extreme engineering.com

Auto-belay
Cable Replacement
Process

Version 2.00

WARNING: The air pressure in the auto-belay system is what causes the cable to be retracted when releasing the cable or climbing the wall with the cable attached to the climbing harness. This restriction of movement provided by the air pressure is NOT enough for proper operation of the auto-belay.

If air is displaced from the air/oil tank into the hydraulic check valve area of the auto-belay system, there will not be the proper restriction of movement when the cable is pulled out of the auto-belay. NEVER CLIMB a wall with an auto-belay that does not exhibit the proper restricted movement when extending the cable out of the auto-belay for the complete length of travel from the top to bottom of the climbing wall surface. There is a very noticeable difference between air pressure pulling on the cable versus the restricted movement caused by oil when the cable is extended.

The oil in the system is what provides the proper restriction to control the speed of decent when a climber is being lowered to the ground by the auto-belay. If there is air in the system when a person has climbed to the top of the wall and then lets go to lower back down to the ground, the decent will NOT be slow and controlled. Personal injury may occur if the air has not been fully purged from the system.

Reference section 1.14 for further information on:

"PRIME BEFORE YOU CLIMB".

Auto-Belay Cable Replacement Instructions

Version Information

- 2.00 11/11/08
  Complete re-write of cable replacement procedures.

- 1.xx unknown date
  Instructions embedded into Mobile Wall, Stationary Wall and Auto-Belay Owner's Manuals.

Auto-Belay Cable Replacement Instructions

Table of Contents

To jump to a particular section, hold the CTRL key down and click on the section title.

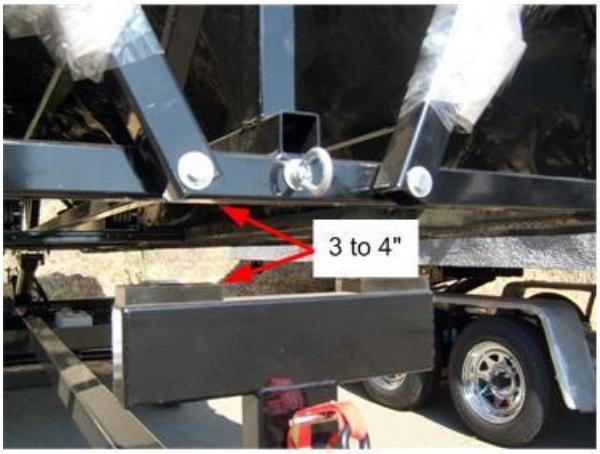
1. Auto-belay Cable Replacement Instructions

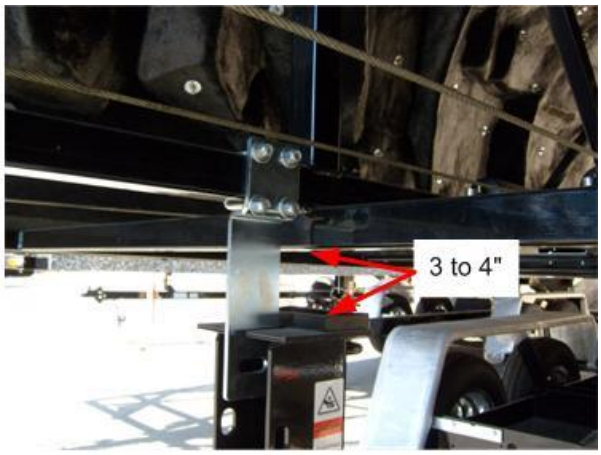
1.1. Mobile Wall Air Pressure Release

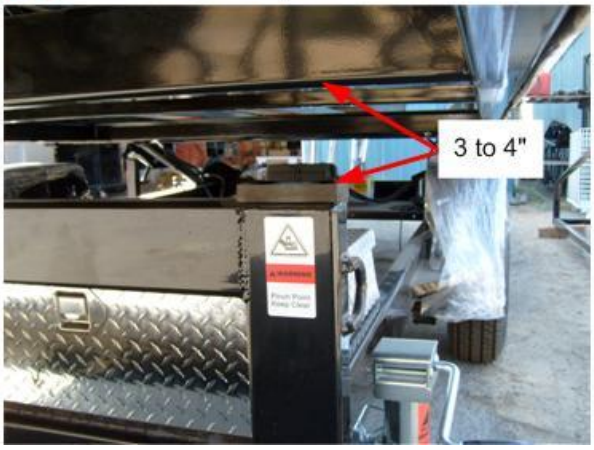
If the cables are attached to the eye-bolts at the bottom of the climbing panel, release them and allow the cable to retract to the top of the wall.

With the wall in the fully down position, remove the tower lockdown pin and raise the climbing tower three to four inches up off of the tower rest.

