

Part 1

Top hydraulic cylinders and lock assemblies removal/reinstall

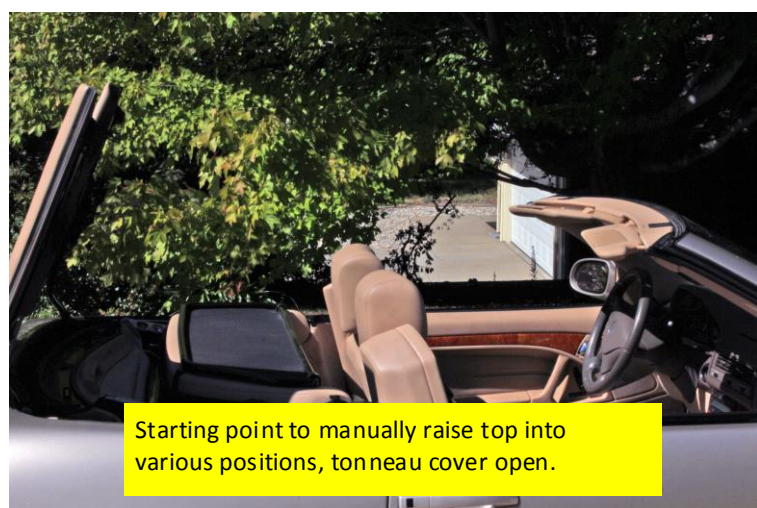
- 1) Bow extension cylinders (96-02)**
- 2) Top locks and cylinders**
- 3) Tonneau Cover Lock(s)**
- 4) Main lift cylinder (in part 2 only)**
- 5) Rear locks and tonneau cover lift cylinders**

Bow Extension Cylinder Removal and Reinstall 96-02 years

I recently had to remove and install just the bow extension cylinders and used the Top Hydraulics guide and other sources of information but found some details lacking so I've created this supplemental guide. This information is specific to 96-02 cars with both bow cylinder pins held in place by e-clips. Previous years that used the Allen head bolt require access through the interior of the car and the additional steps to remove interior panels and also use the "match trick" for re-installation. Much of this information can still be used for these other model years but I tried to eliminate any steps not required for the 96-02 cars. If you're just removing bow cylinders and not the main cylinders no interior access is necessary, all the work can be done outside the car. The two bow cylinder pins are removed and the switch on the left cylinder is removed to enable pulling the bow cylinders out of the top frame. The top plate with folding flaps also does not need to be removed. Reinstall doesn't require using the match trick, using the interior access hole or lowering the top into the storage area, which is likely safer for the bow cylinder switch and preventing switch damage as the cylinder position moves a lot when the top is lowered completely. I attempted to include additional pictures and additional detail to help plan for the job before getting started. I've included tool advice and more info about e-clip sizing and the various top positions for the different tasks. Hope this helps others. I was able to pull both bow extension cylinders, replace the rod seals and reinstall in about 6 hours and I'd say about 4 hours of this time was taking apart the cylinders and replacing the seals, which is not something I'd recommend for everyone, bow cylinders are expensive and they require the right tools(see part 2) and careful disassembly to prevent damaging them. Even if you're doing the main cylinders at the same time as the bow cylinders I would still use this removal and installation method for the bow cylinders and not bother using the interior access hole for the one pin. This is my first cut at this so any errors or other suggestions I'll revise in future versions.

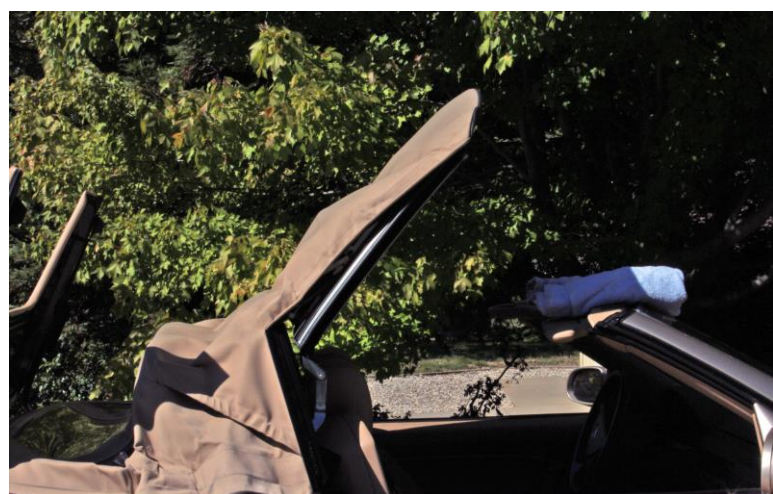


Soft top positions for the different steps of removing & reinstalling the bow extension cylinders. The two vertical positions are for removing the top pin and the rear bow up (partial and full up) are bottom pin, switch, hydraulic lines and cylinder removal from the top frame.

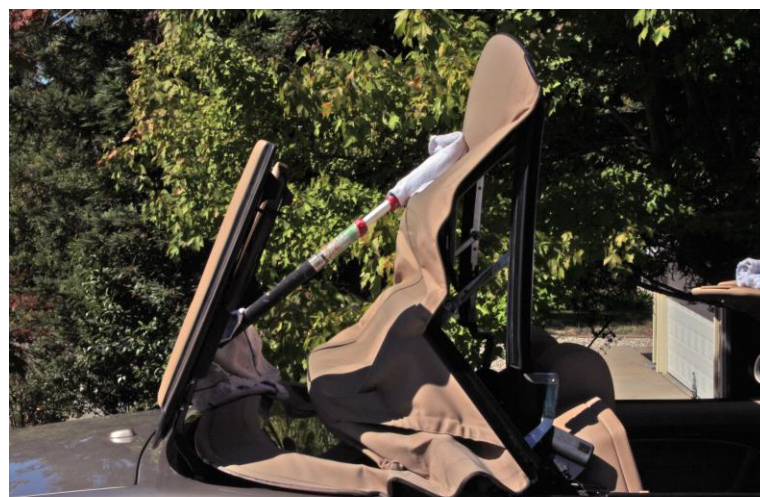


Starting point to manually raise top into various positions, tonneau cover open.

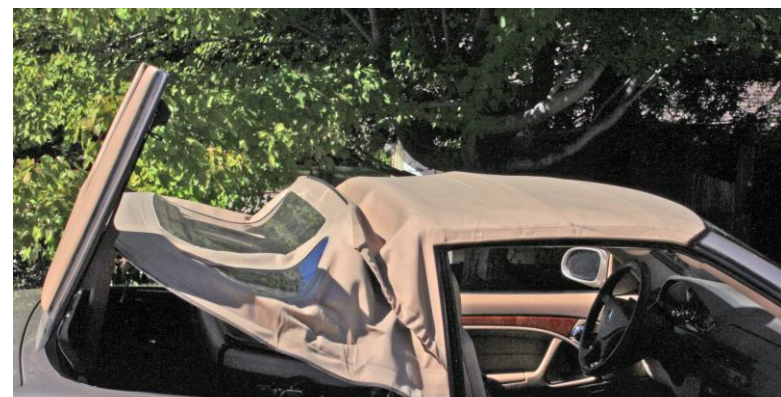
Note the brace used to hold the top and bow from moving. Highly recommend having something to keep the top from moving while working, especially in the vertical position. I also used rolled up towels on top the windshield area to prevent the front latches from locking.



Position for bow cylinder top pivot pin removal. Either stop the top near this position or raise manually from starting position. Hold or brace in this position while removing top pin Just past vertical to enable clearance for top pin removal.



Top position for bow cylinder top pin e-clip, wave washer and wire guide removal/installation. For pin removal see next picture, top must be moved forward some. Easier to remove e-clip, wave washer and switch guide in this more vertical position. Note the high-tech paint extension handle to brace soft top.



Position for bow cylinder removal from within the top frame after pivot pins, switch and hydraulic lines are removed/disconnected. Top raised and does not need to be latched, just the only picture I have in this position.



Position for bow cylinder bottom pin, e-clips(2) and pin removal/installation, switch removal/install and main top pin removal/install. Top raised but not latched in front, bow up. Rolled towels to cushion and prevent top from latching in front.

Tools

Here are some tools I think are essential before starting the task of removing and installing the rear bow cylinders.

Since e-clips are involved and in tight spaces I think some type of clip installation tool is necessary. Also just plan on losing one or more e-clips and have some spares handy before beginning the job. More on e-clips size later.

A long reach hook and pick tool set is great to have to position and pull the e-clips off the shaft and I added a small strong round magnet taped to the end of the pick that helps capture the clips as they're removed. See pictures.

Long needle nose pliers are needed to pull out and install the pivot pins. Other basic tools include a long flat head screw driver, magnetic pick-up tool, good light and a Philipps head screwdriver for the switch screws.

I really like this e-clip tool (pictured)
<https://www.amazon.com/Jonard-CS-1022-Setter-Length-Thickness/dp/B006C3TRWQ>



Bow cylinder top pin removal



Top position for e-clip and wire guide removal.

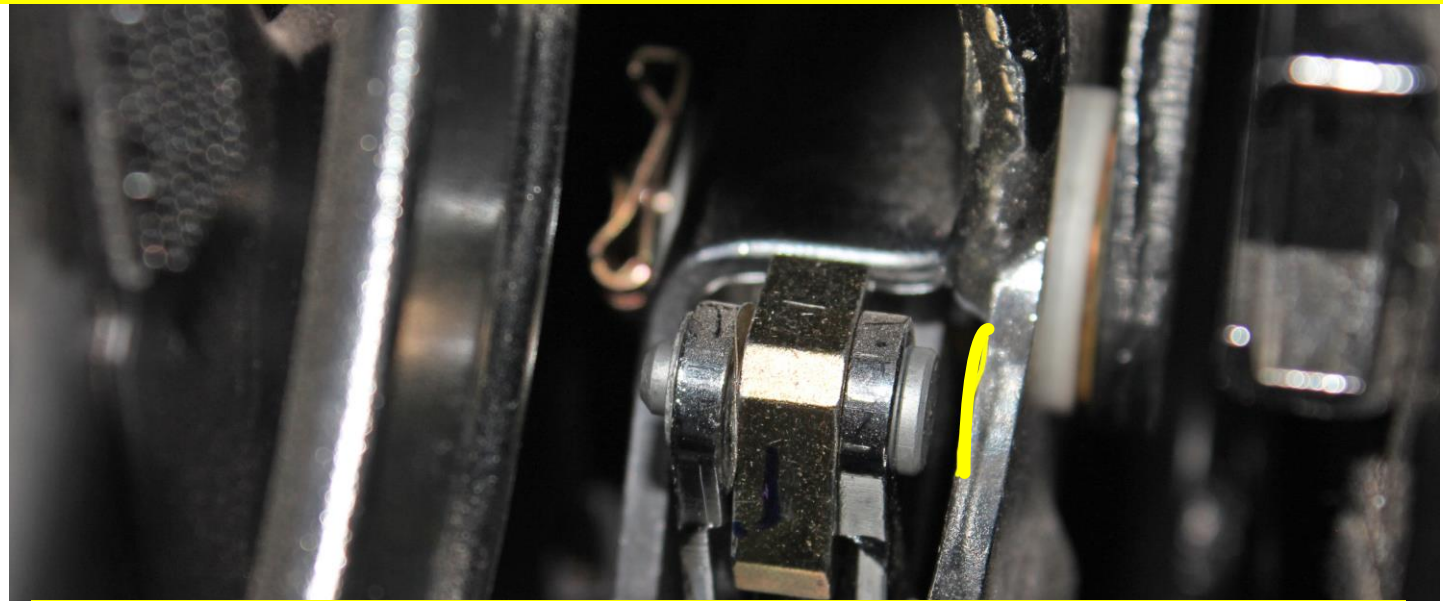


Top position for wave washer and top pin removal

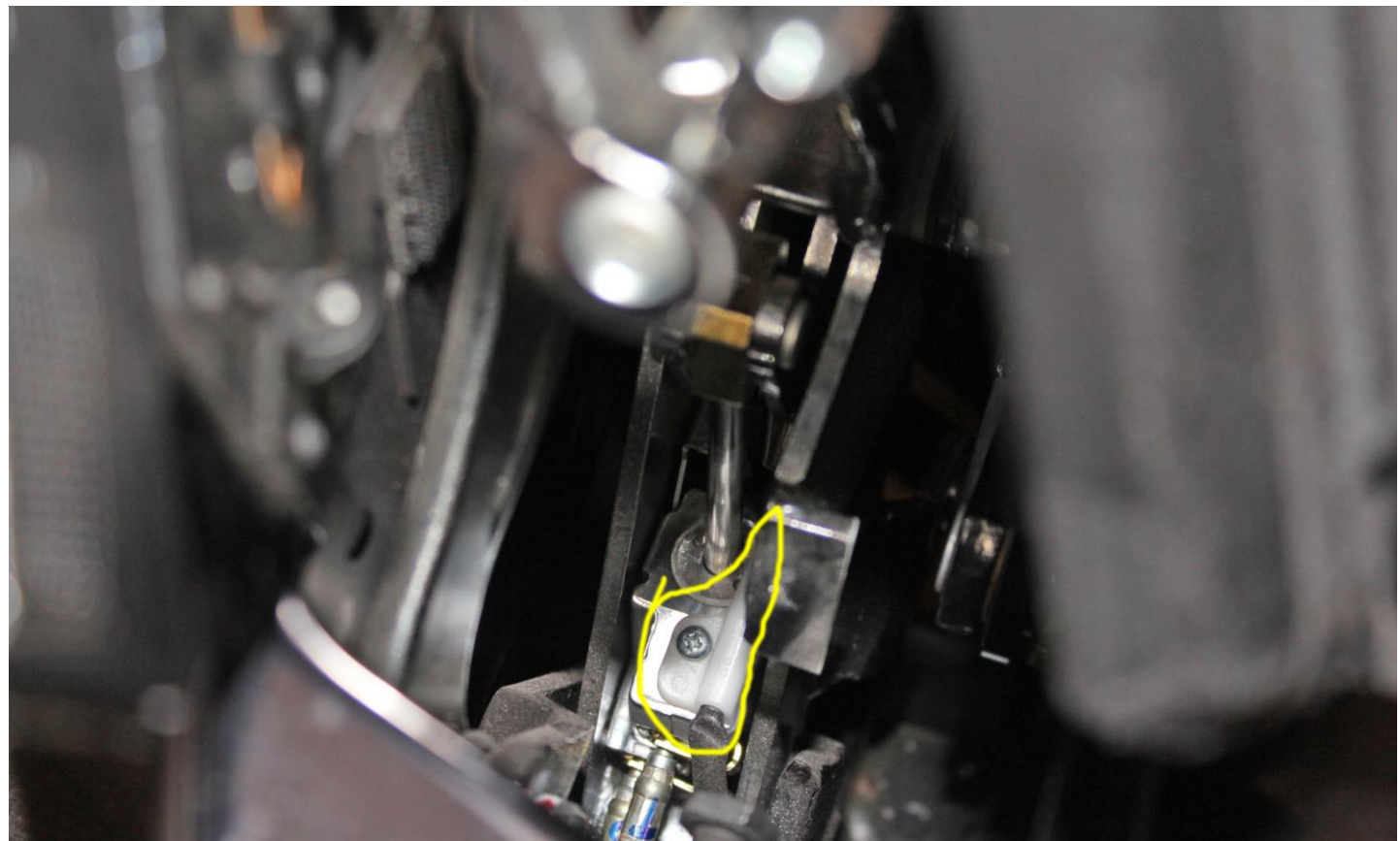


Driver side bow cylinder top pin and working above door jam area. One inner e-clip(left most), one wave washer and the top pin. Remove top wire guide screw and plastic guide first. Use a magnetic pick-up tool or magnetized screwdriver for screw retention. Then remove e-clip with pick and back out pin until wave washer can be pulled out, then remove pin completely. Top vertical position needs to move towards windshield direction to provide enough clearance for the pin. Push cylinder rod all the way down after pin removal.

