directly provide maintenance and repair contracts. However, local distributors for this product may provide this service. BSI would be pleased to assist the DOT with identifying and training local service personnel.

6. What type of environmentally safe antifreeze does your company recommend? Are there any antifreezes, which are not compatible with the materials that the ABSORB 350 is made of?
- Customers should consult with local agencies to use solutions that are in conformance with local requirements. Some customers have indicated that common deicing and dust control chemicals that are used on the highway make excellent choices for antifreeze agents. These include:
 - Calcium Chloride (CaCl_2) - a 25% by weight solution should yield protection to below -20°F . *
 - Calcium Magnesium Acetate (CMA) - a 32% by weight solution should yield protection down to -20°F . *
 - Potassium Acetate (KAc) - a 32% by weight solution should yield protection down to at least -20°F . *
- * Above recommendations are from Cryotech Deicing Technology, Inc. Reference information can be obtained at the following web site: <http://www.cryotech.com/cf7.htm>
- There are no known antifreeze agents that should affect the materials in the ABSORB 350™ system. Unlike some types of water filled systems, the plastic containers in ABSORB 350™ have no metals exposed to the antifreeze solution.
7. Does your company have any concerns about the width of median required to accommodate the units? What happens with opposing traffic hitting wreckage?
- The ABSORB 350™ system has been approved as a non-redirective crash cushion in accordance with NCHRP Report 350 testing and evaluation criteria. As such, it should be applied where the characteristics are suitable for non-redirective crash cushions. The hazard presented by post impact debris from this system is no more or less significant than post impact debris from other redirective or non-redirective systems. Generally, redirective non-gating type crash cushions are best suited for narrow median locations and redirective gating and non-redirective systems are acceptable for wide medians, exit points and in other tangent sections. It should be noted that the debris patterns and hazards presented by redirective gating systems and ABSORB 350™ are very similar.

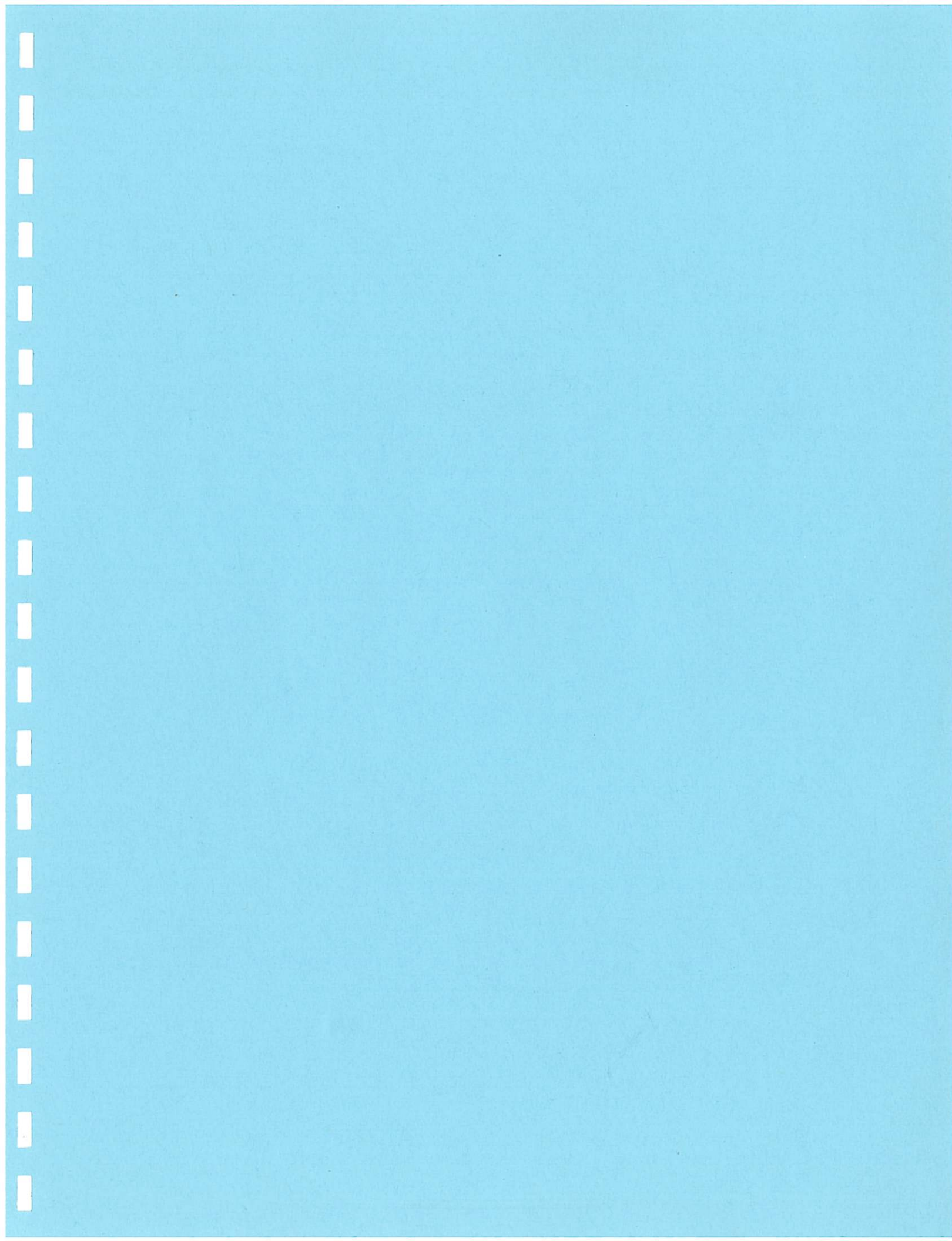
8. What are the approximate prices of the TL-2 and TL-3 units?
- The ABSORB 350™ system has been cost effectively designed and priced. The prices for Test Level 2 and 3 ABSORB 350™ systems are dependant on the number being ordered. Typical price ranges of \$4000 to \$6000 per complete system (FBO Rio Vista, CA) could be anticipated for large quantities.
9. Can the ABSORB 350™ “nose piece” be angled off the concrete barrier to better face traffic.
- The ABSORB 350™ system is designed to be flexible to allow for “small angle adjustments” and movement at job site. The “nose piece” can be angled off to face traffic as long as all of the ABSORB 350™ units remain pinned and fully connected. For larger angles, it is recommended that the last concrete section be moved to face traffic to reduce tension on the system.
10. What about “vandalism”. Can the ABSORB 350™ units be easily cut or damaged.
- The ABSORB 350™ system has been designed to minimize the potential for vandalism. It is made of durable linear low density polyethylene (LLDPE) that is approximately one quarter inch (7mm) thick to reduce the likelihood of blunt or sharp objects from penetrating the top or side walls.
11. How is the ABSORB 350™ drained?
- The ABSORB 350™ system can be drained in minutes by following this easy three step process: 1) Uncap the three inch fill hole located at the top of each unit, 2) Unpin the unit from adjacent units, 3) One person with a pry bar can tip the unit on it’s side until it is partially drained and then rotate the unit upside down to be fully drained. Drainage can also be accomplished by using a water truck with vacuum or reversible pump capabilities.
12. Can the ABSORB350™ be assembled prior to delivery to the site?
- The ABSORB 350™ system can be assembled prior to delivery when proper equipment is available to transport and unload the system at job site. Adequate lifting capabilities will be needed at jobsite to unload and properly place the system. However, initial assembly at job site will take less than one hour with two persons. Refurbishment of the ABSORB 350™ typically takes less than one half hour.