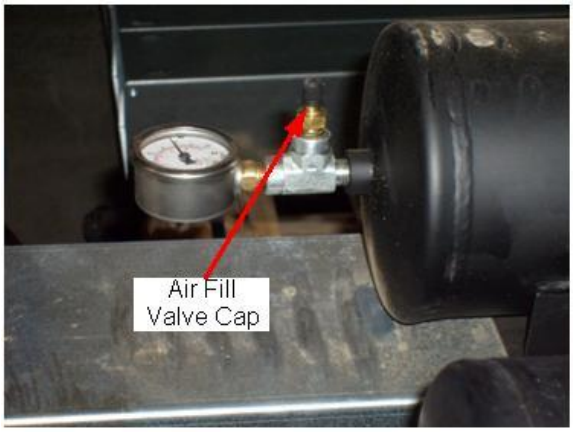
The reason for this is the oil level in the auto-belay tank, from the factory, is slightly above the mid-point level of the reservoir tank capacity. With the wall in a level (horizontal) position, the automatic transmission fluid will spew out of the air fill valve when releasing the air pressure. Raising the front of the wall three to four inches above horizontal will cause the fluid to drop down below the air fill valve level. It is normal for a small amount of oil, or vaporized oil to appear around the air fill valve when releasing air pressure.

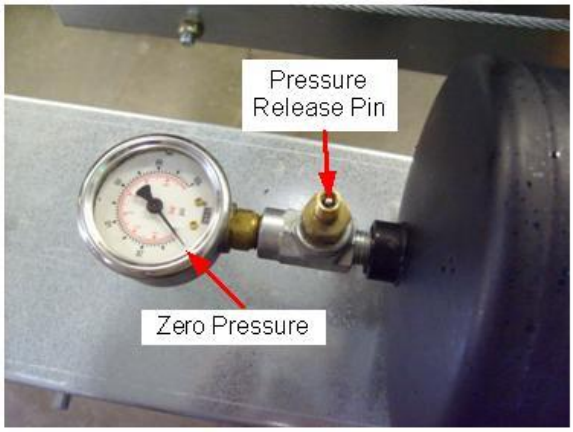






Remove the tower lockdown pin and slightly raise the tower of the mobile wall. Release the air pressure from all auto-belays which you are replacing the cables on. To release the pressure, remove the small black rubber cap from the air fill valve. To prevent oil that may remain in the air fill valve from spraying, hold a rag over the air fill valve while releasing the air pressure. Using a small screw driver, carefully press inward on the fill valve pressure release pin. Be careful not to bend or press too hard on the pressure release pin while releasing the air pressure. Drop the air pressure down to zero as indicated on the air pressure gauge next to the air fill valve.



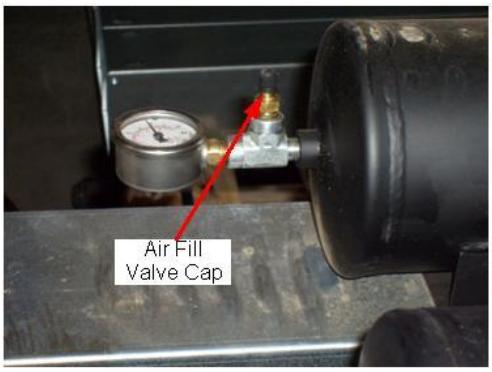


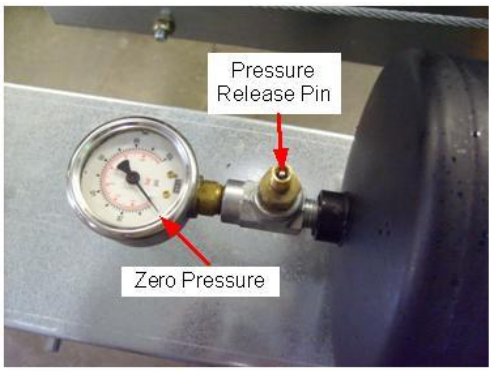
Once all air pressure has been released from the auto-belays receiving a cable replacement, lower the tower back down onto the tower rest.

1.2. Stationary Wall Air Pressure Release

If the cables are attached to the eye-bolts at the bottom of the climbing panel, release them and allow the cable to retract to the top of the wall.

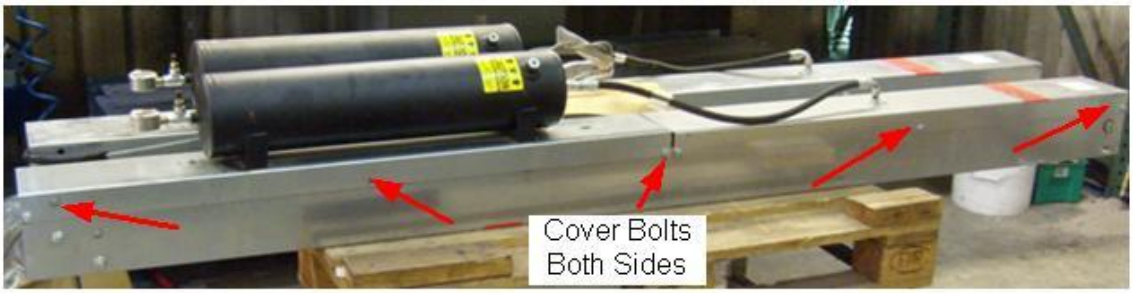
To release the Auto-belay air pressure, remove the small black rubber cap from the air pressure fill valve. Using a small screw driver, carefully press inward on the fill valve pressure release pin. Be careful not to bend or press too hard on the pressure release pin while releasing the air pressure. Drop the air pressure down to zero as indicated on the air pressure gauge.





