

## **Final Inspection**

After the anchor bolts have been tightened to the proper torque value, check that the SMART CUSHION® is not distorted in any way as might happen if the unit is secured to a foundation which is not a flat plane. Check that the front section is pulled out to within 1 inch of the front stop bolts and that no part of the unit has been damaged by shipping and handling. Verify that all assembly bolts are tight and have not come loose during shipping or installation. Finally, check that no tools or other equipment have been left within the SMART CUSHION® structure.

## **Resetting SMART CUSHION® after Impact**

In the event of any impact, the crash cushion will require a full evaluation to determine the necessary repairs to return it to service. To do this, proceed as follows:

### **Site Preparation**

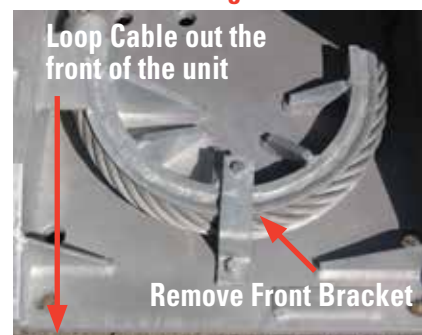
**Do not begin work until the area is declared safe and accessible.**

### **Re-Extension and Inspection after Frontal Impact**

1. Remove the front delineator panel and attach pulling means to the **bottom brace** of the front sled.
2. Use wire or strap on the bottom brace at the front of the sled to hold the spelter socket up in the air while pulling out or it will catch on the base frame cross braces. (See Fig. 1)
3. Remove the front cable bracket that is located on the front sheave at the front of the attenuator. (See Fig. 2)
4. Attach a ½" Grade 100 chain to the bottom brace of the front sled.
5. Pull the sled forward one to two feet to give you slack on the cable.
6. If necessary, use Work Area Protection Corp's cable release tool to break cable loose from the sheave at the front of the attenuator if the zinc coating has attached the cable to the sheave. (See Fig. 3)



**Fig. 1**



**Fig. 2**



**Fig. 3**



7. Pull out in two foot increments while helping the cable feed out of the front of the unit. (See Fig. 4)

8. Pull the sled out the rest of the way in **short smooth increments** so you can help feed the cable out the front of the attenuator. This will give you a cable loop in front of the attenuator. **When you are past the last cross brace, you will need to remove the strap or wire to allow the cable to follow the path into the front sheave.** The sled must be fully extended to replace the shear bolts. The sled should be approximately 1 inch from the stop bolts in the front.  
**\*\*During any pullout, do not stand within the snap radius of the chain in case of failure\*\*.**



Fig. 4

9. During frame pullout, inspect front part of the cable from the spelter socket, as it will be partially obscured after extension of the mobile frames and sheaves. **See the cable inspection procedure.**

10. Remove the front and rear sheave cover plates at each end of the cylinder by removing the two hex bolts that hold them down.

11. Remove the anti-rotation pins, which are the two outer pins, inserted through the holes in the sheaves from both the front and back sheaves. This will be easily done with Work Area Protection Corp's anti-rotation pin removal tool.  
**Caution: Do not remove the center pin. The rear pins are longer than the front sheave pins and cannot be intermixed so leave them by their locations.**

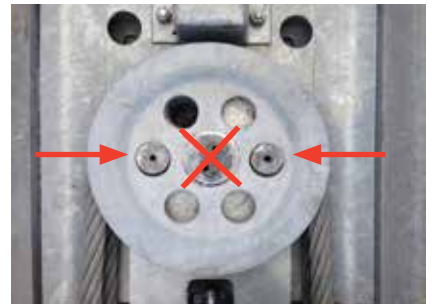


Fig. 5

(See Fig. 5)

12. Remove shear bolt remnants in the holes on both sides of the mobile sheaves. These are grade 8 bolts so they can be difficult to remove without a 90 degree pry bar with a claw to pry out. (See Fig. 6)



Fig. 6

13. Attach a pulling means to the shackle on the mobile sheave assembly. (See Fig. 6)

14. Slowly pull out the mobile sheaves. **Do not stand inside the cable loop or be in the pulling strap danger zone.**

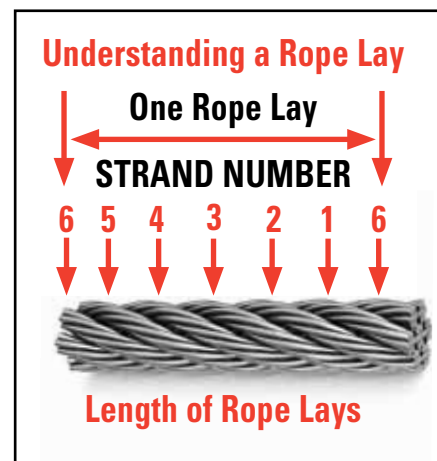
15. Finish pulling out the mobile sheaves until you can see through the shear bolt holes **but do not put in the shear bolts yet.**
  
16. If the cable passes inspection, release any tension on your pulling strap and reinstall the anti-rotation pins in the front and back sheave assemblies and reinstall the cover plates for those sheaves using marine grade anti-seize on the bolt threads. The sheaves may be aligned by inserting a pry bar into the sheave holes. Work your way from the bottom up.
  