13. Can the ABSORB 350™ be moved while filled with water?

- The ABSORB 350™ system can be moved while filled with water. It is designed to be picked up and laterally transferred through the Barrier Transfer Machine (BTM) or it can be moved with forklifts. Each unit weighs approximately 110 lbs dry and 715 lbs filled with water.

14. Can the ABSORB 350 unit be attached to the end of guardrail median barriers?

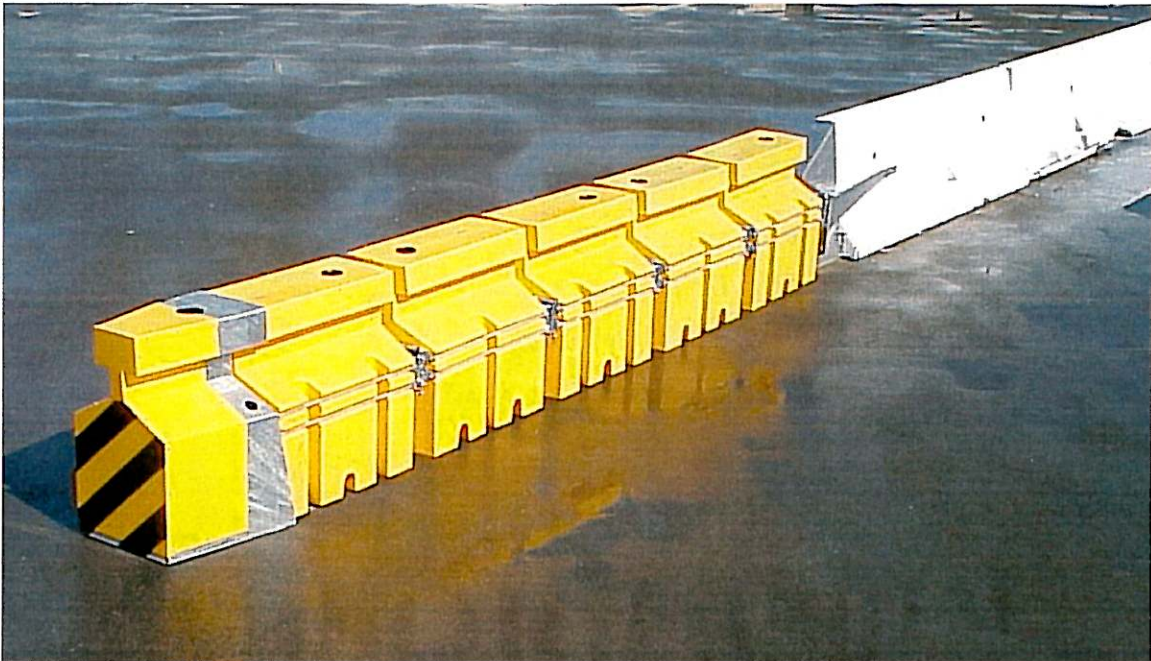
- The ABSORB™ system is designed for attachment to portable and permanent concrete barrier as well as Quickchange® Moveable Barrier (QMB). If portable concrete barrier is properly transitioned to the guardrail system, ABSORB 350™ can be attached to the concrete barrier. If it is determined that the market needs or demands guardrail attachments, a special transition will be designed to attach the ABSORB 350™ system directly to a guardrail end later this year. However, at this time, the system must be attached to a concrete barrier.