1.3. Remove The Auto-belay Box Covers

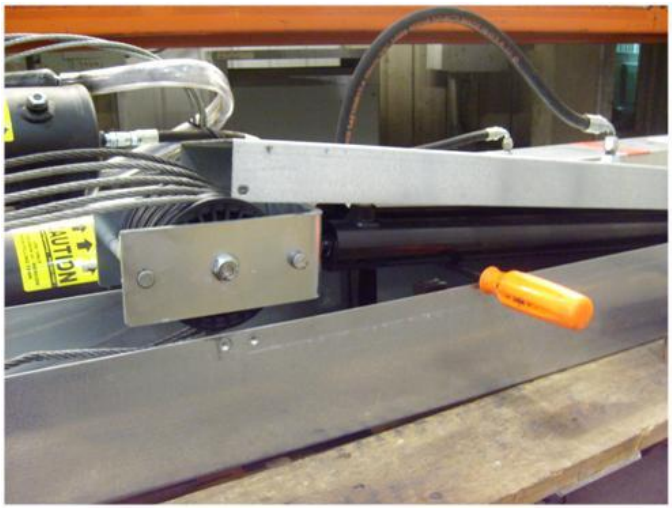
Remove the bolts that hold the covers in place using an SAE 7/16" socket or wrench. There are a total of 18 bolts with internal tooth lock washers to remove, 3 on each side of the top and bottom covers.



Move the cover with the air/hydraulic fluid reservoir off to the side to provide access to the cable inside the top of the auto-belay box. When moving the cover off to the side, be careful not to damage the hydraulic hose between the tank and the lower half of the auto-belay.

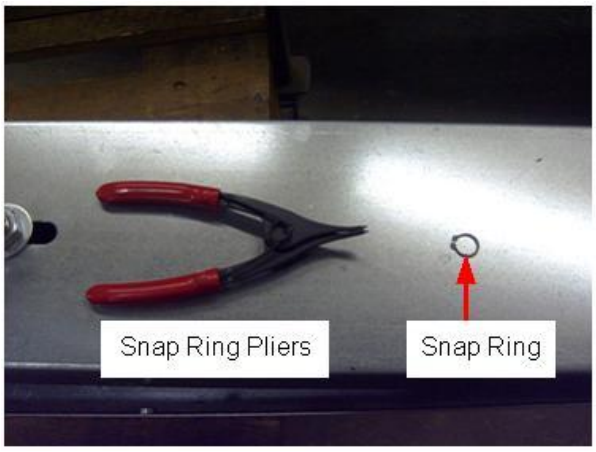
If you are changing cables on a stationary wall, find a way to hang the tank/cover from the steel structure that the auto-belay is mounted to. Do Not allow the tank/cover to hang by the hose anywhere as this will damage the hose.

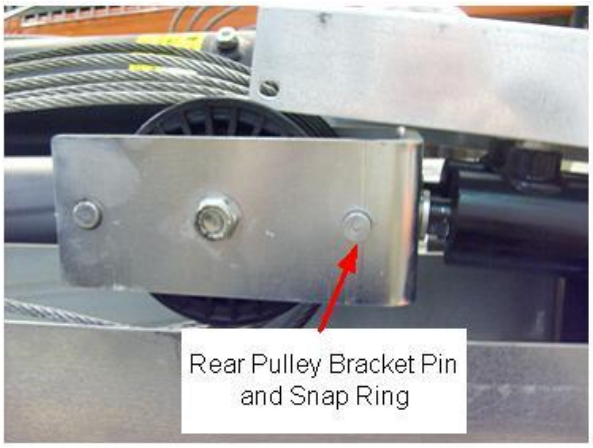
The auto-belay hydraulic cylinder rams are positioned inside the lower portion of the auto-belay box. A pin at the bottom of the rams and auto-belay box is all that holds them in place. You cannot move the lower auto-belay box cover to the side due to the hydraulic fittings that connect the outside hose to the inside hoses. To provide room for changing the cable, raise the entire hydraulic assembly at the top of the lower cover. Raise the entire assembly upward until you can insert an object that will rest on the top of the bottom auto-belay box sides and allow the hydraulic assembly to rest on the object. In the following example, a large screwdriver was used to hold the assembly up out of the auto-belay box. When raising the assembly and cover, be careful to not damage the hydraulic hoses and fittings both on the inside and outside of the Auto-belay.