Bow cylinder top pin and wire guide removal (cont.)



If the top is straight up vertical, which is the best position for removing the e-clip and switch guide but the pin cannot be pushed out enough to remove wave washer or be removed completely. The yellow highlight line shows where the pin will hit the frame and why the top needs to be moved forward to the windshield some to get the needed clearance. The top should held or braced when it's in this position as the top can fall down against the top of the windshield frame.



Top wire guide that needs to be removed. Magnetized screwdriver or magnetic pick up tool needed to retain screw after removal. Top position straight up vertical is most convenient for this task.

Bow cylinder bottom pin removal



Bow cylinder bottom pin and e-clips, in top storage compartment area. See next page for removal.

Top position, bow up

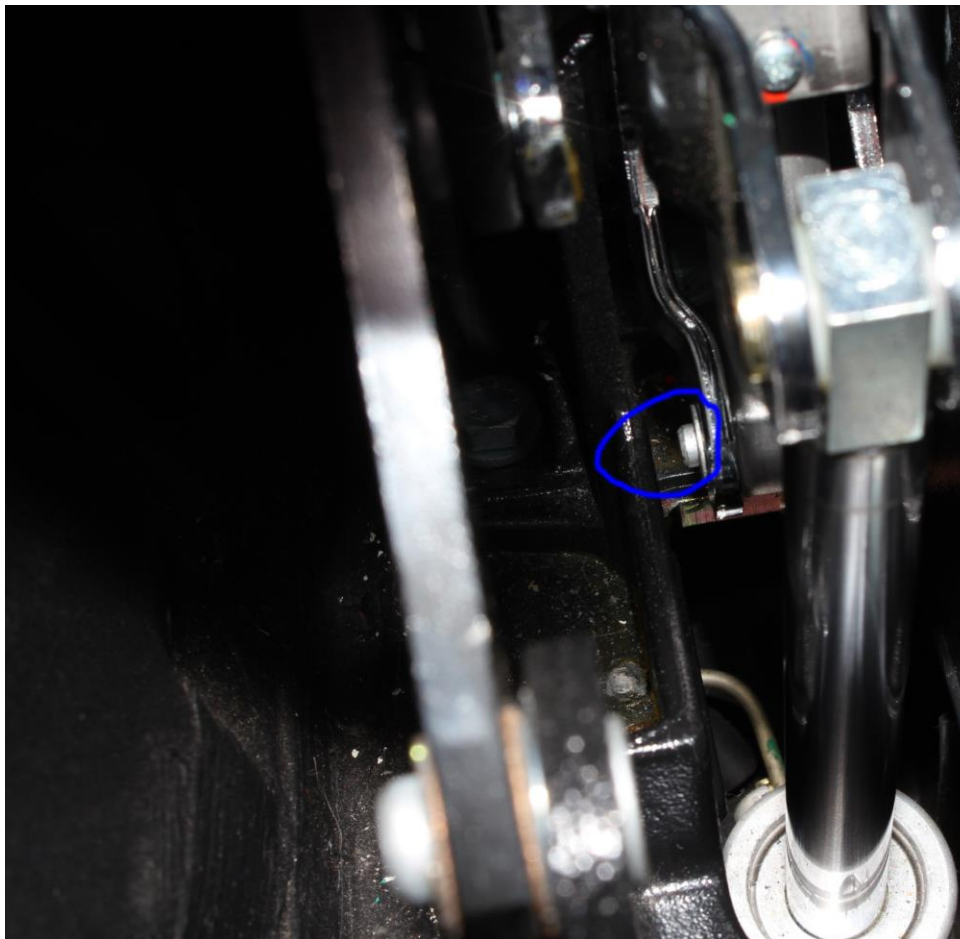


Main lift cylinder can be disconnected at top pivot pin and rod pushed all the way down to provide better access to rear bow cylinder switch and bottom e-clips. Push down and hold position to give time for fluid to drain out of cylinder. Doing this is optional.

Bow cylinder bottom pin removal

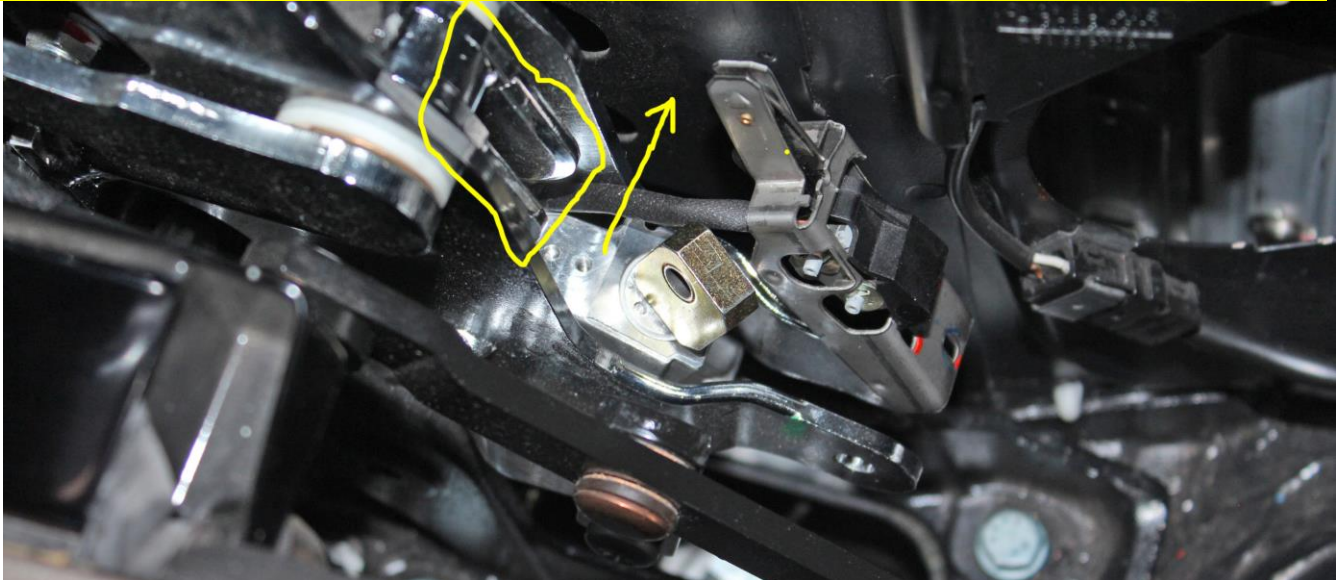


Driver side bow cylinder right or inner e-clip. Remove e-clip with pick tool then push pin to left some and remove left side e-clip. Remove 3 switch screws before removing bottom pin completely. Have magnetic pick-up tool or magnetized screwdriver to retain screws. Main cylinder rod can be disconnected at top pin and moved out of the way for better access. Optional



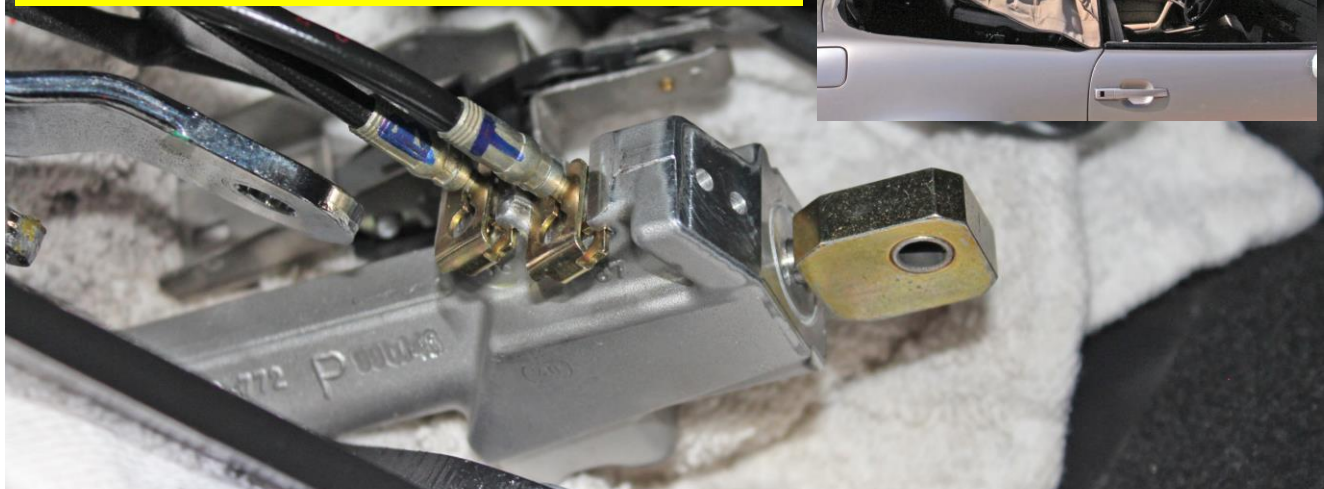
Driver side bow cylinder left or outer e-clip. Remove before pushing pin out to the left. Limited clearance for pin removal with e-clip attached so better just to remove outer e-clip.

Bow cylinder removal from frame



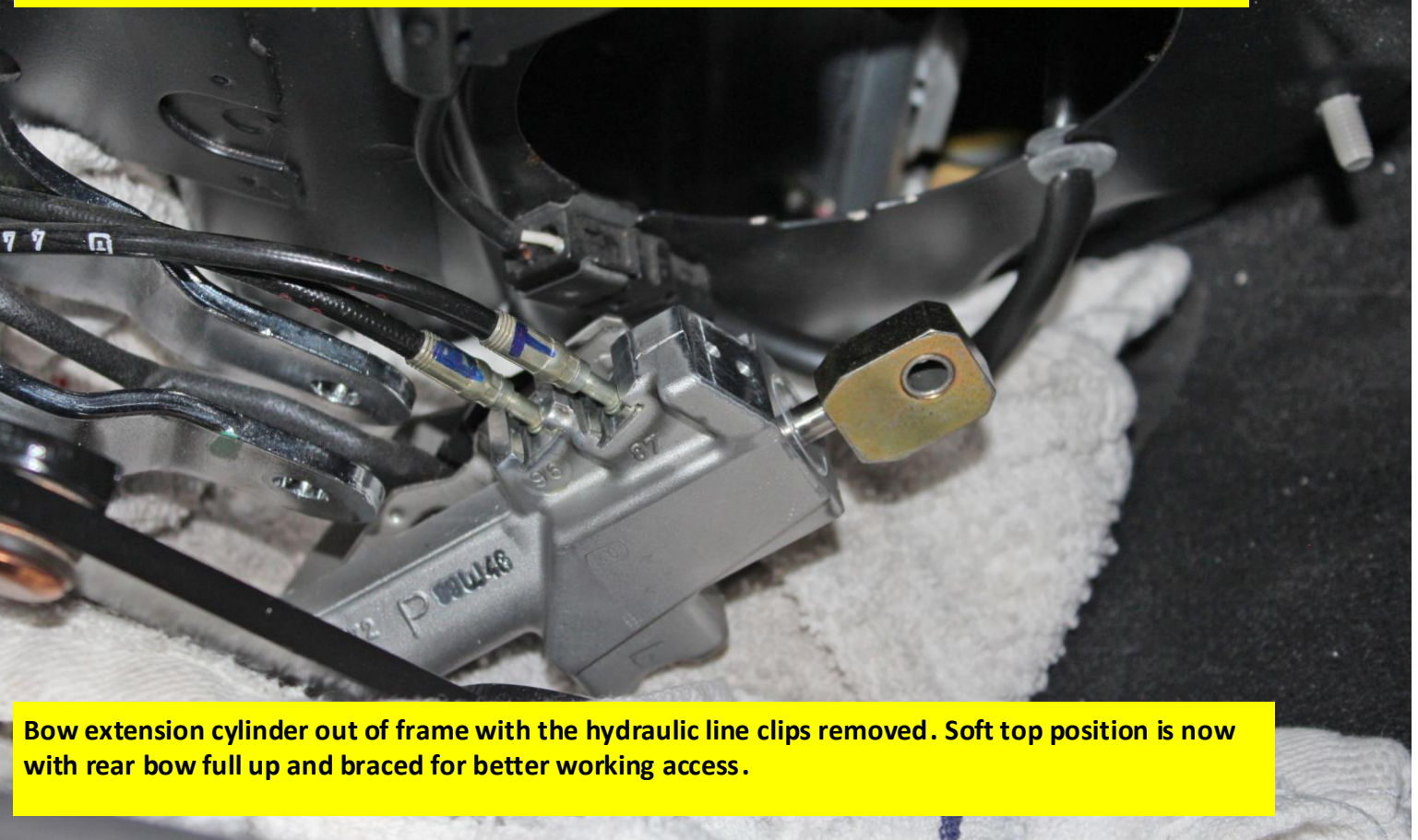
Bow extension cylinder with both pins removed, switch removed and set aside. Rear bow of top needs to be repositioned down to gain enough clearance to pull the cylinder out of the frame, see highlighted area showing how the bow upper pivot arm limits clearance with bow currently in the up position. As the bow is lowered the pivot arm rotates and provides the needed clearance to remove the cylinder from within the soft top frame.