ABSORB 350™

Crash Cushion

INSTALLATION AND MAINTENANCE MANUAL Installed on Permanent and Portable Concrete Barrier



BARRIER SYSTEMS INC

ABSORB 350™ Crash Cushion

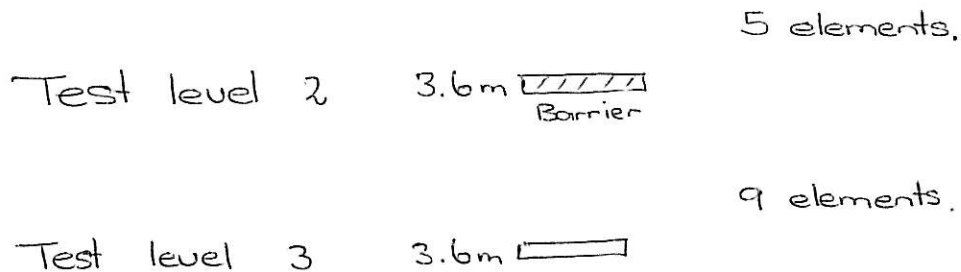
Installed on Permanent and Portable Concrete Barrier for Test Level 2 (70 km/h) Applications Test Level 3 (100 km/h) Applications

The following is the installation and maintenance instructions for an Absorb 350™ System when it is attached to Portable or Permanent Concrete Barrier.

Test level 2 and 3 configurations are the same with the exception of the number of Absorb 350 elements used.

- Test level 2 requires 5 Absorb 350 elements.
- Test level 3 requires 9 Absorb 350 elements.

This system is designed to be attached to Portable or Permanent Concrete Barrier with section lengths of at least 3.1 meters (10 feet).



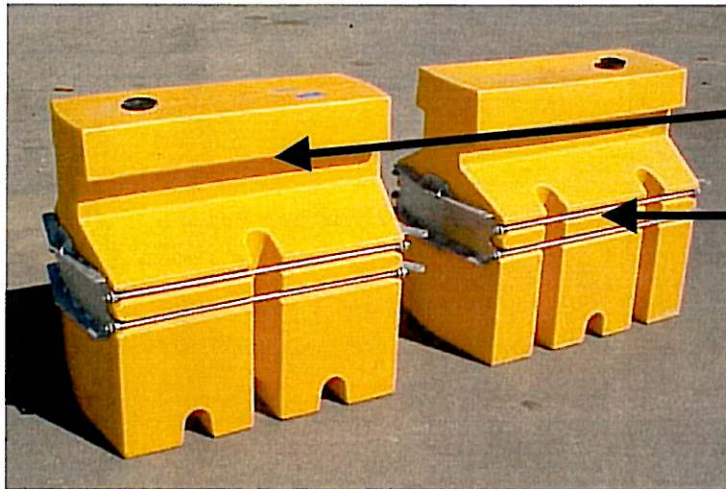
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PLEASE DIRECT ANY QUESTIONS REGARDING
THE USE OR INSTALLATION OF THIS PRODUCT TO
BARRIER SYSTEMS, INC., CUSTOMER SERVICE AT
707-374-6800

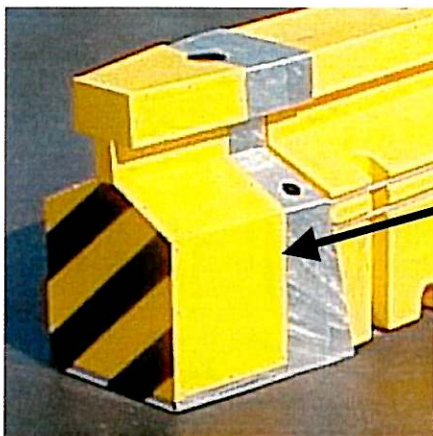
TERMINOLOGY

The following pictures show the elements and assemblies that comprise the Absorb 350 System.

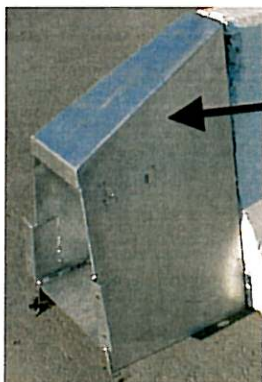


Type B Element

Type A Element



Nose Piece connected to
Energy Absorbing Element
Assembly #B991204



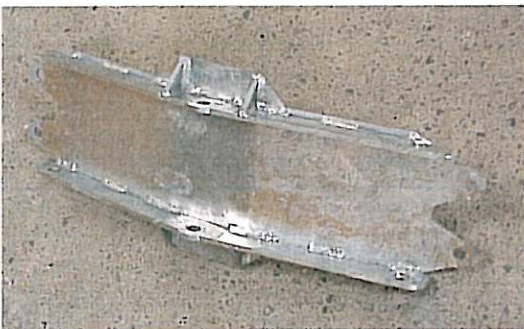
Adapter, Absorb 350 to Portable
and Permanent Concrete Barrier
#B000520