1.4. Remove The Rear Pin From The Pulley Bracket

Remove the snap ring from one side of the rear pulley bracket pin using external snap ring pliers. While removing, spread the snap ring apart just enough to allow it to be removed from the groove in the pulley bracket pin. If the snap ring is spread too far, it will not re-engage in the groove properly when it is placed back on the pulley bracket pin. Should the snap ring be spread too far, it will require replacement with a new snap ring. Push the pulley bracket pin out through the opposite side of the pulley bracket. Set the pulley bracket pin and the snap ring to the side for re-attachment later.

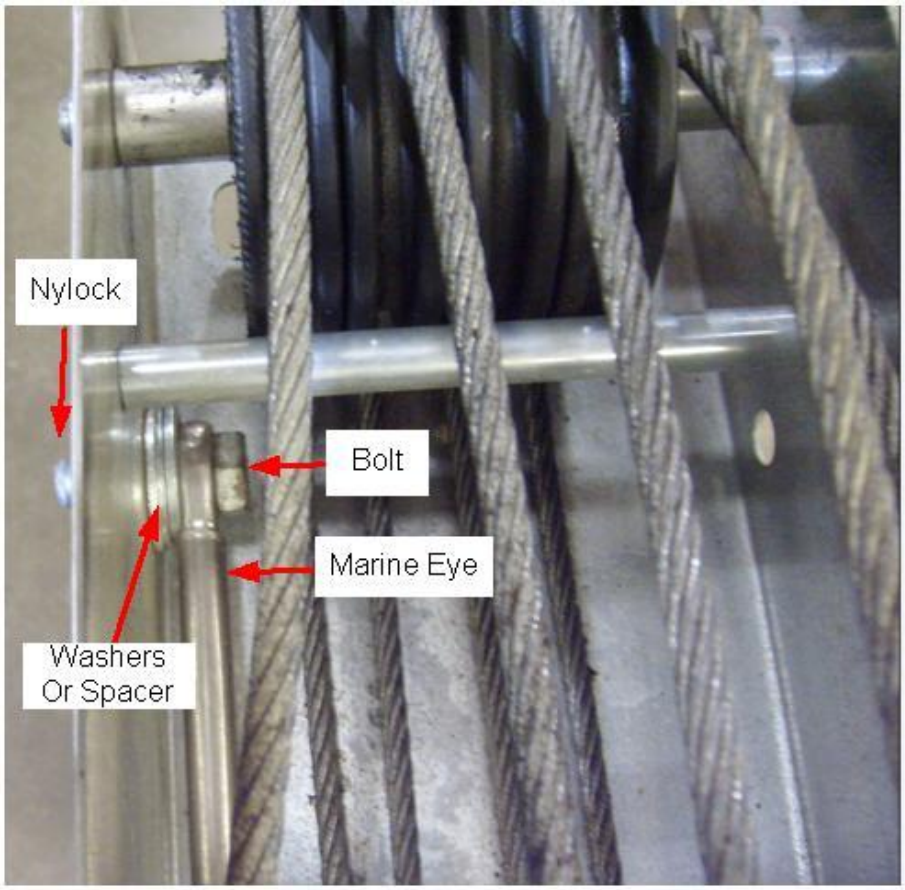




1.5. Remove The Internal Cable Mounting Bolt

Using two SAE ¾" wrenches or sockets, remove the internal cable mounting bolt.

Older versions of auto-belays utilized a spacers between the auto-belay box and the marine eye attached to the cable on the inside of the box. Current auto-belay manufacturing utilizes 3 washers instead of the spacer. Set the bolt, nylock and washers/spacer to the side for re-attachment later.



1.6. Remove The Cable

Remove the old cable from the auto-belay by pulling on the end of the cable that extends outside of the box. There is enough clearance for the marine eye to be pulled through between the pulleys and the pulley bracket attached to the hydraulic cylinders. Should the cable or marine eye get caught between the pulleys and the pulley bracket, you can help thread it through the area with your hands.