Note to orientation of the hydraulic line clips for reassembly, rounded end towards outside of car for the drivers side, passenger side is opposite, rounded end inward.



Here's the bow cylinder removed from the frame. To pull the cylinder out of frame the rear bow needs to be approximately in the position shown above, about halfway up. There's enough room to reach in and pull the cylinder up out of the frame from outside the car. This bow position provides the needed clearance with the upper pivot arm and enables removing the bow cylinder from the frame. On a later page there's more pictures and information about the pivot arm to switch clearance. Basically, the lower the rear bow position the more clearance you have to remove the cylinder so raise the bow just enough to gain adequate access from outside the car.

Bow cylinder removal



Bow extension cylinder out of frame with the hydraulic line clips removed. Soft top position is now with rear bow full up and braced for better working access.



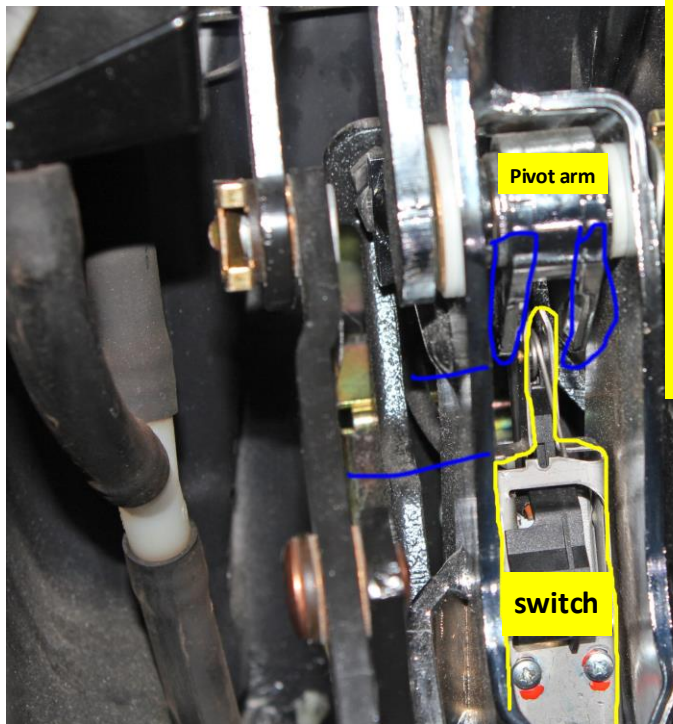
The rear bow cylinder is out and ready for rebuild with new seals. For reinstall start here and hook up lines with the clips in the correct orientation (round end outward, see previous page). Adjust rear bow position down and insert cylinder back in frame area. Make sure the switch wire routing is correct. Install bottom pin and clips then install switch (three screws). Move rear bow full down and move the top position to the vertical position, orient the top pivot block correctly and install top pin,



Wider side

Check when reinstalling... Correct orientation of the rod end eyelet for switch actuation . The driver side bow cylinder (has the switch) rod end block is not symmetrical, the wider side needs to go towards the switch like shown. Switch is not installed in this picture but with the cylinder in this position the switch would go on bottom side of cylinder.

Information on the bow cylinder with switch and potentially damaging the switch.



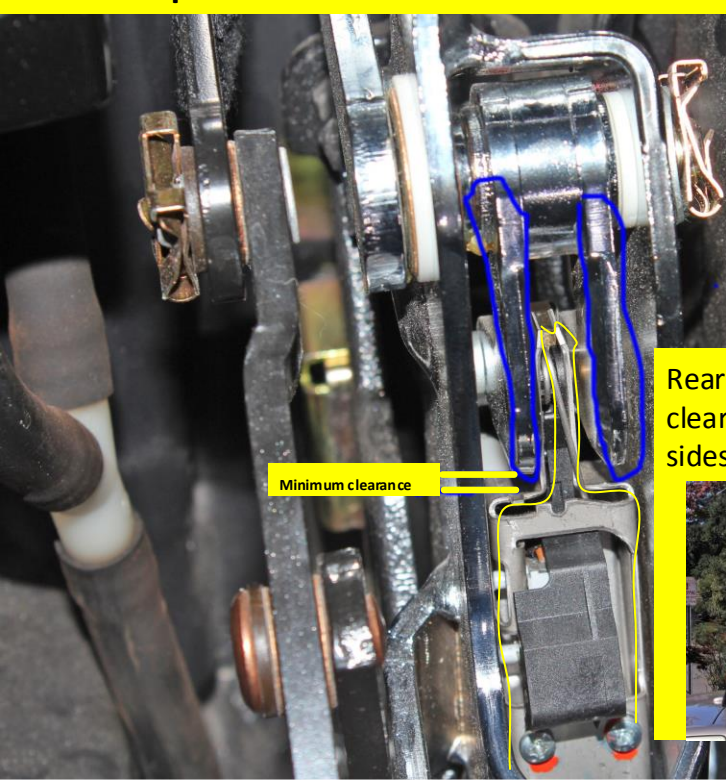
Rear bow partially down. Position needed to remove cylinder from frame. As the bow is lowered there's more clearance with the L-shaped pivot arm sides. Yellow outline is switch and blue highlight is upper pivot arm sides and clearance to switch. Switch is attached to bow cylinder.



In the Top Hydraulics guide for bow cylinders there's mention of crushing the switch when the bow cylinder is loose in the frame and the top is being moved around. I think this most likely occurs when the bottom pin is removed and the cylinder can move around within the frame, especially when the soft top is lowered completely to access the bolt/pin through the interior access hole. With the bottom pin installed I could not see any contact with the switch when the top is up but there is minimum clearance between the switch and pivot arm sides when the bow is up.

My advice is to leave the right(passenger) side bow cylinder connected while working on the left side to limit the up travel of the bow and when it's necessary to move the rear bow around to remove the cylinder in the frame area (and bottom pin is removed) then always lift the bow slowly and gently while shining a light in the area show in the pictures and make sure there's no contact with the switch.

Minimum pivot arm sides to switch clearance when bow is up.



Rear bow up, note the minimum clearance between the pivot arm sides and switch in this position.



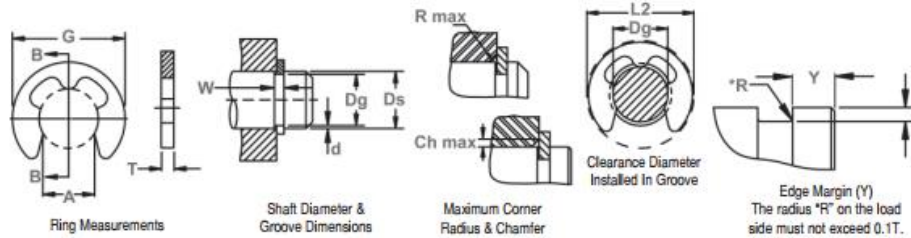
To remove the bow cylinder from inside the top frame the bow does need to be roughly midway (or lower) between full up and full down to provide enough clearance while also providing access from the outside the car to pull it out of the frame. Once out then the bow can be up completely to remove the hydraulic line clips.

I had problems getting the proper size e-clips to use as spares so here's some information about e-clip sizing. Groove size is the key dimension and for the rear bow pins it's 5mm. There are naming differences with e-clips so you may see the correct e-clip specified as either a 5mm or 6mm size. I think the difference may be due to the difference standards; DIN or ANSI. It's best to order quality e-clips with part numbers and dimensions known. I finally order Rotor clip brand e-clips from McMaster Carr. Two attempts ordering clips from Amazon were unsuccessful, horrible quality and sizing. Below I highlighted the correct metric sizing for ISO and ANSI standards. I've read 7/32 e-clips could also be used but I didn't try this e-clip size.

DE Shaft Rings (DIN 6799)**

Radially Assembled, External E, Metric

Perhaps the most popular and widely used radial retaining ring is the "E" (so named because it is shaped like the letter "E"). Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.

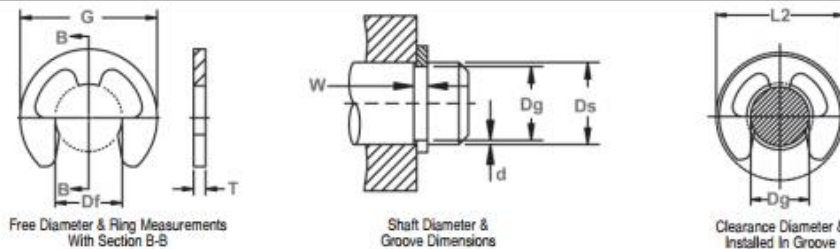


RING NO.	NOM SIZE	SHAFT DIA. (mm)			GROOVE SIZE			RING SIZE & WEIGHT				CLEARANCE		SUPPLEMENTARY DATA									
		Dg	From	To	Dg	Tol.	W	Tol.	T	Tol.	A	Tol.	kg/1000	G Ref.	L2 Max.	Y Min.	Pr kN	Pg kN	Ds'	R/Ch Max.	Pr kN	Max. load w/ R/Ch Max. kN	RPM Limits
DE-0.8	0.8	1.0	1.4	0.8	-0.04	0.24	+0.04	0.2				0.58		0.003	1.95	2.25	0.4	0.08	0.03	1.2	0.3	0.04	5000
DE-1.2	1.2	1.4	2.0	1.2		0.34	-0.00	0.3				1.01		0.009	2.90	3.25	0.6	0.12	0.04	1.5	0.4	0.06	4700
DE-1.5	1.5	2.0	2.5	1.5	-0.06	0.44		0.4				1.28	±0.04	0.021	3.90	4.25	0.8	0.22	0.07	2.0	0.6	0.11	4200
DE-1.9	1.9	2.5	3.0	1.9		0.54		0.5				1.61		0.040	4.40	4.8	1.0	0.35	0.10	2.5	0.7	0.17	4000
DE-2.3	2.3	3.0	4.0	2.3		0.64		0.6				1.94		0.069	5.90	6.3	1.0	0.50	0.15	3.0	0.9	0.24	3800
DE-3.2	3.2	4.0	5.0	3.2		0.84		0.6	±0.02			2.70		0.088	6.90	7.3	1.0	0.65	0.22	4.0	0.9	0.32	3500
DE-4	4.0	5.0	7.0	4.0	-0.075	0.74	+0.05	0.7				3.34		0.158	8.85	9.3	1.2	0.95	0.25	5.0	1.0	0.47	3200
DE-5	5.0	6.0	8.0	5.0	-0.74	-0.00	0.7	4.11	+0.048	0.236	10.85	11.3	1.2	1.15	0.90	7.0	1.0	0.60	2800				
DE-6	6.0	7.0	9.0	6.0		0.74		0.7				5.26		0.255	11.80	12.3	1.2	1.35	1.10	8.0	1.1	0.70	2500
DE-7	7.0	8.0	11.0	7.0		0.94		0.9				5.84		0.474	13.80	14.3	1.5	1.80	1.25	9.0	1.3	1.00	2200
DE-8	8.0	9.0	12.0	8.0	-0.09	1.06		1.0				6.52	+0.058	0.660	15.75	16.3	1.8	2.50	1.42	10.0	1.5	1.25	2000
DE-9	9.0	10.0	14.0	9.0		1.15		1.1				7.63		1.090	18.20	18.8	2.0	3.00	1.60	11.0	1.6	1.50	1700
DE-10	10.0	11.0	15.0	10.0		1.25		1.2				8.32		1.250	19.70	20.4	2.0	3.50	1.70	12.0	1.8	1.75	1500
DE-12	12.0	13.0	18.0	12.0	-0.11	1.36	+0.06	1.3	±0.03	10.45		1.630		1.630	22.70	23.4	2.5	4.70	3.10	15.0	1.9	2.30	1300
DE-15	15.0	16.0	24.0	15.0		1.55	-0.00	1.5		±0.07	12.61		±0.07	3.370	28.70	29.4	3.0	7.80	7.00	20.0	2.2	3.30	1100
DE-19	19.0	20.0	31.0	19.0		1.80		1.75		15.92		6.420		6.420	36.50	37.6	3.5	11	10.00	25.0	2.5	3.60	780
DE-24	24.0	25.0	38.0	24.0	-0.13	2.05		2.00		21.88	+0.084	8.550		8.550	43.50	44.6	4.0	15	13.00	30.0	3.0	4.00	550
DE-30	30.0	32.0	42.0	30.0		2.56		2.50		25.80		13.50		13.50	51.30	52.6	4.5	23	16.50	36.0	3.5	5.30	420

ME Shaft Rings

Radially Assembled, External 'E', ANSI Metric

Perhaps the most popular and widely used radial retaining ring is the "E" (so named because it is shaped like the letter "E"). Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.



RING NO.	SHAFT DIAMETER		GROOVE SIZE			RING SIZE & WEIGHT				CLEARANCE DIA.		THRUST LD (kN)					
	mm	DEC	Dg	Tol.	F.I.M.**	W	Tol.	d	DI	Tol.	T	Tol.	kg	G	L2	Pr	Pg
ME-1*	1	039	0.72	-0.05	0.04	0.32	+0.05	0.14	0.64		0.25	±0.05	0.004	2.0	2.2	0.06	0.02
ME-2	2	079	1.45		0.04	0.32		0.28	1.30		0.25		0.014	4.0	4.3	0.13	0.09
ME-3	3	118	2.30		0.04	0.50	+0.10	0.35	2.10	+0.03	0.40		0.036	5.6	6.0	0.30	0.17
ME-4	4	157	3.10	-0.08	0.05	0.70		-0.45	2.90	-0.08	0.60		0.095	7.2	7.6	0.70	0.30
ME-5	5	197	3.90		0.05	0.70		0.55	3.70		0.60		0.13	8.5	8.9	0.90	0.40
ME-6	6	236	4.85		0.05	0.70		0.58	4.70		0.60		0.21	11.1	11.5	1.10	0.60
ME-7	7	275	5.55		0.08	0.70		0.73	5.25		0.60		0.34	13.4	14.0	1.20	0.80
ME-8	8	315	6.40		0.08	0.70		0.80	6.15		0.60		0.36	14.6	15.1	1.40	1.00
ME-9	9	354	7.20	-0.10	0.08	1.00		0.90	6.80		0.90	±0.06	0.58	15.8	16.5	3.00	1.30
ME-10	10	393	8.00		0.08	1.00	+0.15	1.00	7.60	+0.05	0.90		0.68	16.8	17.5	3.40	1.60
ME-11	11	433	8.90		0.10	1.00		1.05	8.55	-0.10	0.90		0.68	17.4	18.0	3.70	1.90
ME-12	12	472	9.80		0.10	1.20		1.20	9.20		1.10		1.00	18.6	19.3	4.90	2.30
ME-13	13	512	10.30		0.10	1.20		1.35	9.95		1.10		1.13	20.3	21.0	5.40	2.90
ME-15	15	591	11.80	-0.15	0.10	1.20		1.60	11.40		1.10		1.40	22.8	23.5	6.20	4.00
ME-16	16	630	12.50		0.10	1.20		1.75	12.15		1.10		1.45	23.8	24.5	6.60	4.50
ME-18	18	709	14.30		0.10	1.40		1.85	13.90	+0.10	1.30		2.3	27.2	27.9	8.70	5.40
ME-20	20	787	16.00		0.10	1.40		2.00	15.60	-0.15	1.30		2.8	30.0	30.7	9.80	6.50
ME-22	22	866	17.40	-0.20	0.10	1.40		2.30	17.00		1.30		3.4	33.0	33.7	10.80	8.10
ME-25	25	984	19.20		0.10	1.40		2.60	19.50		1.30		4.2	37.0	37.7	13.20	10.10

Position of the rear bow cylinder within the top frame at the different top positions. Rod extension is not shown correctly just the relative position of the cylinder in the top frame.