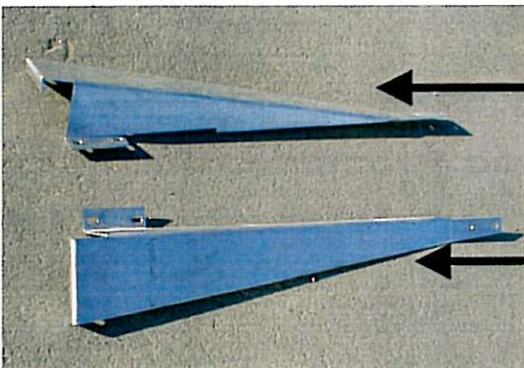
Hinge Plate Adapter
#B000611



Rear Hinge
#B991213

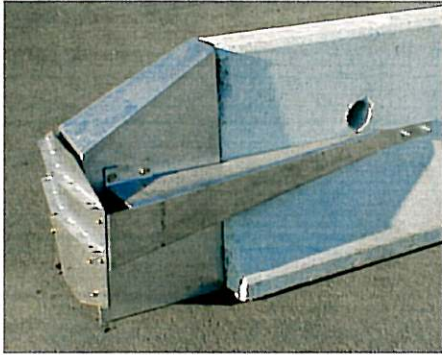


Front Hinge
#B991214



Strap Adapter-right
#B000207

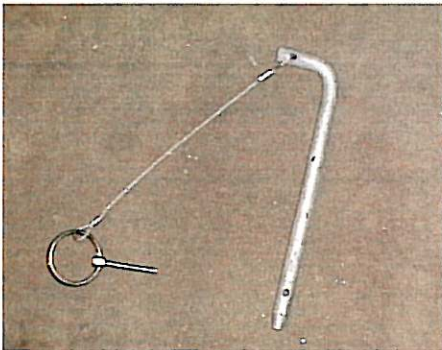
Strap Adapter-left
#B000209



Taper Adapter and Strap Adapter
assembled on Concrete Barrier

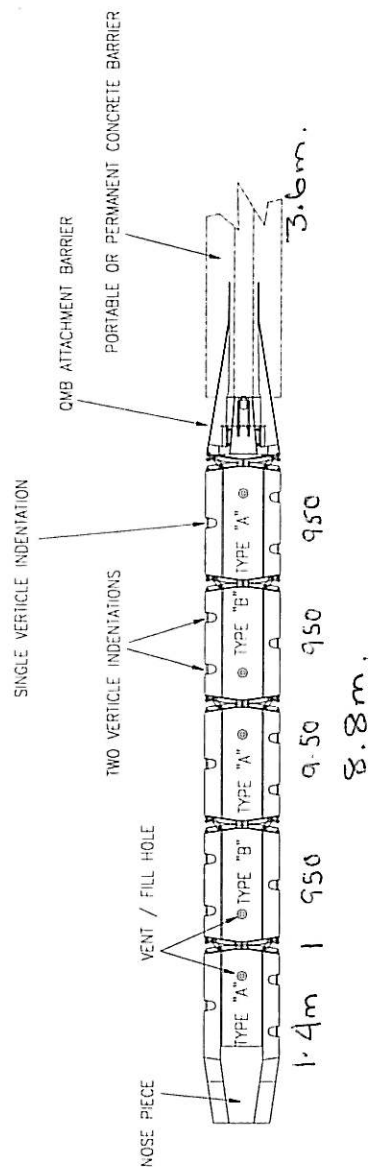


Anchor Bolt
#A000521

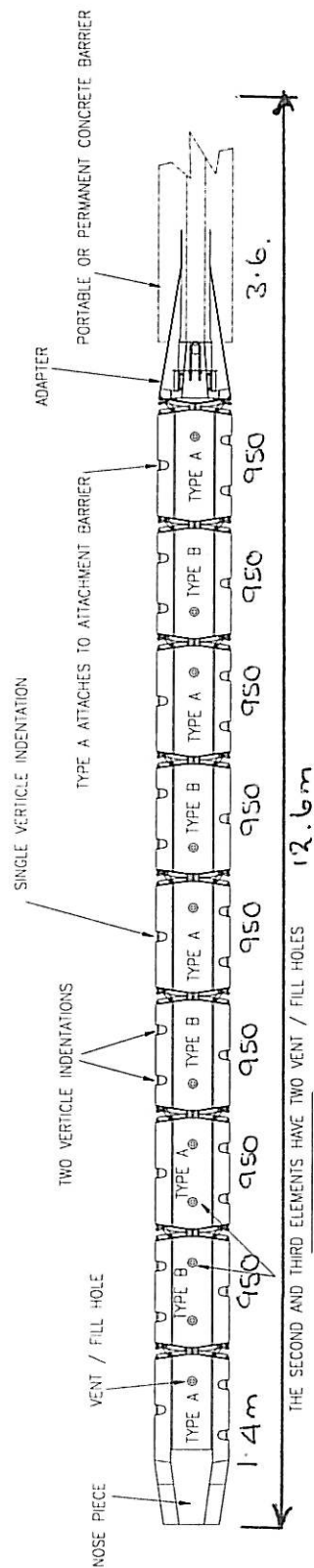


Link Hinge Pin
#A991221

TEST LEVEL 2 (70 km/h) APPLICATION



TEST LEVEL 3 (100 km/h) APPLICATION



THE ORIENTATION OF THE VEHICLE INDENTATIONS AND THE VENT FILL HOLE MUST BE AS SHOWN IN THIS DRAWING. REFER TO THE ABOVE DRAWING FOR THE TYPE A AND B ELEMENT ORIENTATION.