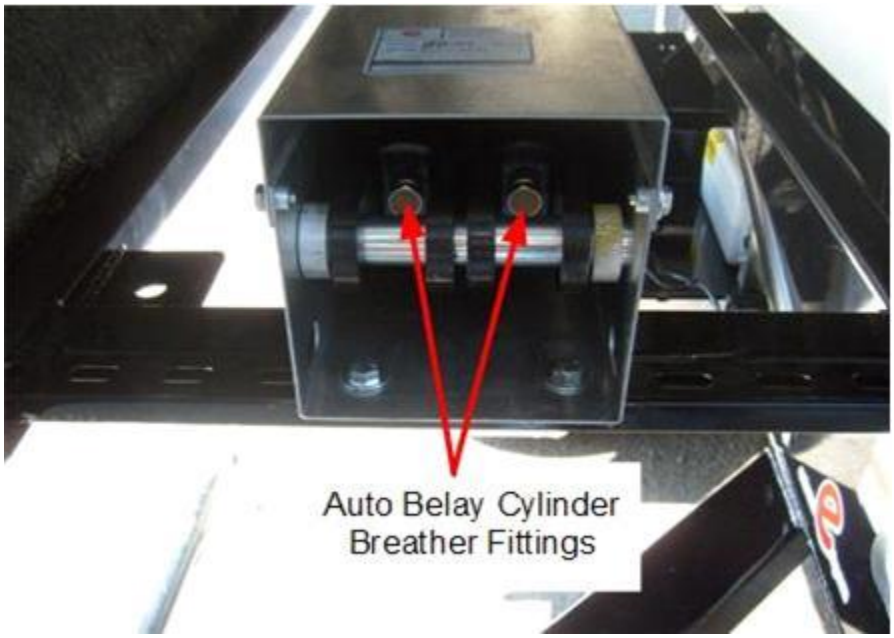
1.7. Safety Inspection Of Internal Components

Once the old cable has been removed, inspect all components inside the box for proper operation, damage or oil leakage.

Inspect all pulleys mounted at the top of the auto-belay box and to the pulley bracket. Ensure there is no damage to any of the pulleys. Check that all pulleys rotate smoothly and independently. When rotating a pulley, it should not rub against anything on either side of the pulley. There are machined spacers between each pulley to prevent them from rubbing against each other. Should a pulley rub against another, the spacer between them is either missing or damaged and needs to be replaced. Inspect pulleys for cracks or breakage. Any cracked or broken pulleys must be replaced.

Inspect all hydraulic fittings and hoses for damage or leakage. There should be no fresh oil residue beyond what may have occurred from the original Auto-belay manufacturing process. Any fitting leakage should be corrected either by additional tightening of the connection or replacing of the fitting if tightening does not stop the leakage. If there is leakage found on the rubber hose portion of a hydraulic hose or between the rubber hose portion and the fitting that is directly attached to the hose, the hose must be replaced.

One possible exception to visible oil is from the breather cap installed at the very bottom of each ram.



Extreme Engineering utilizes high pressure hydraulic cylinder rams in a low pressure environment. Therefore, a very small amount of weeping of oil may appear around the breather cap area of the auto-belay. This is considered normal.

If the oil residue is greater than the normal weeping amount, this may be an excessive leakage. Any hydraulic cylinder that is demonstrating excessive leakage must be replaced.

Excessive leakage can be determined as follows:

- If all three of the following conditions are true:
  - If you are having to add 10 to 15 psi of air pressure per month to the auto-belay air/oil tank, **and**
  - There is no oil residue seen from any other components inside and outside of the auto-belay other than around the normal weeping of oil at the breather cap on the bottom of the auto-belay cylinders, **and**
  - There are no air leaks coming from the auto-belay air tank, the hose attached to the air tank, the fittings and air pressure gauge attached to the air tank.

- You see visible oil dripping from the breather cap on a continual basis.

- You are at an event and you find a puddle of oil on the ground which originated from an auto-belay.

If at any time you are unsure whether an auto-belay is demonstrating excessive leakage, contact Extreme Engineering's Technical Support for further troubleshooting assistance.

1.8. Install New Cable Assembly

Replacement cables purchased from Extreme Engineering always come with a new swivel, protective swivel boot, protective cable hose and carabiner. Do not re-use the swivel.

Prior to replacing the existing cable, always determine which side of the auto-belay box the cable extends out of and which side the marine eye attaches to. String the new cable exactly like the existing cable. To install the cable, take the marine eye end of the new cable (the end without the swivel attached) and thread it in a looping fashion around each top and bottom pulley.

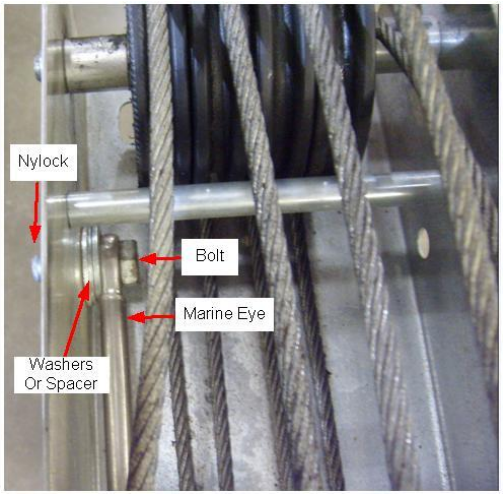
Drape the cable across the top of the spacer at the top of the auto-belay. Pull the cable down to the bottom pulley assembly (pulleys attached to the hydraulic cylinders). Place the cable in the groove of the pulley and wrap the cable over the top and back underneath the pulley. Pull the cable back up to the first top pulley on the same side. Bring the cable around from under this pulley back over the top with the cable in the groove of the pulley. Repeat this action until the cable has been wrapped around all pulleys from left to right. Pull the marine eye up to the to the top mounting hold on the side of the auto-belay box after completing the looping of the cable around all pulleys.