Front top lock cylinders removal. Begin with top cover on windshield removal. Two screws each end, one screw hidden underneath rubber end piece.

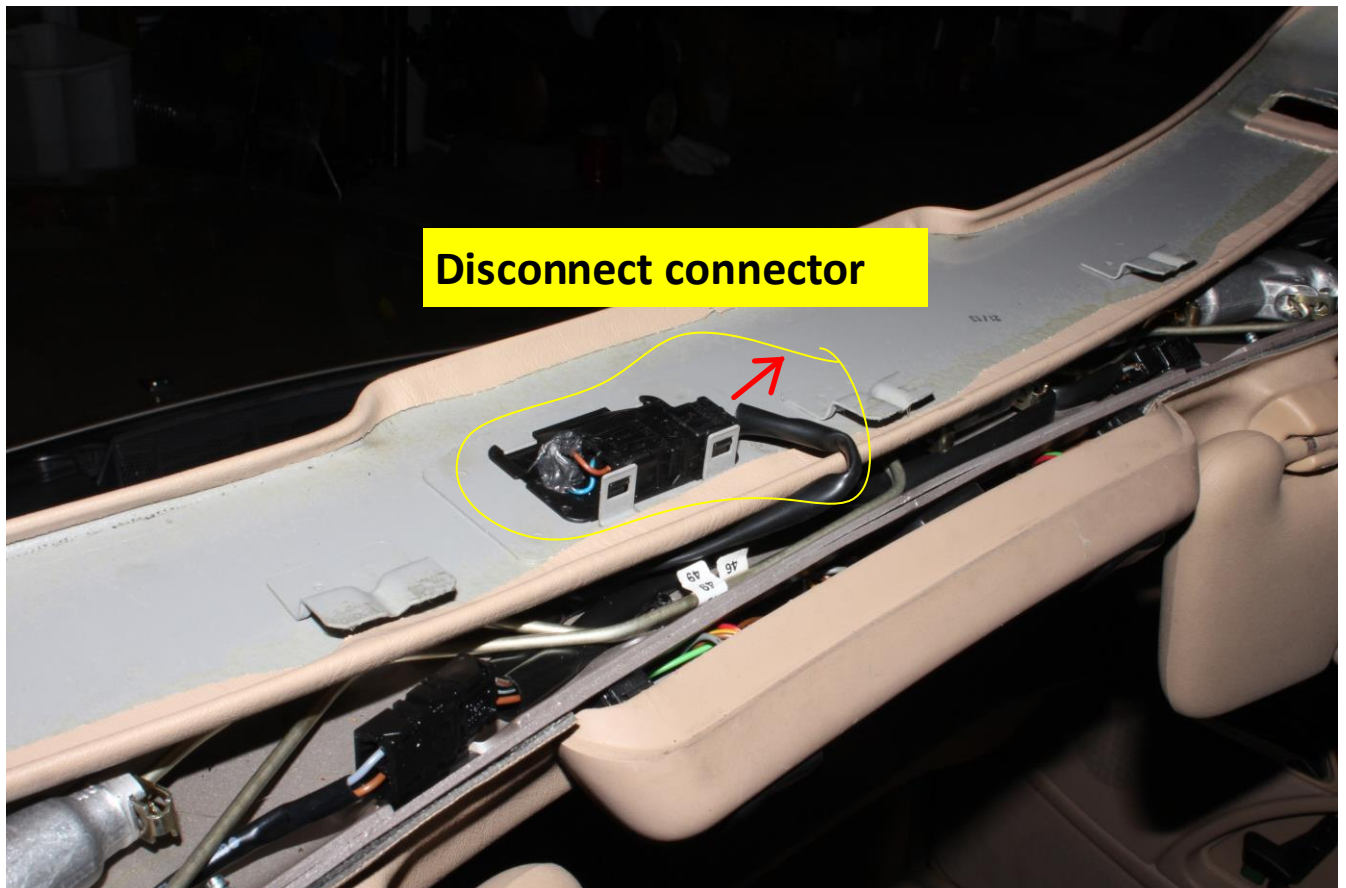


Remove screw for the latch cover plate and slide towards outside of car. Don't pry up against the tab shown below, slide it out and note the tab goes under the metal frame of the latch not just under just the top cover.



Once the end screws and two latch covers are removed the cover can be slide rearward to release from the four front clips. I used a plastic pick tool to pry it a little at a time until the clips released. You need to pull up on the rubber end pieces as you pry back and work one end out then the other. The shape of the rubber end pieces prevent the cover sliding rearward until you pull them up some. A wire is attached to the cover so don't yank the cover back, just move cover back until released from the clips and then turn the cover over.

This is the proximity switch that detects when the top is up or not. Don't yank the cover off and pull on the wire before disconnecting, it will pull the wires out of the switch. Ask me how I know.

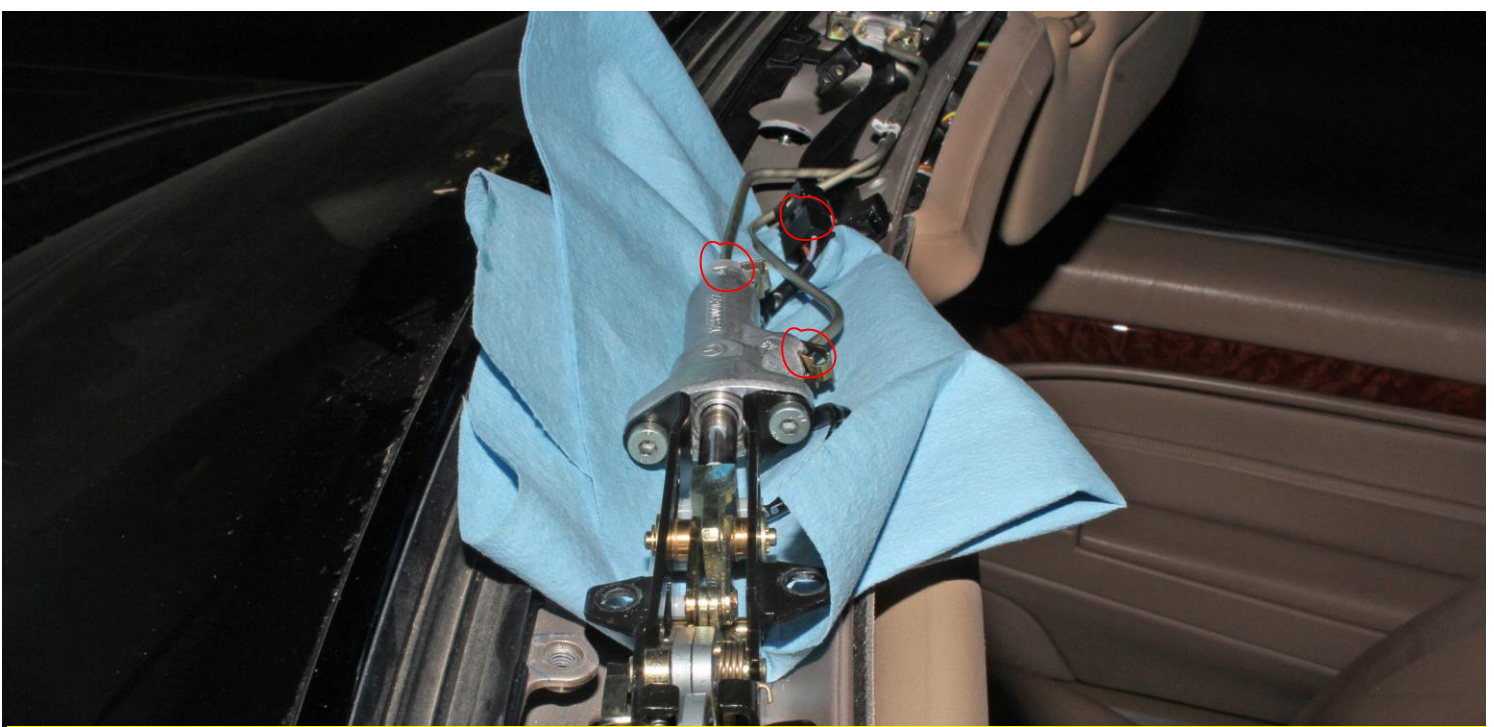


Another view of the top switch and wire connection.

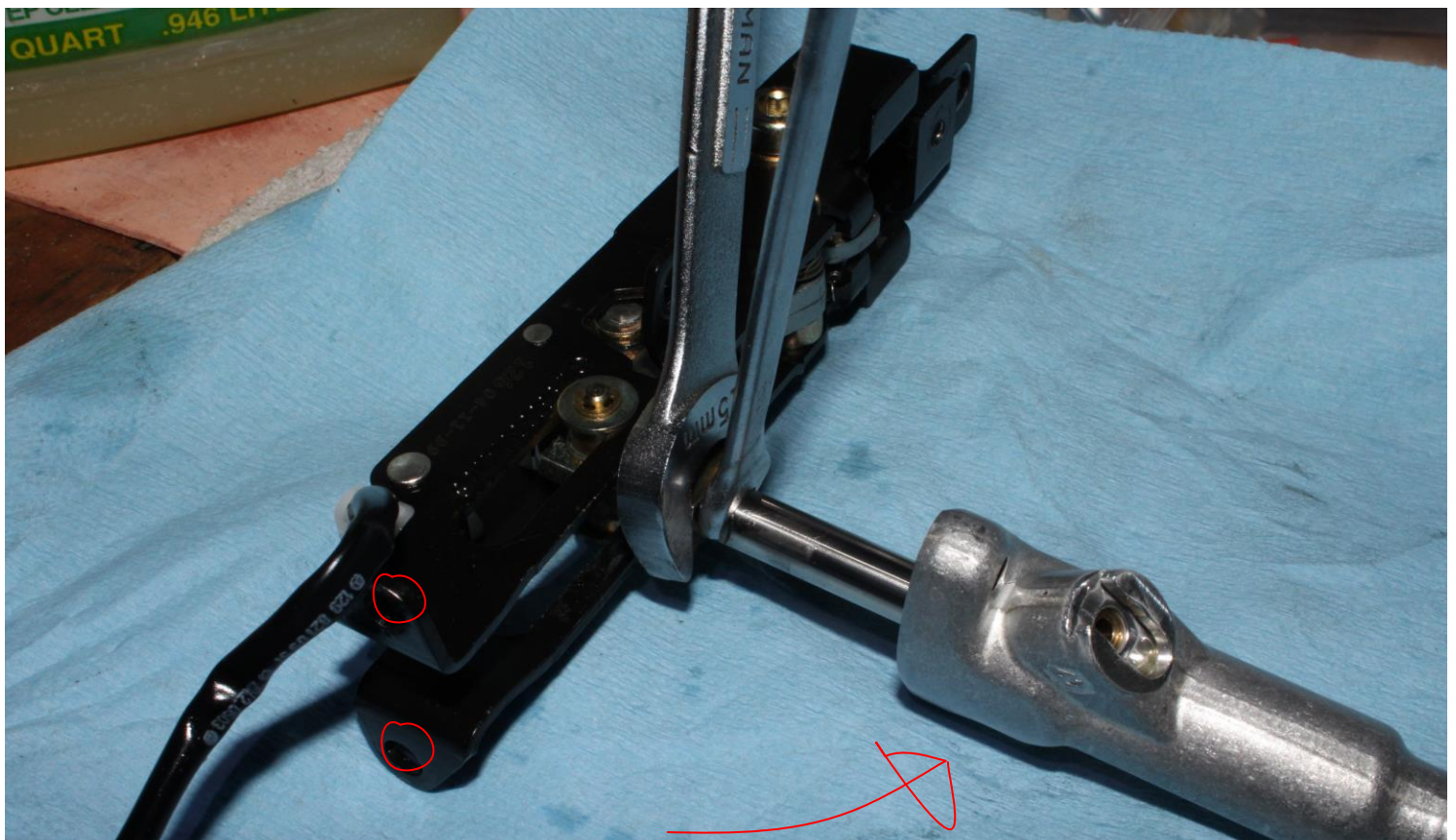


With the top cover now removed the front lock assembly can be removed. Start by removing the three T-30 bolts.





With the three bolts removed you can position the lock assembly to remove the two hydraulic line clips and also disconnect the wire at this time. Carefully pull the hydraulic lines out the ports and then the whole assembly can be lifted out.



Remove two 4mm Allen head bolts and swing the cylinder over to remove the rod end from the latch assembly. Use a 15mm and 7mm wrench to loosen the rod end. Note: I had to file down the 7mm wrench some to fit the narrow flats on the rod. Heat will likely be required to break the rod end free.