figure 1

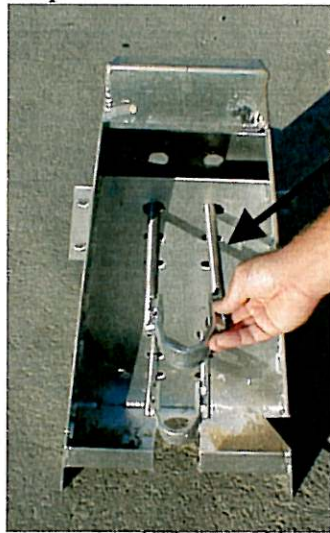
INSTALLATION

Two people can easily accomplish the initial installation. The installation should be completed prior to filling the energy absorbing elements with water. It is not necessary but is easier to start setting the assembly from the concrete barrier wall end and assemble towards the nosepiece.

STEP 1

Install the Adapter to the Portable Concrete Barrier wall. Use the following steps to install the Adapter.

Step 1.1

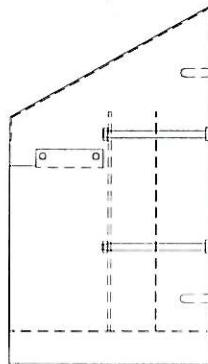


A000521

Place the two Anchor Bolts (A000521) into the Adapter (B000520) as shown. The bolts should be placed in the upper and lower holes if they will not interfere with the mounting on the end of the concrete barrier. If there is interference use the closest holes to the top and bottom that is possible.

B000520

Step 1.2

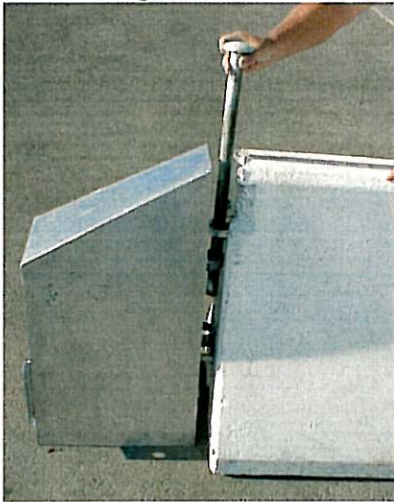


Place both anchor bolts through both plates as shown in the drawing. Start two nuts on each anchor bolt and push the anchor bolt to the rear until the nuts are against the plate.

Step 1.3

In the event that the taper adapter is installed on a permanent concrete wall, mounting bolts must be installed. The taper adapter should be set against the wall in its proper position. A punch can be used to mark the concrete in the four spots that the anchor bolts shown above would be located. Then four ½" wedge anchor bolts need to be installed. Then install the taper adapter, torque the ½" nuts on the wedge anchor bolts to 40 ft/lbs.

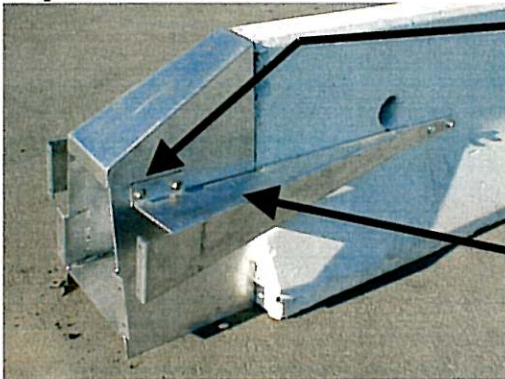
Step 1.3



Place the adapter at the end of the Portable Concrete Barrier wall. Insert the Portable Concrete Barrier pin through the two loops of the Portable Concrete Barrier and the two loops of the anchor bolts as shown.

Tighten the four nuts on the Anchor Bolts to a torque of 15 ft/lbs. Then install a jam nut against the first nut with a torque of 40 ft/lbs.

Step 1.4



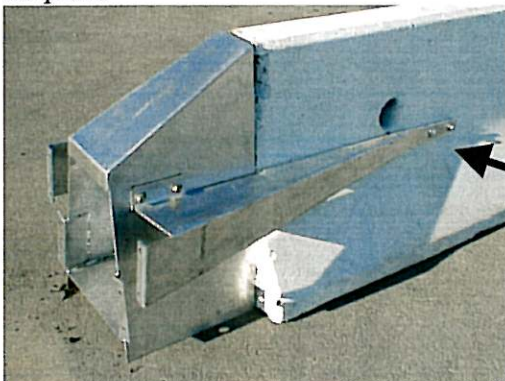
Bolt the left and right Strap Adapter to the Taper Adapter. B000207 & B000209

Hold the top edge of the Strap Adapter parallel with the road surface. Mark the rear holes (2) of the Strap Adapter on concrete barrier

Step 1.5

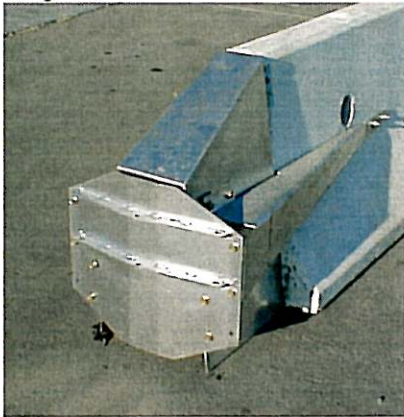
At each of the four (4) marks made above on the Portable Concrete Barrier drill a $\frac{1}{2}$ " diameter hole 3 $\frac{1}{4}$ " deep.