17. Put tension on your chain and replace the two ¼ inch **Grade 8** shear bolts in the front corners of the mobile sheaves.
  
18. Inspect the cylinder, anchor bolts and side panels according to the subsequent procedures listed.

### **Side Impact Inspection and Repair**

1. Inspect and replace any damaged side panels.
  
2. Inspect and replace any damaged side keeper bolts on all panels. There are three styles of side keeper bolts. The winged style is for the panel connected to the sled and bolts through the first frame behind the sled. The center side keepers have a ½ inch shoulder while the last side keeper, which is bolted to the terminal frame, has a ¼ inch shoulder.
  
3. Inspect and repair any damaged side guides.

### **Cable Inspection Procedure**

The cable should be visually inspected for damage. The most common sign of rope deterioration is broken wires. The wire must be clean and not under tension to perform a visual inspection. The visual inspection should include looking for broken wire strands, localized wear or crowns. A sharp awl or marlin spike can be used to separate wires to check if internal damage is present, indicated by loose wires or crowns. If internal inspection shows any damage to any core wires, the cable should be replaced. If there are more than six random broken wires in one rope lay or three broken wires in one strand in one rope lay, the wire rope should be replaced. A rope lay is the length along the rope in which one strand makes a complete revolution around the rope. (See Fig. 7)



**Fig. 7**

Inspect the spelter socket for broken wires, damaged eyes or other fatigue. Any signs of broken wires at the spelter socket will require a new cable.

Cable damage is the indication of an over-design impact.

The unit must be inspected by an authorized manufacturers' representative.



## **Cylinder Inspection**

The cylinder should be inspected for:

- Dented or swollen tube jacket
- Visible cracks in any welds and fluid leakage from the welds
- Piston rod surface damage, bending or fluid leakage in seal area
- If fully collapsed or over design impact speed, disconnect piston rod from the mobile sheave after the unit is pulled out and push the piston rod in checking for free movement.

If any of these inspections are suspect, replace cylinder and have it examined by the manufacturer. Current models have PTFE seals with an unlimited static life.

## **Anchor Bolt Inspection**

Anchor bolts may come loose or be damaged upon impact. These bolts may be replaced by welding a nut or putting a double nut on them and backing them out of the hole. Drill out the old epoxy and reinstall new bolts with new epoxy following previous instructions on page 7.

## **Side Panel Inspection**

Side Panels are designed to nest and collapse with minimal or no damage upon frontal impact. The side keepers sustain a shock upon impact. These side keepers should be replaced if there are any signs of fatigue, bending or other visible damage. Inspect the side panels for any bending or torn metal. If damage is found, any side panel is removable by removing four bolts. It may be necessary to remove the bolts on the panel upstream to slide out a panel located in the middle of the unit. The side keepers used to hold the large front sled panels are different than the side keepers on the center panels. Also, the side keeper used on the last terminal brace, which is the rearmost support, has a shorter shoulder ( $\frac{1}{4}$  inch vs.  $\frac{1}{2}$  inch), as it does not have a panel overlap. These shoulders must seat into the outer overlapping panel and pin the inside panel to the frames using a torque value of 270 N-m (200 ft-lbs). Be careful not to pin the edge of the outside panel as it will restrict free sliding of that panel.

## **Side Guide Inspection**

At the bottom of each support frame, there are two guides to stabilize and guide collapse of the attenuator. Inspect each side guide for damage. These guide assemblies are very rugged. If the side guides are not damaged they can be reused. The torque value for the side guides is 920 N-m (680 ft-lb). These side guides are stronger than the rail, so visually inspect the rail for crowns. Any crowning of the rail can be straightened.



## **Final Inspection**

After the resetting of the SMART CUSHION® is complete, verify by visual inspection that all assembly bolts are tight and show no sign of damage. Finally, check that no tools and other equipment or debris have been left within the SMART CUSHION® structure. Verify that no other damage unrelated to the most recent impact has occurred and that no significant corrosion or other deterioration has taken place.

## **Non-Repairable Impacts**

There can be instances where the impact is outside the scope of the SMART CUSHION® design. This may render the SMART CUSHION® unsafe to reuse and it should be replaced.

## **Periodic Maintenance**

Maintenance is very site dependent. Small amounts of debris and trash will not affect the performance of the SMART CUSHION®. Accumulations of dirt/mud can impede the collapse of any system. We suggest an annual cleanout of the system in the fall of the year. If sites are in locations prone to heavy rain/mud runoff, a bi-annual cleaning may be required.