WIPER
SUBSTITUTE
CONCENTRATE
NO ODOR
0-1038
SURFACE PREPARATION
CLEANER & DEGLOSSER
QUART .946 LITERS



INO
CLAVOS
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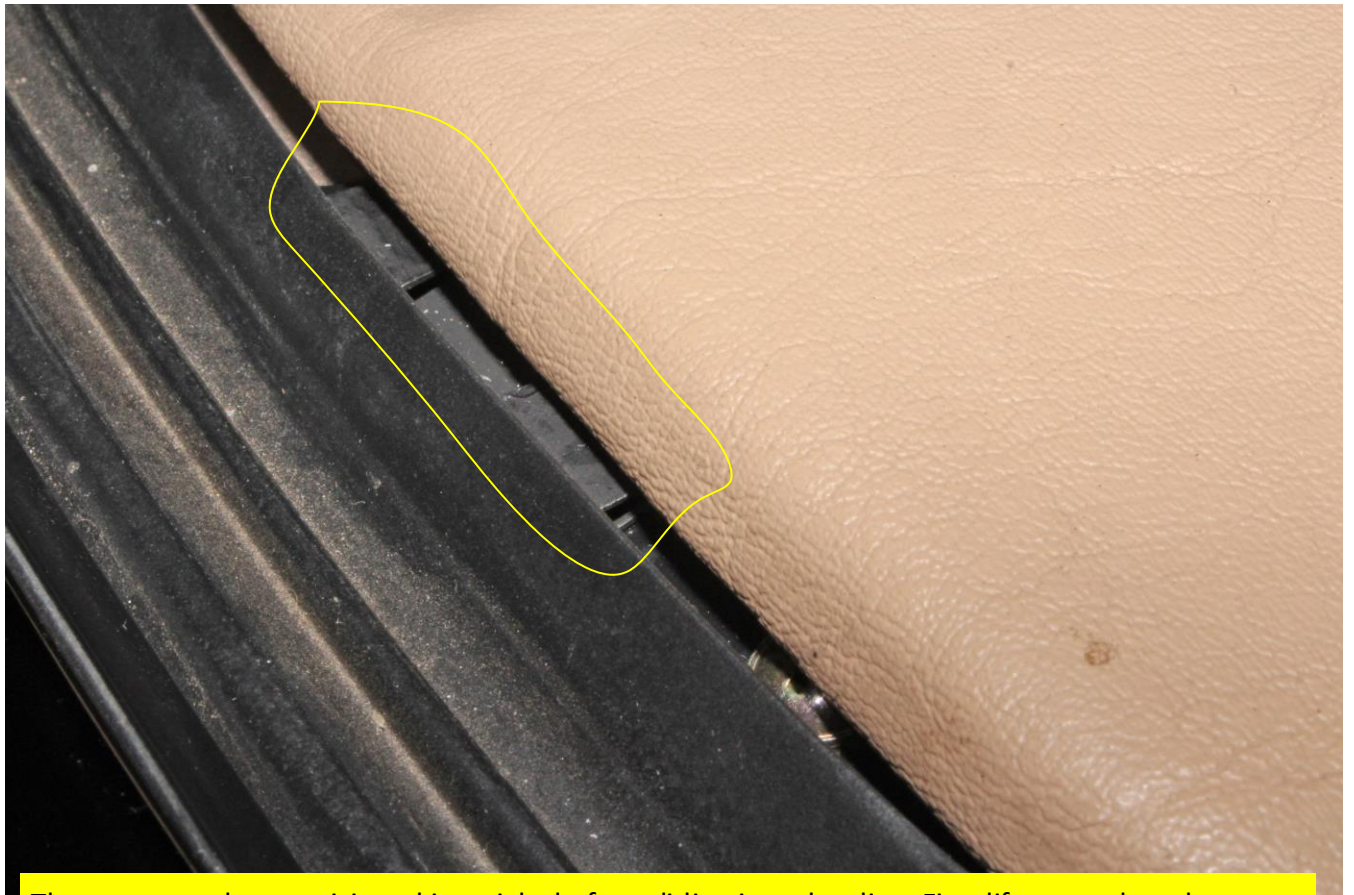
Reinstallation of top cover



The cover over the top front locks slides into four clips on the top of the windshield and I just want to point out the tabs on the cover (see photo below) that slide into the windshield area clips shown above must first sit on top the tab area highlighted above then push into the clips. If the cover tabs are too far rearward the tabs can be pushed down too low, hang up and the cover can't slide all the way forward. Any of the four clips can cause a problem so check each one before sliding the cover in place. The cover tabs can't be too far forward either see next page.



Here's a cover tab that slides into the clips on top the windshield, all four need to be positioned correctly before sliding the cover forward.



The cover needs to be positioned just right before sliding into the clips. First lift up on the edge rubber ends to get the cover started under the rubber ends on both sides with an even gap to the front seal like shown above across the length of the cover. The cover needs to be far enough forward for the cover tabs to be sitting on the clips tabs but back far enough the cover tabs aren't over the insertion part of the clips. If any of the cover tabs are too far forward they won't insert into the clips, this can happen with the two inner clips. Too far back and the cover tabs end up under the clip tabs on the windshield and then you can insert the cover all the way.



Rubber end pieces need to be pulled up to slide in cover, screw would not be installed at this point.

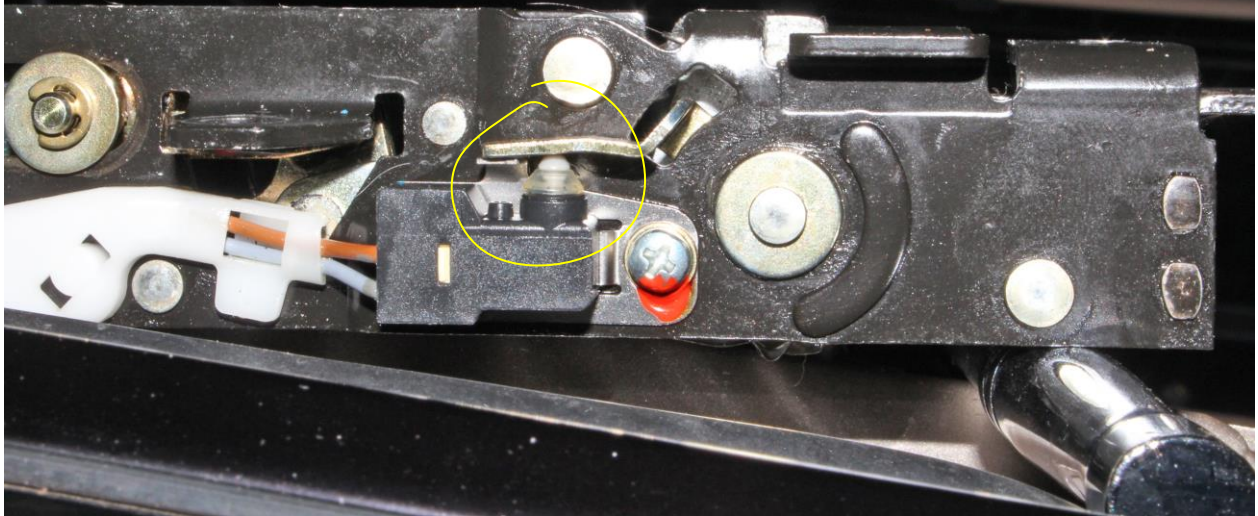
Cover tabs that slide into clips on top of windshield.



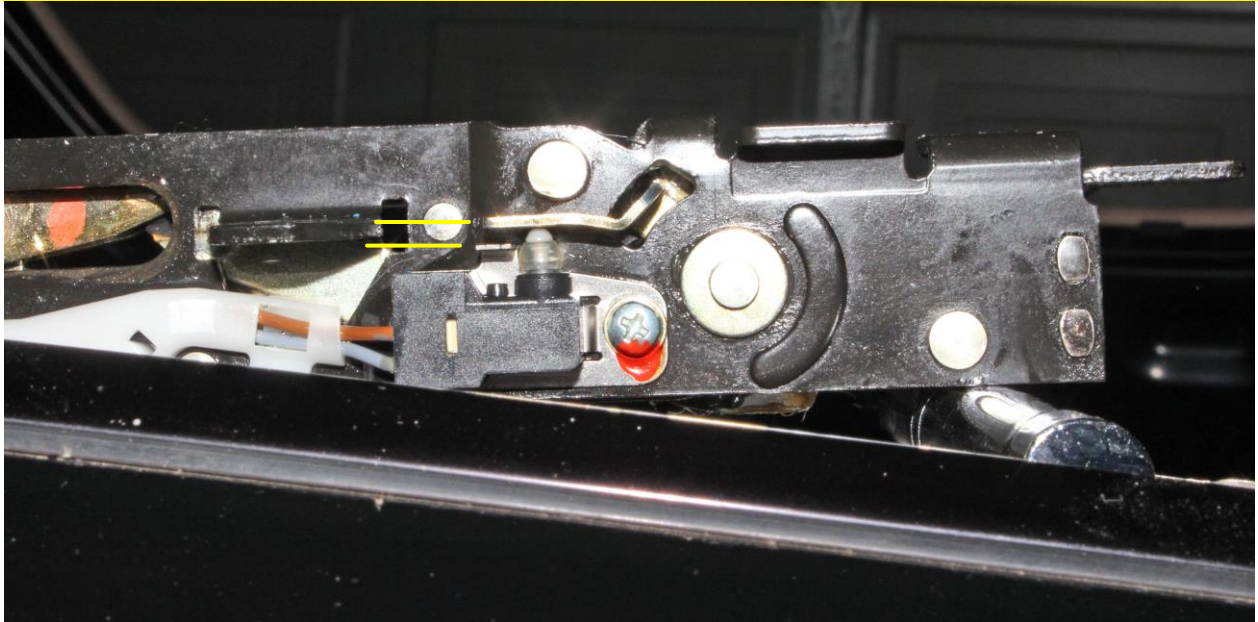
One of four clips the top slides into.

For reference of the front lock switch position when the latch is open or closes.

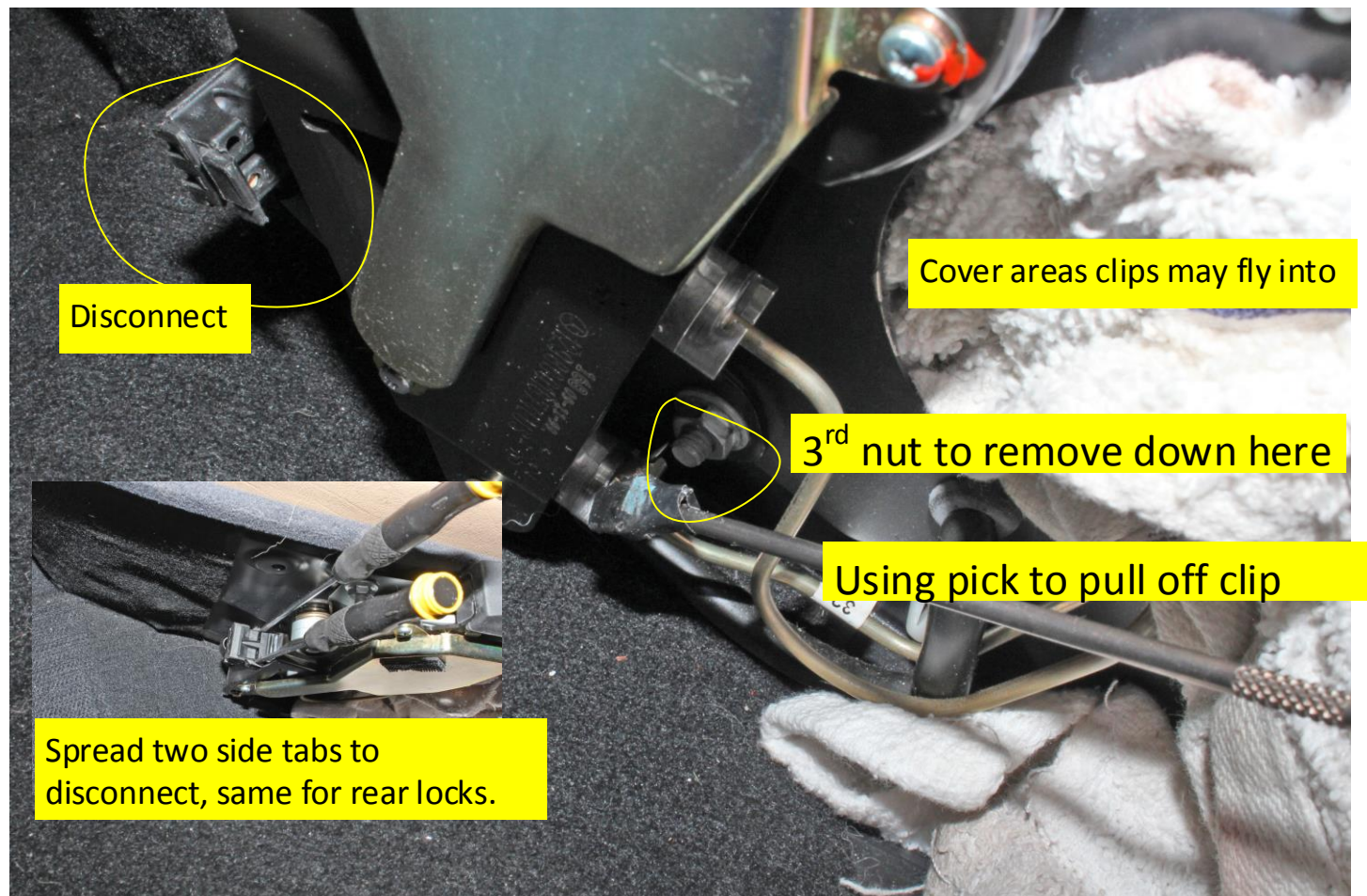
Front lock switch position with latch open, top down.



Front lock switch position with latch closed, top up and locked.