Step 1.6



Install 4 - $\frac{1}{2}$ " x 4 $\frac{1}{4}$ " (wedge anchor) cement anchor bolts. Place one $\frac{1}{2}$ " flat washer and nut on each anchor bolt. Torque the nuts to 40 ft/lbs.

Step 1.7

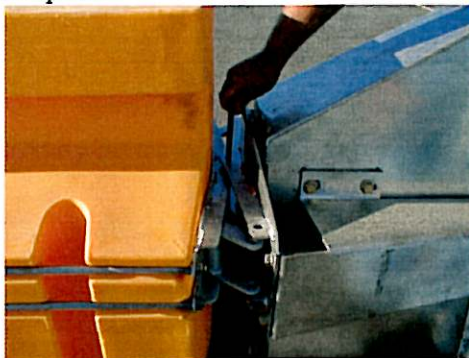


Install the Hinge Plate Adapter (B000611) onto the Taper Adapter as shown with eight (8) $\frac{1}{2}$ " x $1\frac{1}{4}$ " NC GR 5 CADII PLTD bolts

STEP 2

Install the first Energy Absorbing Element (Type "A") to the Hinge Plate Adapter. For element assembly see page 12.

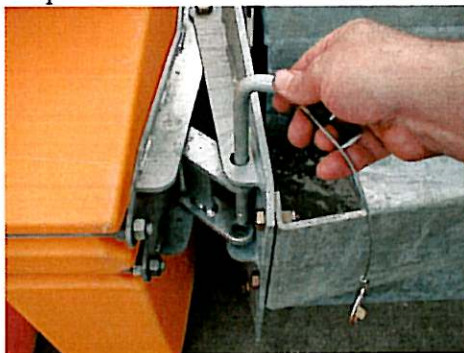
Step 2.1



Install the center pivot bolt, $\frac{1}{2}$ " x 8", and $\frac{1}{2}$ " nylock nut.

Tighten the nut only until the end of the bolt threads protrude out of the nylon portion of the nut.

Step 2.2



Install a Link Hinge Pin on each side of the hinge. Then make sure that the clip that is attached to the end of the chain is installed into the hole in the end of the Link Hinge Pin.

STEP 3

Install the Energy Absorbing Elements. Install the Center Pivot Bolt and the two Link-Hinge Locking Pins on each element.

Test Level 2 – install five (5) elements total.

Test Level 3 – install nine (9) elements total.



There are two types of Energy Absorbing Elements. Each type has a forward and rearward end. The forward end is considered the end that faces the Nose Piece. The rearward end faces the Concrete Barrier wall. The two types of elements are identified by the number of vertical indentations along each side in relation to the front and rear hinges. See elements on page 3.

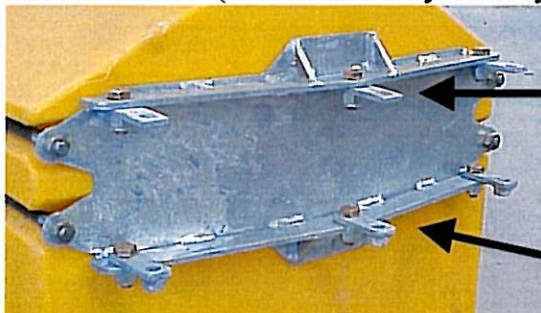
When the Absorb 350 system is assembled, it is important to ensure that the two types of elements are ALWAYS ASSEMBLED IN AN ALTERNATING FASHION as shown in Figure 1 (Page 6). Thus, when you look down either side of the assembled system, you should see an alternating pattern of vertical indentations (i.e. two, one, two, one, etc.).

NOTE

The second and third elements of Test Level 3 systems must have two vent / fill holes. If elements are not available with the two vent / fill holes in the top, the second hole must be cut in these two elements. The hole layout and size measurements are the same as the existing hole. See figure 1 drawing of Test Level 3 on page 6.

STEP 4

Six tabs are loosely bolted (so they swivel for adjustment) onto the last hinge assembly before the Nose Piece. These tabs are the mounting points for the nosepiece. Three of the tabs have nuts welded onto one end. These go on the top of the bottom bar of the hinge assembly. The three tabs with a hole in each end go on the bottom side of the top bar of the assembly as shown below. (These tabs may already be installed.)

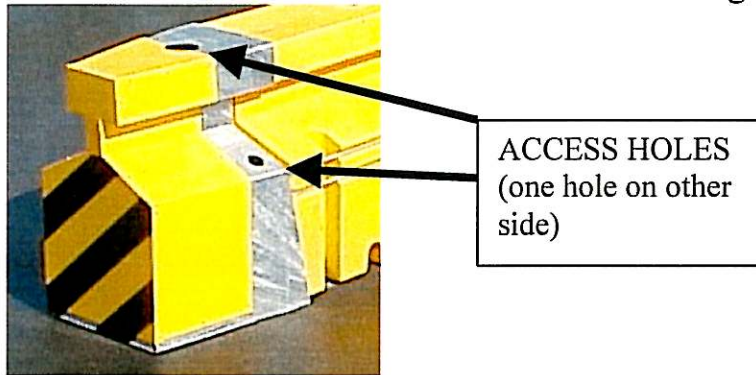


→ Tabs with two holes.