Ensure the cable is in the center groove of every pulley. Ensure the cable does not cross over itself anywhere throughout the loops.

Auto-Belay Cable Replacement Instructions

1.9. Attach Marine Eye to Auto-belay Box

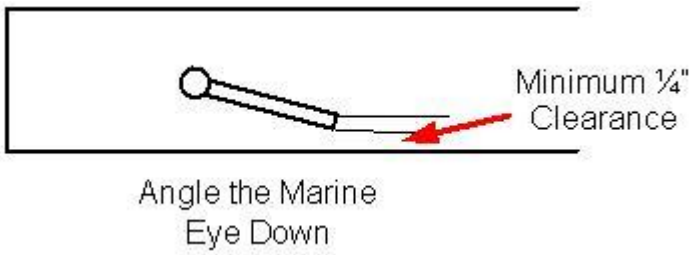
Re-attach the marine eye to the inside of the auto-belay box. Using the original ½" x 1-½" bolt, place the bolt through the eye of the marine eye. Place the three ½" internal diameter hole washers over the bolt on the opposite side of the marine eye.



<u>If your auto-belay cable originally contained a spacer instead of the three washers, there may be a clearance issue</u>. Some marine eyes attached to the cable can be up to 1/4 of an inch wider than others. This difference in width may cause clearance issues between the head of the attachment bolt and the cable loop nearest the bolt. If the head of the bolt does not clear the side of the cable by at least 1/8", replace the spacer with three standard ½" internal diameter washers.

Push the bolt with marine eye and three washers through the auto-belay box from the inside. Place the nylock nut onto the bolt on the outside of the auto-belay box and tighten. **<u>The nylock nut must be replaced every 3rd cable change</u>**. The nylon locking nut is a standard SAE ½" nut with a size 13 thread.

The marine eye should be angled down toward the bottom of the auto-belay box to prevent clearance issues with the pulley bracket attached to the hydraulic cylinders when the auto-belay cable is fully extended out of the auto-belay. Leave at lease ¼ inch clearance between the bottom of the marine eye/cable and the bottom of the auto-belay box.

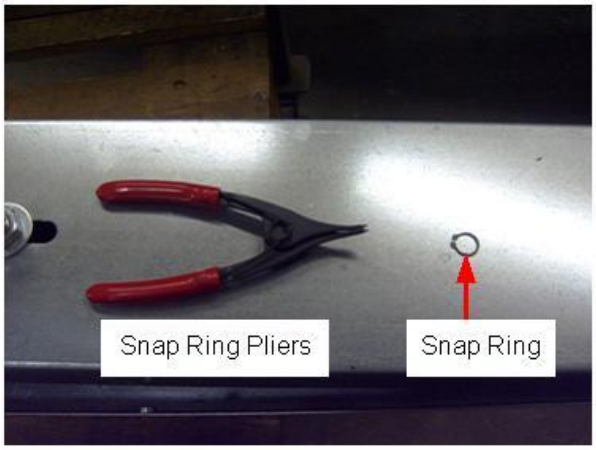


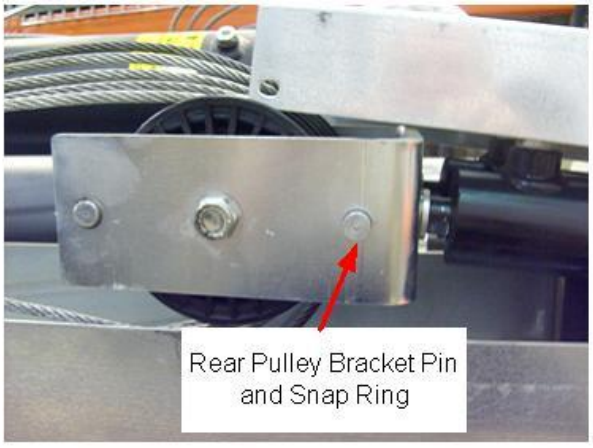
While holding the bolt on the inside of the auto-belay box with an SAE ¾" wrench, tighten the nylock nut with an SAE ¾" wrench or socket.

After tightening the bolt, check for clearances. Ensure there is clearance between the cable and the bottom of the Auto-belay box. Ensure the marine eye is at a downward angle toward the bottom of the Auto-belay box. Ensure there is clearance between the head of the bolt and the cable wrapped around the pulleys closest to the bolt.