Tonneau cover lock removal, 3 nuts, 1 switch connector, 2 hydraulic lines

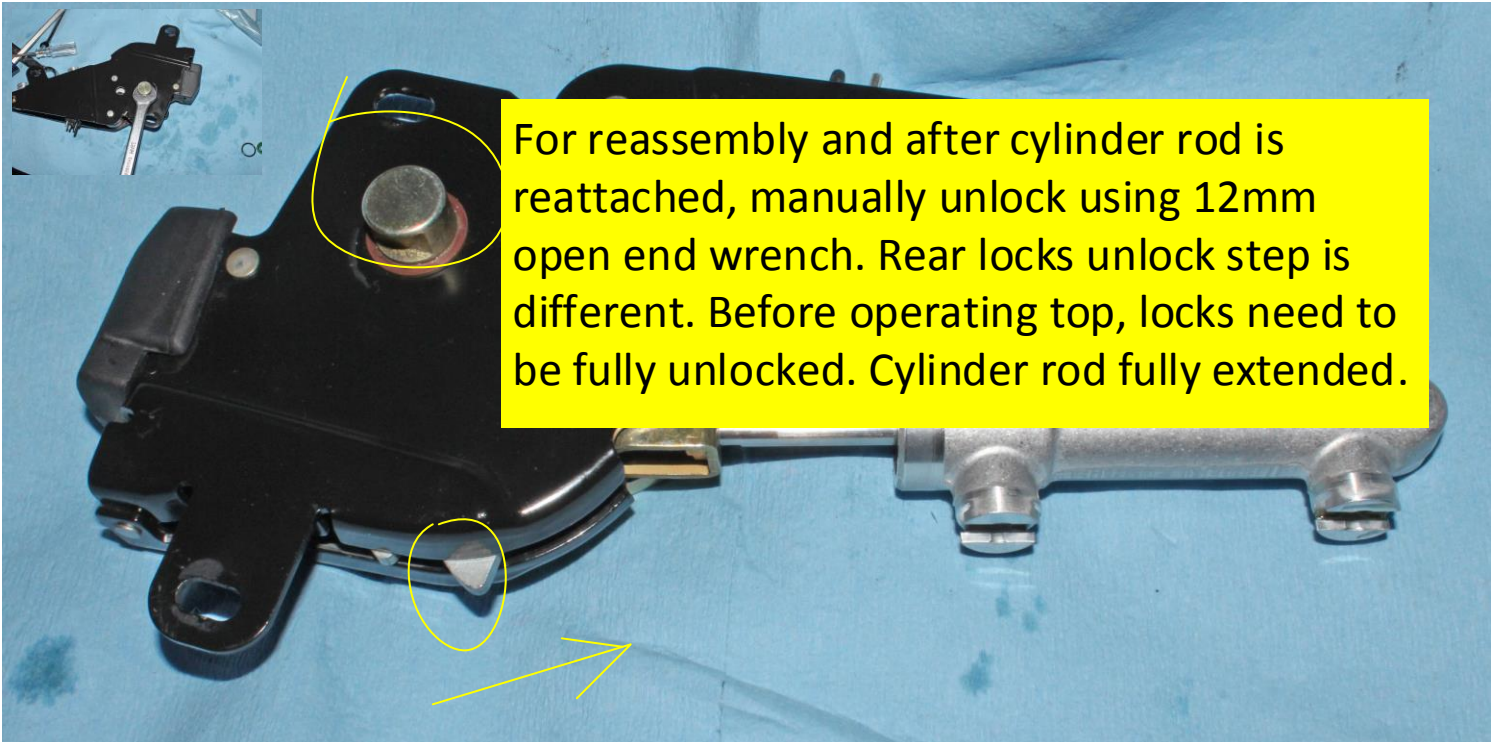


Removing cylinder from lock assembly,
remove e-clip and pin



Lock needs to be manually locked to gain
access to rod end, see next page.

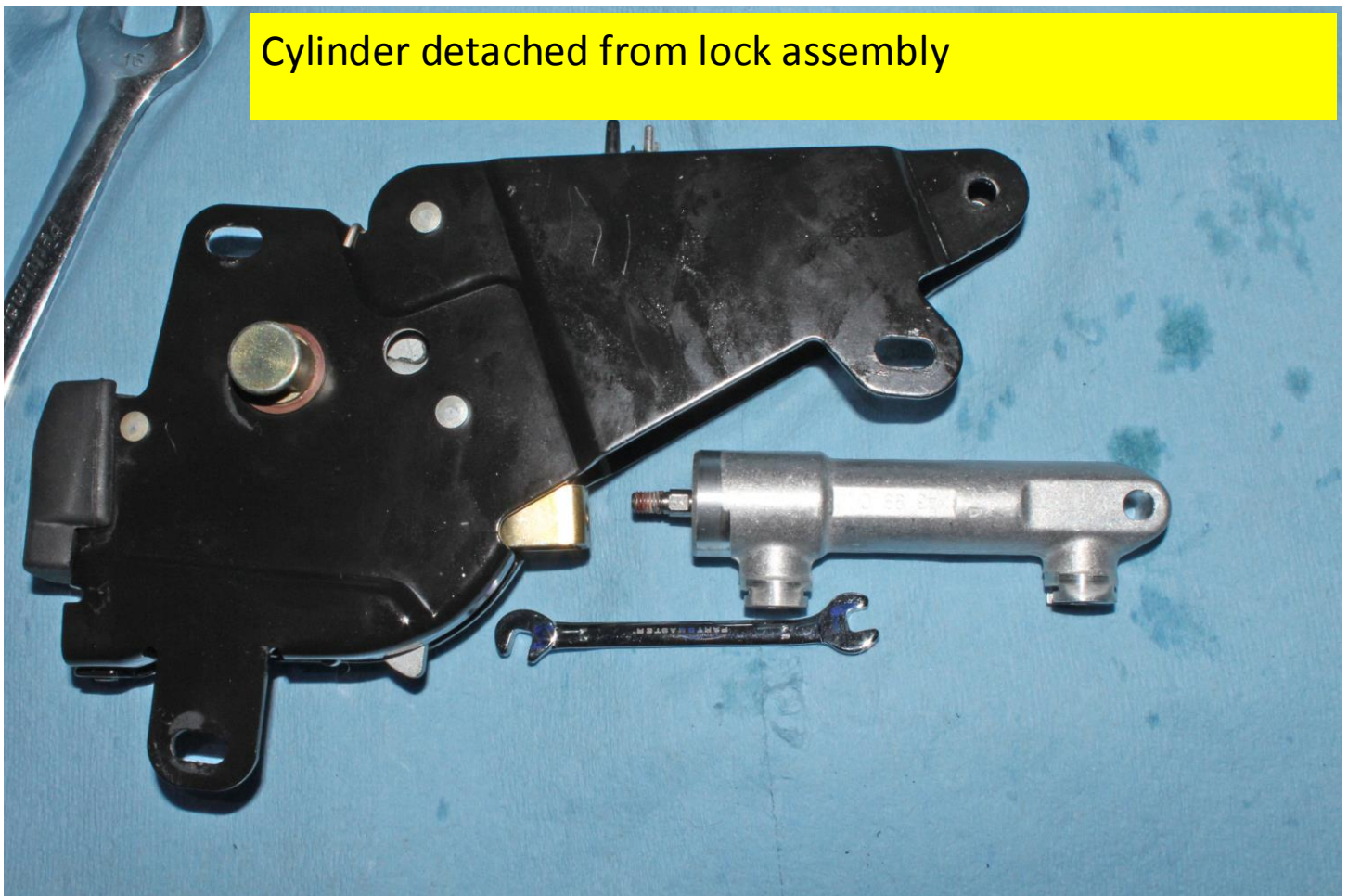
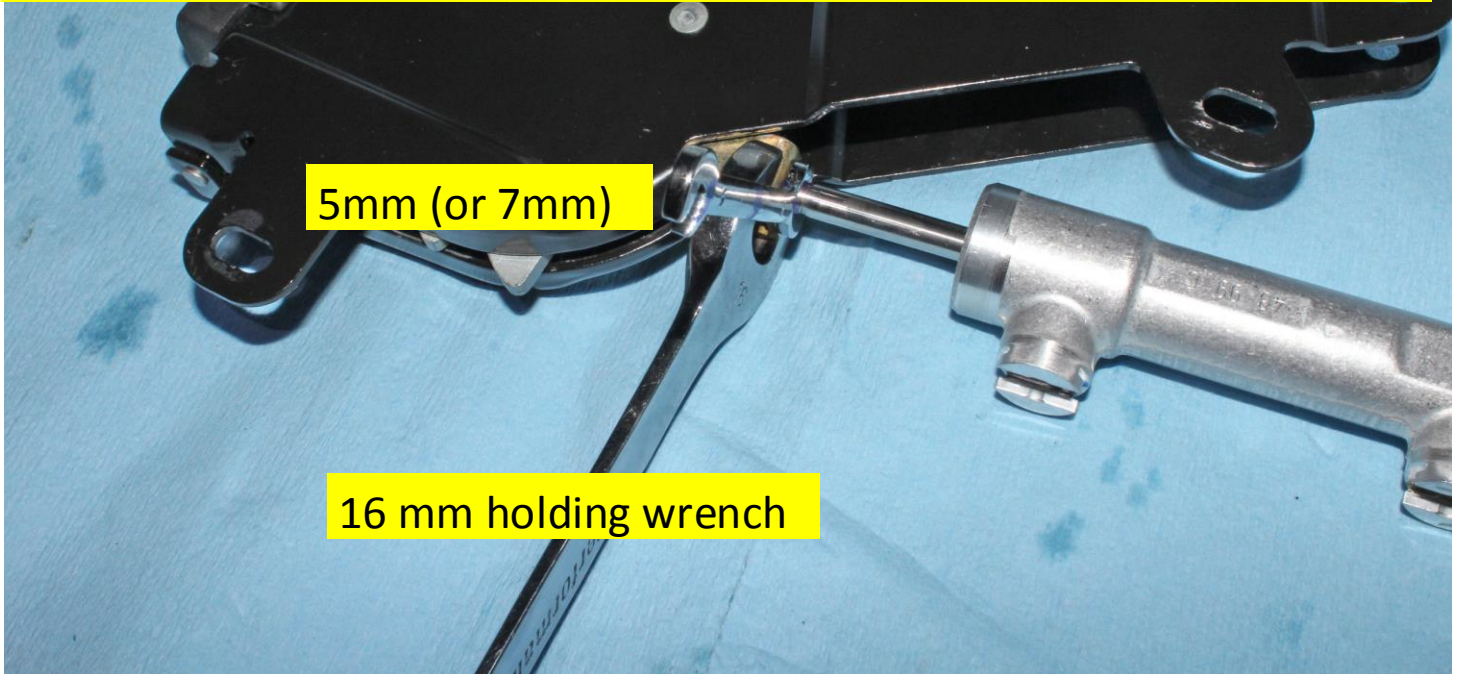
Manually lock
by first pushing
down on latch,
see below to
get to full
locked position



For reassembly and after cylinder rod is reattached, manually unlock using 12mm open end wrench. Rear locks unlock step is different. Before operating top, locks need to be fully unlocked. Cylinder rod fully extended.

Full lock position by moving highlighted tab in the indicated direction, this provide access to rod end. Similar for rear locks.

Removing rod end with 5mm open end wrench. I later found out there were different cylinder sizes used for the tonneau lock so a 7mm wrench may be required for the larger cylinders used. Heat may be required to break thread lock sealant. Rear locks similar, 7mm open end, heat is required to remove rear lock rods from lock assemblies.



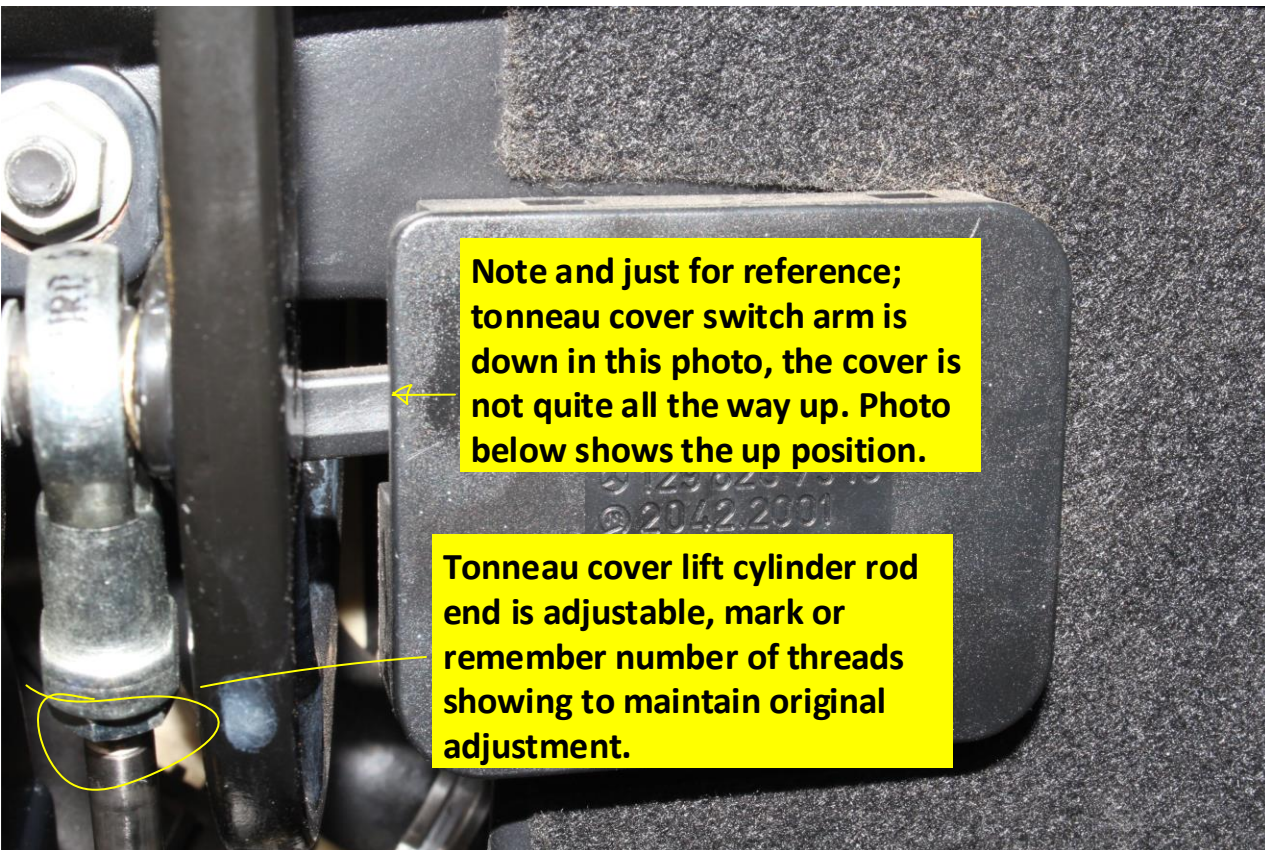
Rear locks and tonneau cover lift cylinders in soft top compartment area



Mark position of rear lock by tracing nut outline



Tonneau lift cylinder rod end e-clip needs to be removed and rod pushed down to get access to rear lock nut; three nuts total for rear lock.