→ Tabs with nuts

STEP 5

Install the nosepiece on the end of the last Type A element. There are three $\frac{1}{2}$ " x 6" bolts that secure the nosepiece to the tabs on the hinge assembly. There are three access holes in the nosepiece that allows installation of these bolts. These bolts must be securely tightened. It is very important that the Nose Piece does not become detached during an impact.



STEP 6

If necessary adjust the Energy Absorbing Elements so there is a straight alignment with the downstream QMB system.

STEP 7

Fill all of the Energy Absorbing Elements with water, except the first element. The plastic container that attaches to the nosepiece is the only container that **does not have any water**. The remaining containers are filled with water to a level that is within 2" from the top of the container.

Fill 4 elements for Test Level 2

Fill 8 elements for Test Level 3

NOTE – FILLING THE ELEMENT ATTACHED TO THE NOSE PIECE WITH WATER WILL CAUSE THE SYSTEM TO PERFORM IMPROPERLY AND MAY CAUSE SERIOUS BODILY INJURY.

In regions where the water filled Absorb 350 elements could become frozen, proper antifreeze agents should be used. Care should be taken to ensure that proper antifreeze agents are used in accordance with local regulations, environmental concerns and ensuring that any post impact liquid on the road surface does not constitute an undue hazard to adjacent motorists.

The Absorb 350 elements should be inspected regularly to ensure that the elements that are intended to contain water (or antifreeze fluid) are kept at adequate fill levels.

STEP 8

Install the evaporation prevention cap into the top of each plastic container.



The cap needs to be securely pushed down to prevent evaporation. In addition the tie strap should be securely fastened to the plastic element.

STEP 9

Installing delineation. Depending on local DOT specifications, install delineation as necessary to the front of the painted nosepiece.

INSPECTION

THE METAL COMPONENTS AND FASTENERS OF THE SYSTEM SHOULD BE PERIODICALLY INSPECTED TO ENSURE THAT THE SYSTEM REMAINS INTACT AND ABLE TO PERFORM IN A SAFE AND EFFECTIVE MANNER.

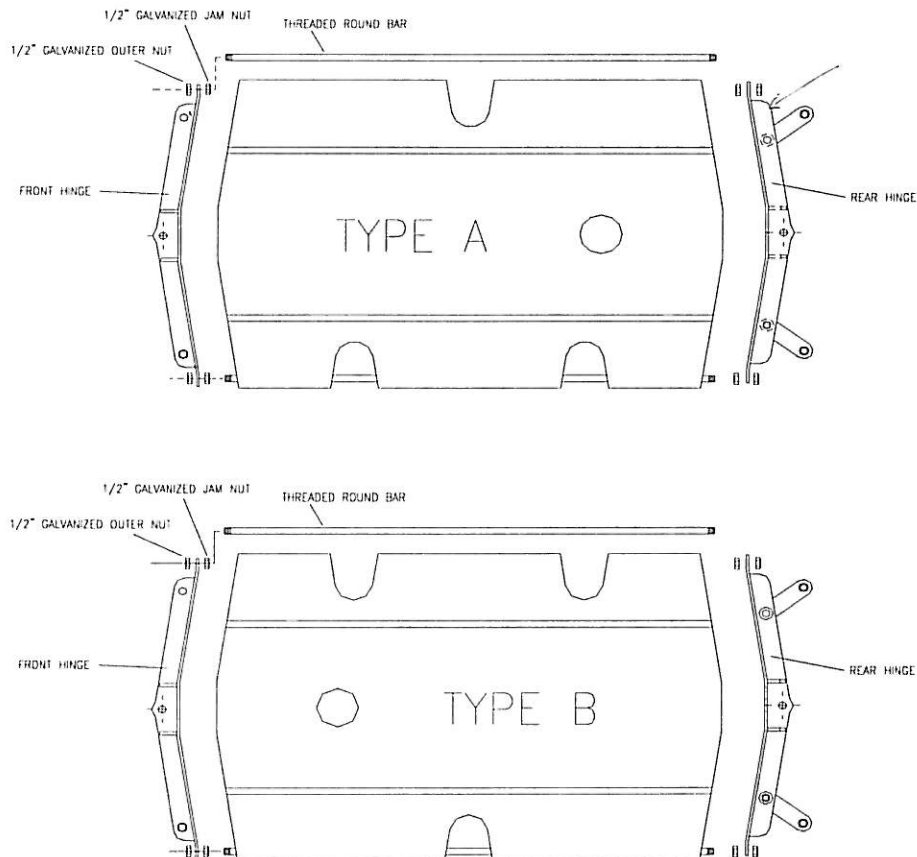
REPLACEMENT OF DAMAGED UNITS

Any component within the system that becomes damaged should be replaced immediately.

ASSEMBLY OF ENERGY ABSORBING ELEMENTS

It is necessary to determine if a Type A Element or a Type B Element is to be assembled. A Type A can be converted to a Type B or vice versa simply by reversing the plastic within the hinge system. Follow the instructions outlined below.