1.10. Replace The Rear Pin On The Pulley Bracket

Re-insert the rear pulley bracket pin into the rear holes on the side of the pulley bracket. Using external snap ring pliers, spread the snap ring apart just enough to allow it to be placed over the end of the pulley bracket pin. Ensure the snap ring engages fully into the groove at the tip of the pulley bracket pin all the way around.





If the snap ring is spread too far during removal or replacement onto the pulley bracket pin, it will not re-engage in the groove of the pin properly. Should the snap ring be spread too far, it will require replacement with a new snap ring.

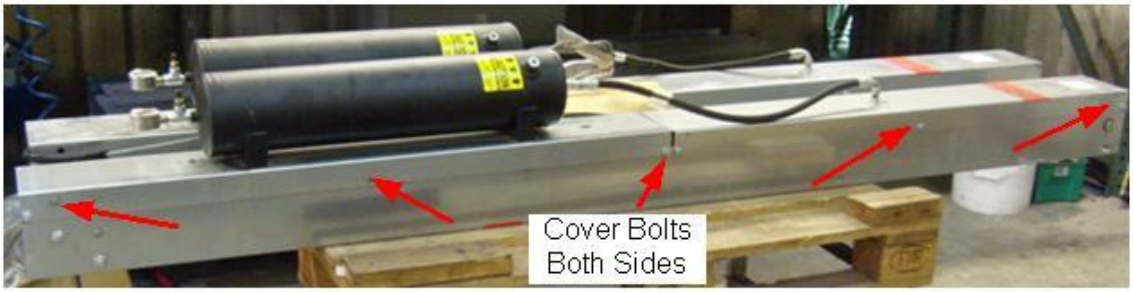
WRONG
Gap between
snap ring and pin

CORRECT
No gap between
snap ring and pin

1.11. Re-Attach Auto-belay Covers

Carefully lower the entire cylinder/pulley assembly back down onto the rubber saddle inside the auto-belay box. Place the lower auto-belay cover over the bottom portion of the Auto-belay box and align the mounting holes. Place the original small bolts with internal tooth lock washer into the holes to re-attach the bottom cover. Using an SAE 7/16" socket or wrench, tighten all nine bolts.

Re-attach the upper cover with the air/oil tank over the top the auto-belay. Place the small bolts with internal tooth lock washer into the holes to re-attach the top cover. Using an SAE 7/16" socket or wrench, tighten all nine bolts.



1.12. Cable Replacement Completion

To complete the removal of the old cable, you will need to remove the davit pulleys attached to the davit arms at the top of the wall.

Prior to removing each davit pulley assembly, note which side of the davit arm the davit pulley assembly is bolted to. Ensure you place the davit pulley assembly back onto the same side of the davit arm when re-attaching. Using two SAE 3/4" wrenches or sockets, remove both the upper and lower Davit Pulley assembly which the old cable passes through.

Auto-Belay Cable Replacement Instructions

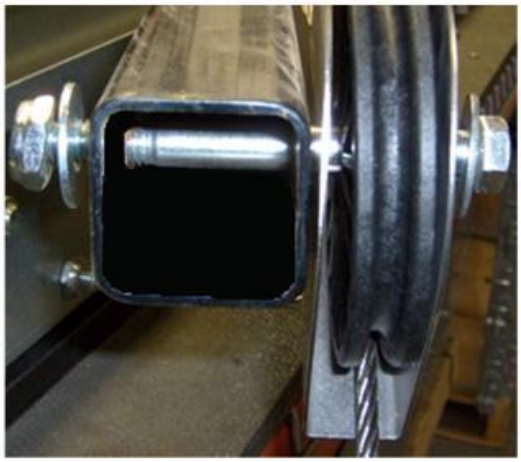
Place the new cable in the davit pulley assembly. Ensure that the cable is not wrapped round the tower frame anywhere between the auto-belay and the lower davit pulley at the front of the tower frame and between the lower and upper davit pulleys.

To place the new cable into the davit pulley assemblies, start by holding the davit pulley shield in one hand with the opening facing up. Lay the new cable through the shield. Place the pulley on top of the cable ensuring the cable is positioned in the groove of the pulley. Place one washer over the davit pulley assembly mounting bolt. While holding the shield and pulley with one hand, with the other hand insert the bolt through the hole in the shield, through the hole in the center of the pulley and out the other side of the shield. Place the davit pulley assembly back on the same side of the davit arm that it was originally removed from. Place the second washer over the bolt and then place the nylock nut onto the bolt.