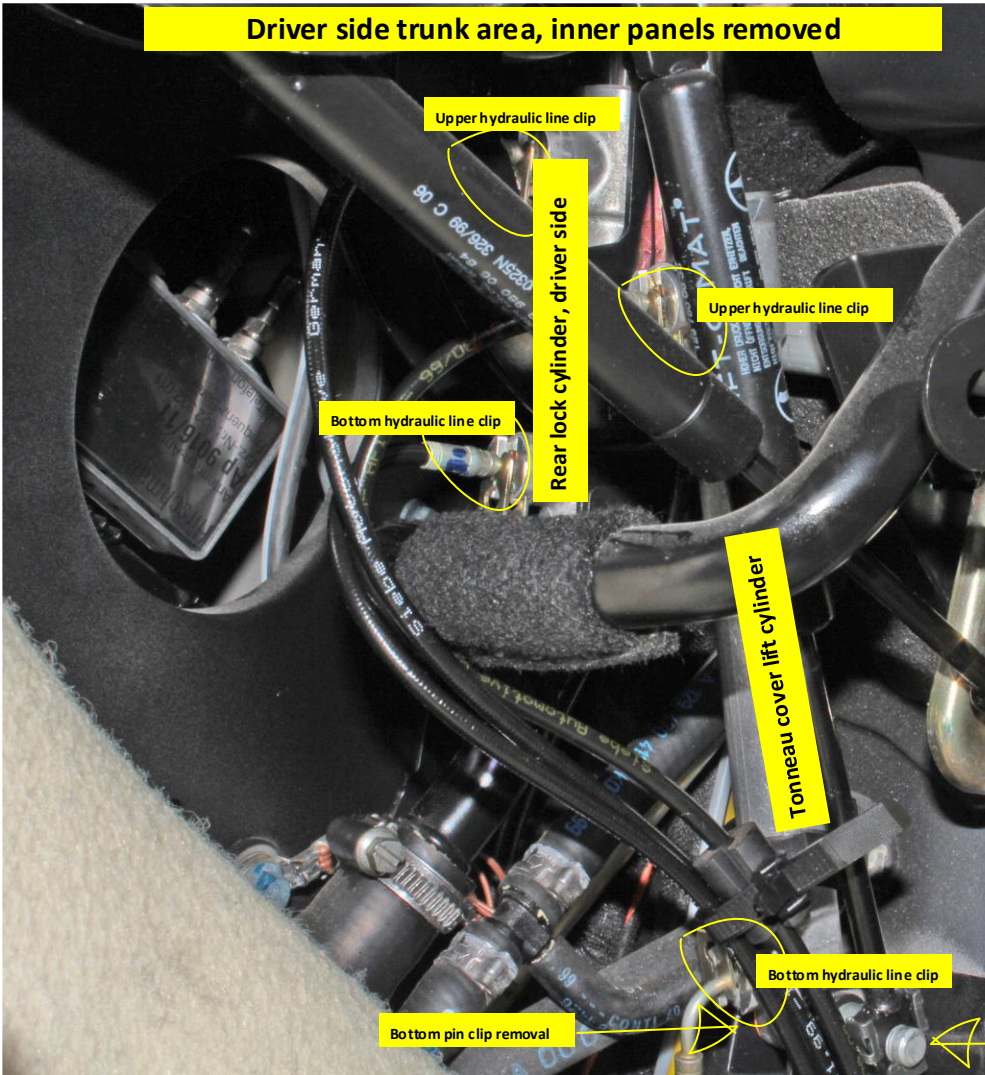
Note and just for reference; tonneau cover switch arm is down in this photo, the cover is not quite all the way up. Photo below shows the up position.

Tonneau cover lift cylinder rod end is adjustable, mark or remember number of threads showing to maintain original adjustment.



Tonneau cover in full up position, switch arm up

Driver side trunk area, inner panels removed



Upper hydraulic line clip

Rear lock cylinder, driver side

Upper hydraulic line clip

Bottom hydraulic line clip

Tonneau cover lift cylinder

Bottom hydraulic line clip

Bottom pin clip removal

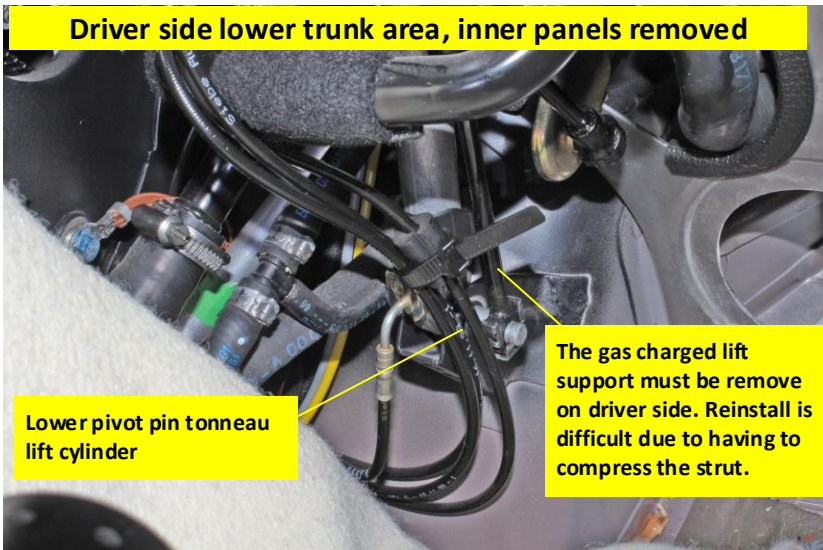
Bottom pin clip release

Tonneau cover lift and rear lock cylinder trunk view. Hydraulic lines and bottom pin for tonneau cover lift cylinder need to be removed.

Not shown but requires disconnecting one electrical connector for the rear lock.

Inner trunk panels already removed. See later pages for CD changer and trunk inner panel removal.

Driver side lower trunk area, inner panels removed



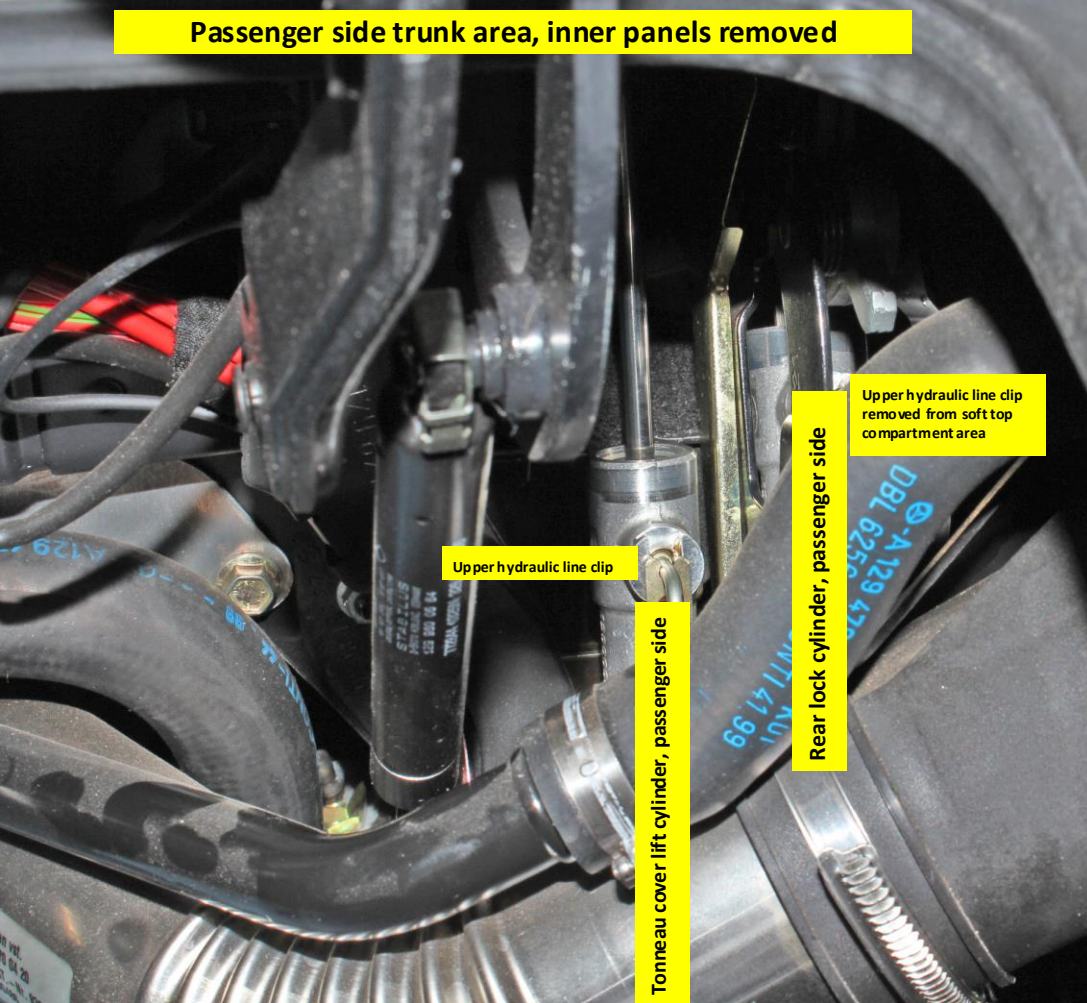
Lower pivot pin tonneau lift cylinder

The gas charged lift support must be removed on driver side. Reinstall is difficult due to having to compress the strut.



Upper hydraulic line clips for rear lock and tonneau lift cylinders

Passenger side trunk area, inner panels removed



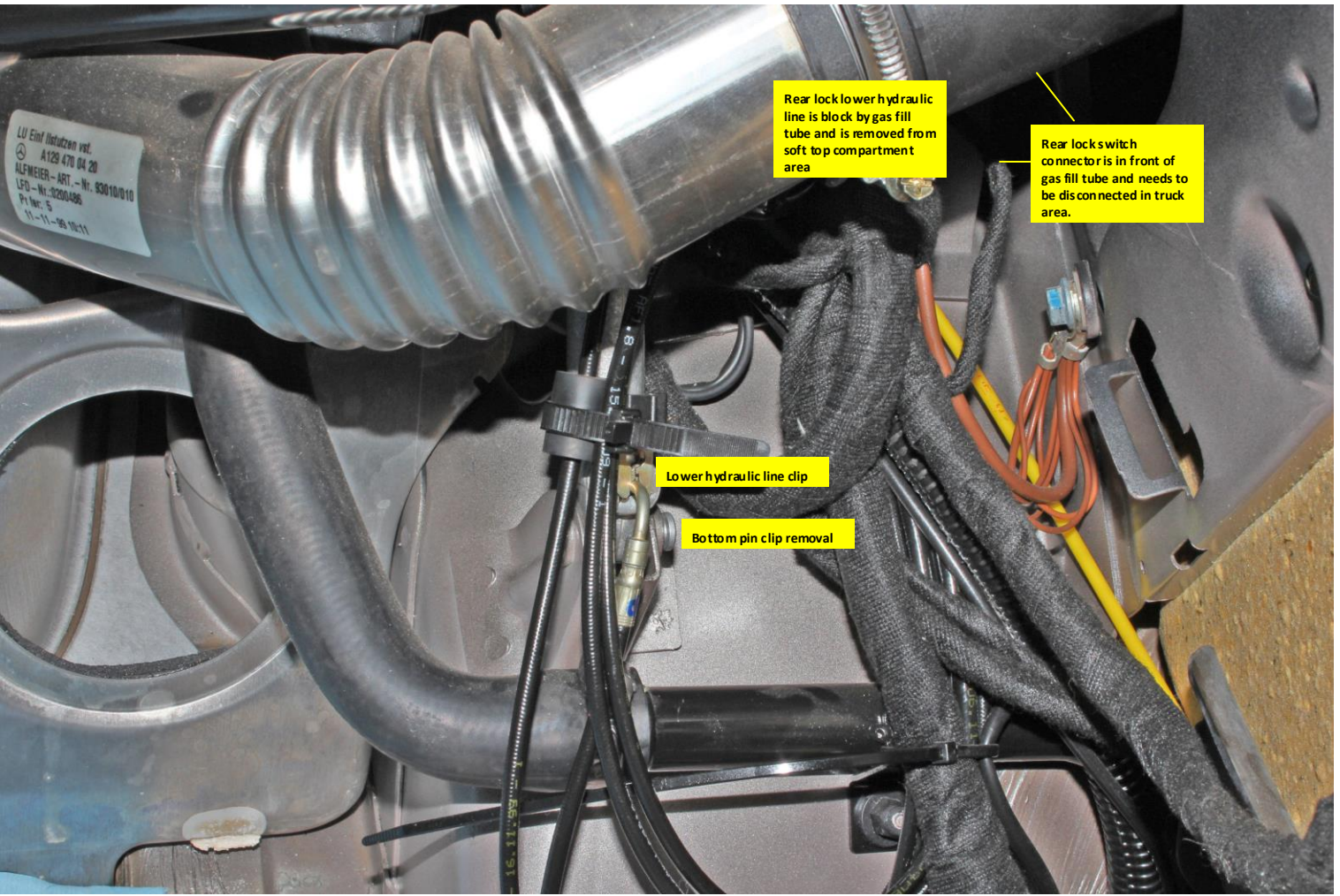
Upper hydraulic line clip

Tonneau cover lift cylinder, passenger side

Rear lock cylinder, passenger side

Upper hydraulic line clip removed from soft top compartment area

On the passenger side the gas fill tube interferes with the rear lock removal. The rear lock electrical connector needs to be disconnected from the trunk side and then the rear lock can be pulled forward into the soft top compartment area where the hydraulic lines can be disconnected and later reinstalled.



Rear lock lower hydraulic line is block by gas fill tube and is removed from soft top compartment area

Rear lock switch connector is in front of gas fill tube and needs to be disconnected in truck area.