ABSORB 350 ELEMENT ASSEMBLY



STEP 1

Install the $\frac{1}{2}$ " galvanized jam nuts onto one end of the four threaded rods. The nut on each end should be threaded on the rod about $1 \frac{1}{2}$ inches.

STEP 2

Install the four threaded rods through the hinge ends and in the horizontal grooves of the energy absorbing element as shown above and loosely start the $\frac{1}{2}$ " nuts. It is sometimes easier to secure all

four rods to one hinge end, then slide this assembly onto the element, then attach the opposite hinge end.

STEP 3

Evenly tighten the outer ½” nuts until the hinge assembly on each end is making firm contact with the energy absorbing element. After this adjustment is made, tighten each of the four outer nuts one full turn.

STEP 4

Thread the jam nuts against the backside of the hinges. Torque the jam nuts to 40 ft/lbs.

Limitations and Warnings

The ABSORB 350™ Non-Redirective Crash Cushion has been designed and tested to perform in accordance with the criteria set forth in the National Cooperative Highway Research Program Report No. 350 (NCHRP 350) for devices in this specific category.

It is very important to note that non-redirective crash cushions should be applied to locations where there is not a need for redirection of impacting vehicles and where there is an adequate clear zone adjacent to the system. Other products that have been approved for use in this operational category include sand barrel arrays.

The ABSORB 350™ system should be installed and maintained in accordance with the instructions in this Installation and Maintenance manual. Failure to install or maintain the system in accordance with these instructions could result in the system not performing in accordance with the product specifications and severe bodily injury to errant motorists that impact the system.

The system should be filled with a proper fluid and delineated in accordance with the instructions in the Installation and Maintenance Manual, federal, state and local requirements. The federal, state and local requirements will always supercede the instructions in the manual regarding delineation and the type of fluid to be used in the elements of the ABSORB 350™ system.

The ABSORB 350™ system should always be installed on a firm surface that would prevent the system from becoming embedded in the surface over long periods of time. Debris should be kept clear of the system and no foreign objects should be in close proximity or on top of the system during operation.

The impact performance of the crash cushion systems described in this document have been conducted under controlled conditions. Barrier Systems, Inc. (Barrier) does not represent nor warrant that the results of those controlled conditions would necessarily avoid injury to persons or property. Barrier expressly disclaims any warranty or liability for claims arising by reasons of death or personal injury or damage to property resulting from any impact, collision or harmful contact with the crash cushion systems or nearby hazards or objects, by any vehicle, objects or persons

LIMITED WARRANTY

Barrier Systems, Inc. (BSI) has tested the impact performance of its moveable barrier and crash cushion systems under controlled conditions, however, BSI does not represent nor warrant that the results of those controlled conditions would necessarily avoid injury to persons or property. BSI EXPRESSLY DISCLAIMS ANY WARRANTY OR LIABILITY FOR CLAIMS ARISING BY REASONS OF DEATH OR PERSONAL INJURY OR DAMAGE TO PROPERTY RESULTING FROM ANY IMPACT, COLLISION OR HARMFUL CONTACT WITH THE PRODUCTS OR NEARBY HAZARDS OR OBJECTS BY ANY VEHICLE, OBJECTS OR PERSONS.

BSI warrants that any product or component part manufactured by BSI will be free from defects in material or workmanship. BSI will replace free of cost any Product or component part manufactured by BSI that contains such a defect.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

BSI'S LIABILITY UNDER THIS WARRANTY IS EXPRESSLY LIMITED TO REPLACEMENT FREE OF COST (IN THE FORM AND UNDER THE TERMS ORIGINALLY SHIPPED), OR TO REPAIR OR TO MANUFACTURE BY BSI, PRODUCTS OR PARTS NOT COMPLYING WITH BSI SPECIFICATIONS, OR, AT BSI'S ELECTION, TO THE REPAYMENT OF AN AMOUNT EQUAL TO THE PURCHASE PRICE OF SUCH PRODUCTS OR PARTS, WHETHER SUCH CLAIMS ARE FOR BREACH OF WARRANTY OR NEGLIGENCE. BSI SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL LOSSES, DAMAGES OR EXPENSES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY SUCH LOSSES, DAMAGES OR EXPENSES ARISING DIRECTLY OR INDIRECTLY FROM THE SALE, HANDLING OR USE OF THE PRODUCTS FROM ANY OTHER CAUSE RELATING THERETO, OR FROM PERSONAL INJURY OR LOSS OF PROFIT.

Any claim by the Buyer with reference to Products sold hereunder for any cause shall be deemed waived by the Buyer unless BSI is notified in writing, in the case of defects apparent on visual inspection, within ninety (90) days from the delivery date, or, in the case of defects not apparent on visual inspection, within twelve (12) months from the said delivery date. Products claimed to be defective may be returned prepaid to BSI's plant for inspection in accordance with return shipping instructions that BSI shall furnish to the Buyer forthwith upon receipt of the Buyer's notice of claim. If the claim is established, BSI will reimburse that Buyer for all carriage costs incurred hereunder.

The forgoing warranty benefits shall not apply to (i) any Products that have been subject to improper storage, accident, misuse or unauthorized alterations, or that have not been installed, operated, and maintained in accordance with approved procedures and (ii) any components manufactured by the Buyer.

W030587 Rev. 4

revised 8/15/00

For additional information regarding this product please contact:

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180 River Rd.
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Fax 707-374-6801

PATENTS PENDING

Last revised 10/2/00