1. Lay cable through davit shield

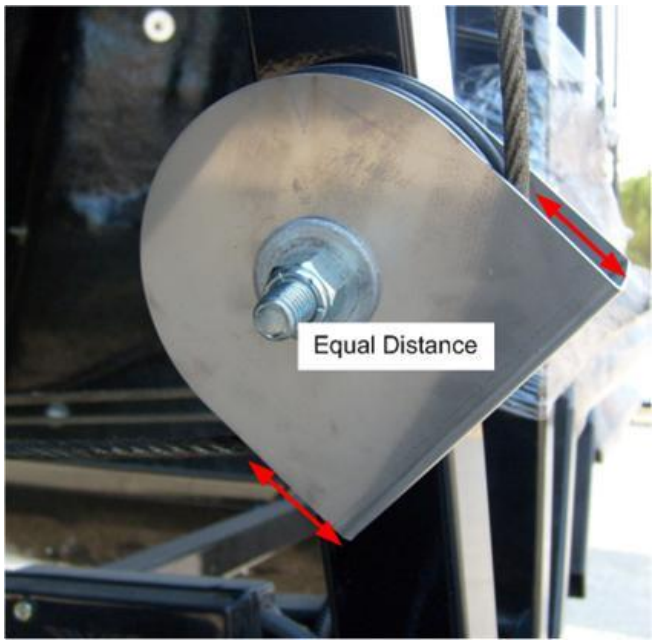
2. Lay pulley on top of cable with cable in groove of pulley

3. Bolt with washer through hole in shield and pulley



4. Washer and Nylock nut on outside of davit arm

Position the davit pulley shield for equal clearance between the cable and the shield at the point where the cable enters and exits the pulley assembly.



With the davit pulley shield held in the proper place, tighten the nylock nut and bolt using two SAE 3/4” wrenches or sockets.

1.13. Re-Pressurize The Auto-belay Air/Oil Tank

Prior to adding air, pull the end of the cable with the swivel down to its respective eye-bolt at the bottom of the climbing wall panel. Attach the cable swivel to the eye-bolt with the carabiner.

The auto-belay air fill Valve accepts a standard automotive style tire air chuck for adding air pressure.

When pressurizing the Auto-belay, any slack in the cable will retract back into the Auto-belay. Ensure the cable doesn’t get caught on yourself or your clothing during the adding of air pressure when the cable retracts into the auto-belay. The cable can retract very quickly, without warning, at some point during the adding of air pressure.

Slowly raise the air pressure in the tank to 65 psi as indicated on the auto-belay pressure gauge near the air fill valve. The proper air pressure operational range is between 60 and 65 psi as indicated on the auto-belay pressure gauge with the cable extended to the eye-bolt. Replace the black plastic air fill valve cap onto the air fill valve.

1.14. Auto-belay Operational Safety Inspection

If you are replacing cables on a Mobile Wall, following the setup procedures found in your Mobile Wall Owner's Manual to setup and raise the mobile wall for operation. For Stationary Walls, the auto-belay is already in the vertical position.

Test each auto-belay operation by first priming the system before you climb. This "Prime Before You Climb" operation must be performed prior to the first climb after setting up a mobile wall for operation and at the beginning of each day for stationary wall operation. As a good measure of safety, you should periodically recheck the auto-belay operation during the day's operation of the wall.

To "**Prime Before You Climb**", disconnect the cable from the eye-bolt near the bottom of the climbing surface and fully extend the cable (pull the cable all the way out) until it stops. Holding onto the cable, allow the cable to retract back into the auto-belay three to four feet and then fully extend the cable again until it stops. Perform this action a minimum of four times. This action will purge any air that may have relocated from the air/oil reservoir tank into the hydraulic system of the auto-belay during the cable swap procedure.

WARNING: The air pressure in the auto-belay system is what causes the cable to be retracted when releasing the cable or climbing the wall with the cable attached to the climbing harness. This restriction of movement provided by the air pressure is NOT enough for proper operation of the auto-belay.

If air is displaced from the air/oil tank into the hydraulic check valve area of the auto-belay system, there will not be the proper restriction of movement when the cable is pulled out of the auto-belay. NEVER CLIMB a wall with an auto-belay that does not exhibit the proper restricted movement when extending the cable out of the auto-belay for the complete length of travel from the top to bottom of the climbing wall surface. There is a very noticeable difference between air pressure pulling on the cable versus the restricted movement caused by oil when the cable is extended.

The oil in the system is what provides the proper restriction to control the speed of decent when a climber is being lowered to the ground by the auto-belay. If there is air in the system when a person has climbed to the top of the wall and then lets go to lower back down to the ground, the decent will NOT be slow and controlled. Personal injury may occur if the air has not been fully purged from the system.

1.15. Auto-belay Operational Safety re-Inspection

The following day or before the wall is used the first time after a cable replacement, check the auto-belay for excessive air loss as indicated on the air pressure gauge as well as excessive oil leakage from anywhere on the auto-belay system.

There may be a small amount of excessive oil leakage initially as a result of releasing the air pressure from the auto-belay system during the cable swap. Clean up any oil residue that may have appeared and follow the procedure for determining excessive leakage as found in section 1.7 Safety Inspection Of Internal Components

ALWAYS REMEMBER, “PRIME BEFORE YOU CLIMB”.