Lower hydraulic line clip

Bottom pin clip removal

Trunk driver side inner panel removal

Rear two screws removal

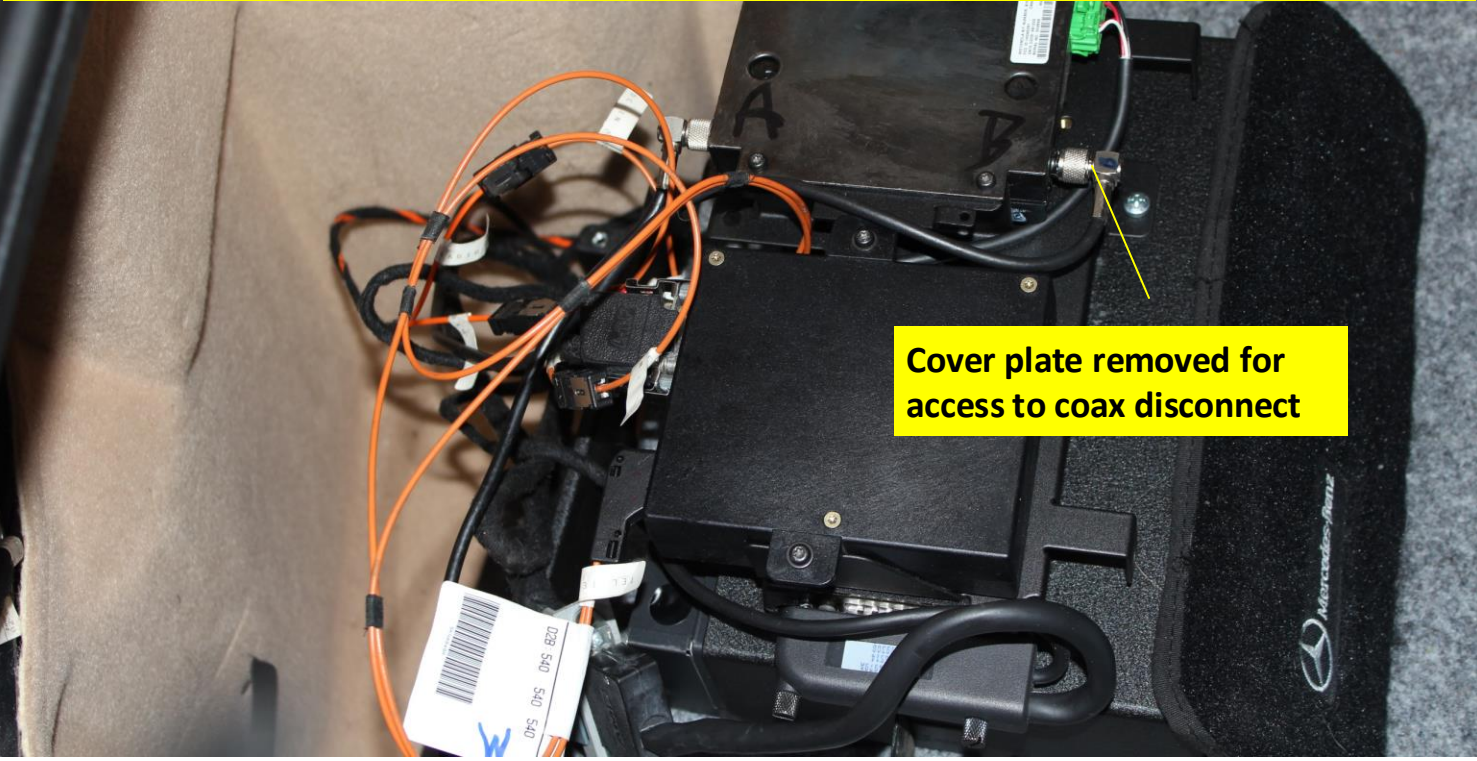
Remove cover plate, two torx screws. Screws can be removed after pulling CD changer out of trunk well.

To get good access to the rear lock and tonneau cover lift cylinders the trunk side panels should be removed and to remove the driver side panel the CD changer needs to come out first. Four screws total to lift CD out and set in trunk to remove all wiring.



Front two screws removal, magnetized screwdriver or magnetic pick tool good to have for these screws in a recessed area.

After the four CD changer screws have been removed the unit can be lifted out of well and set in the trunk for wiring disconnect. Mark all wires (fiber optics, coax, multi-pin) connectors for reassembly and then disconnect all.



CD changer mounting frame needs to be removed; two 10mm nuts on the bottom and two 8mm head screws on the inner side (can't see them in photo below). Note how wiring harness is routed for reinstall.



Mounting frame removed; now side panel can be removed.

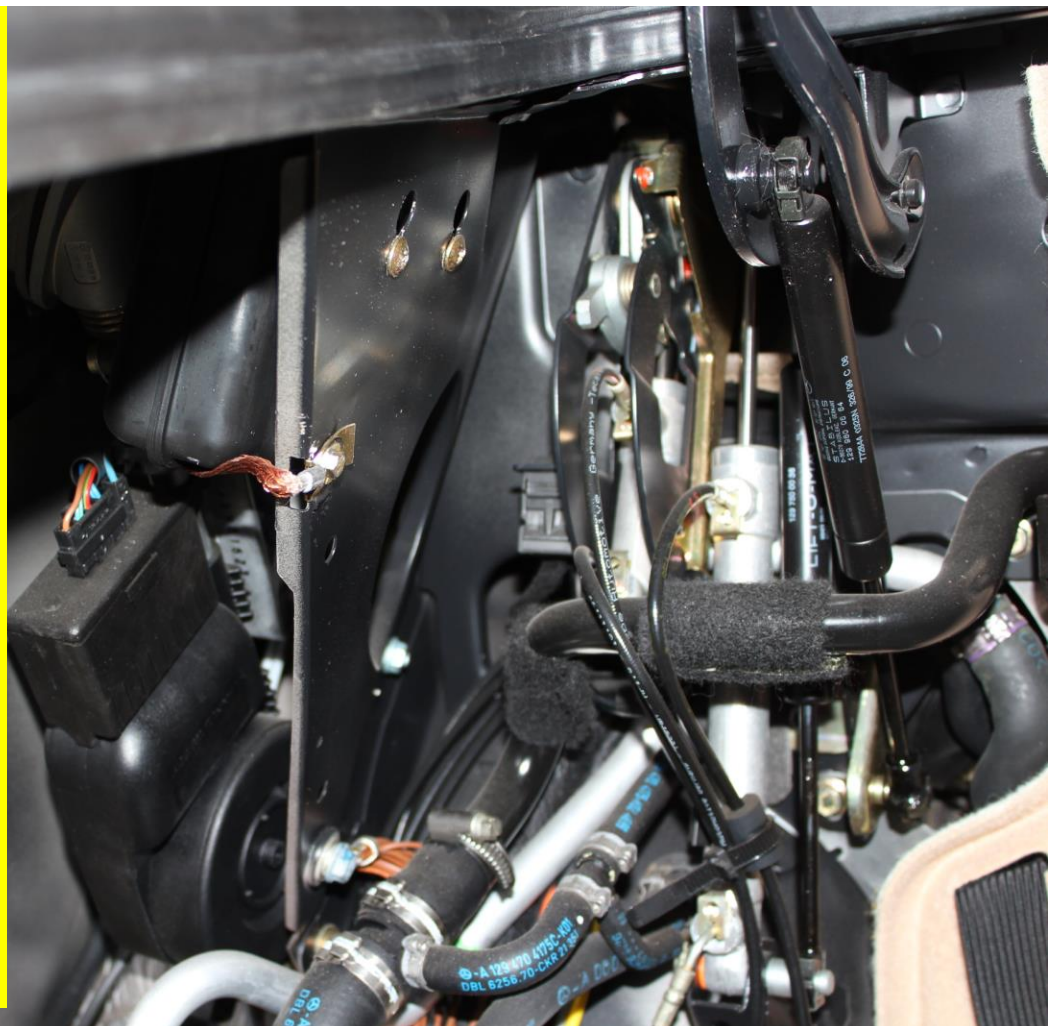




Driver side inner trunk side panel pulled up and out. CD changer, rear lights assembly and push pins all removed to remove this panel.

With side and back panels removed access to the rear lock and cover lift cylinders is enabled.

The front trunk panel is just held in place with the plastic push rivets on top and sides. Removed the passenger side panel, then the front trunk panel and finally the driver side panel.



Part 2

Cylinder disassembly and new rod seal and O-rings replacement

Disassembly and reassembly of the cylinders involves many risks of damaging expensive hydraulic cylinder parts and even yourself so do at your own risk. It's not for everyone but if you do attempt it here are my notes and photos.

Cylinder types and key differences in disassembly/reassembly

1) Lock cylinders (5 or 6 total)- top locks, rear locks-, tonneau lock(1 or 2)- circlip retained head caps, rods have wrench flats(don't have to clamp rod in vise), top rod edge needs to be filed/ chamfered to prevent damage to rod seal during install, heat typically needed to loosen rod ends, there are differences how top locks, rear locks and tonneau lock assemblies are manually locked/ unlocked

2) Tonneau cover lift cylinders(2)-- circlips head caps, adjustable locking nut rod end, rod threads same diameter as rod, need to cover threads to protect rod seals during installation, I used Teflon tape to cover threads before rod seal install

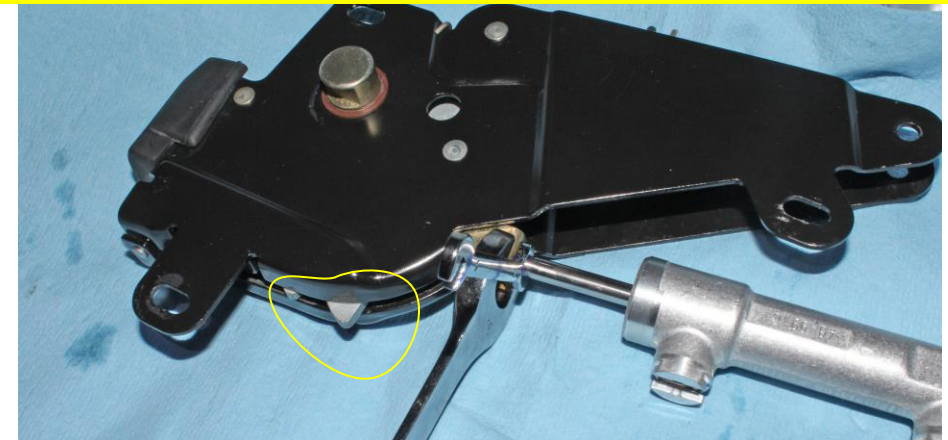
3) Bow extension cylinders(2)- pin hole (for tool) screw type head cap, no circlip, no wrench flats, rod must be held in vise to remove rod end, heat required to remove cap and rod end, port seals in same area as head cap so must be careful with amount of heat, pin holes in cap can be deformed easily during disassembly, head cap O-ring seal is installed internally in cylinder

4) Main lift cylinders(2)- no wrench flats, rod needs to be held in vise to remove rod ends, heat required to remove rod ends, closed groove for rod seal so not an easy press in fit like other cylinders, head cap O-ring seal is installed internally in cylinder

In the following pages not all cylinder types are shown being rebuilt, just what's common and what's different about disassembly and reassembly for the various cylinder types.

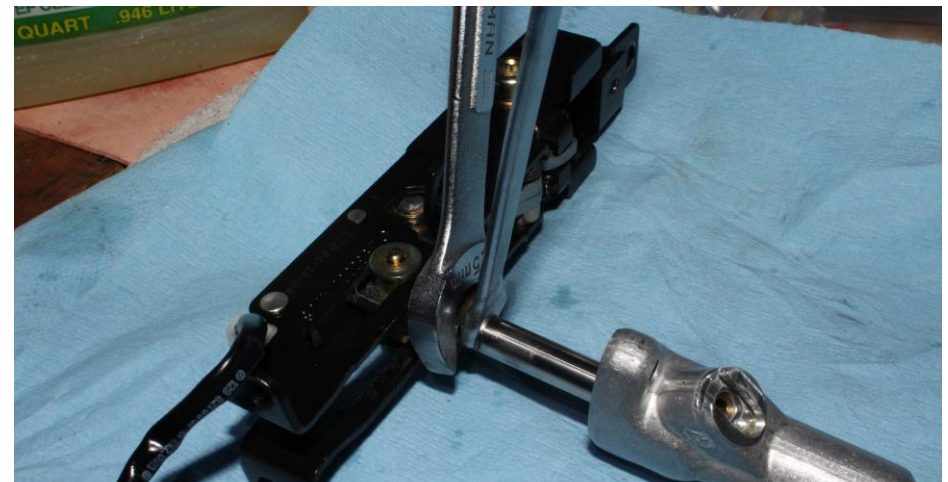
Removing cylinders from different types of lock assemblies

1) For the rear locks and tonneau locks the lock must be manually latched to get access to the rod end. Start by pressing the latch down through the opening.



2) Continue to fully latch by pushing the highlighted tab shown above until fully latched and rod end is accessible. Tonneau lock shown, lower cylinder pin removed.

During reassembly and after cylinder rod end is attached you can manually unlock using a 12mm wrench for the tonneau cover lock. Rear locks do not have this wrench unlock, these locks are unlock internally. Locks must be fully unlocked before operating top.



Top front locks only require removing two 4mm Allen head bolts and swinging the cylinder out for rod end removal. Heat will likely be needed to loosen rod ends.

Rod End Removal for Different Cylinder Types



Tonneau cover lift cylinders (2) have an adjustable rod end with a locking nut. No heat should be needed, just an 11mm and 10mm open end wrenches to remove. Maintain same number of threads showing to preserve original adjustment. Threads are same diameter as rod so threads should be covered to protect rod seal during install, I used Teflon tape.



Lock cylinders, which includes the top front locks(2), rear locks(2) and tonneau cover lock(1 or 2) rods all unscrewed from the lock assembly. These cylinder type have wrench flats on the rod so a 5mm or 7mm wrench can be used to unscrew the rods. Heat is required to break the thread lock hold. Focus the heat on what the rod screws into, not the rod. Use care with heat around switches and wires. Lock assemblies are different, shown above is a front lock.



Bow cylinders(2) rods do not have wrench flats so the rod must held stationary to remove rod end. Heat required for thread lock. Heat the eyelet, not the rod.



Main lift cylinders(2) rods do not have wrench flats so the rod must held stationary to remove rod end. Heat required for thread lock, heat the end of the rod, not the eyelet.

Rod end removal for the different cylinder types.

For all the cylinders the first step during disassembly is to remove the rod from lock assemblies or the rod end eyelet from the rod. Shown are the different rod end types for all cylinders and what is required to remove the rod ends.

Heat should be typically be used for most cylinders to soften the thread lock. I used a common propane torch and infra red thermometer to control the amount of heat used. A micro butane torch or small heat gun would have been better for focusing the heat.

Round wire internal snap ring removal (circlip)

Develop a good method to remove and install the circlips

All except the bow cylinders have a round wire internal snap ring holding the head cap of the cylinder in place and it pays to develop a good method to remove them. Good support of the cylinder is essential to be able to press down hard enough to remove the clip. A vise with soft jaws or similar good support is a must. The circlip and the aluminum cylinder housing need to be protected from sharp edges so round off sharp tips of the tool you're using to pry the clips off. Never tighten a hollow part too much in a vise, the urethane soft jaws worked well for me.



For circlip removal here is my method, there are likely better methods but this is what worked for me.

I supported the cylinder in a vise vertically and on any horizontal underside surface so I could firmly press down to remove the circlip. Rod should be full down to protect from damage. I used a smaller stubby flathead screwdriver with the tip corners rounded to prevent gouging.

Start near either of the clip ends and using the tip of the flathead screwdriver I place the tip at a slight angle from vertical to wedge between the cylinder housing and the clip by pressing down very firmly and opening a small gap, which enables getting the tip down behind the circlip. Press firmly until seeing a small gap between the housing and the clip form and then continue pressing down very firmly to get the tip down behind the clip and then pry inward and up to release the circlip. As soon as the prying starts keep a finger on the circlip to keep it from flying off.

Circlip removal/install (cont.)

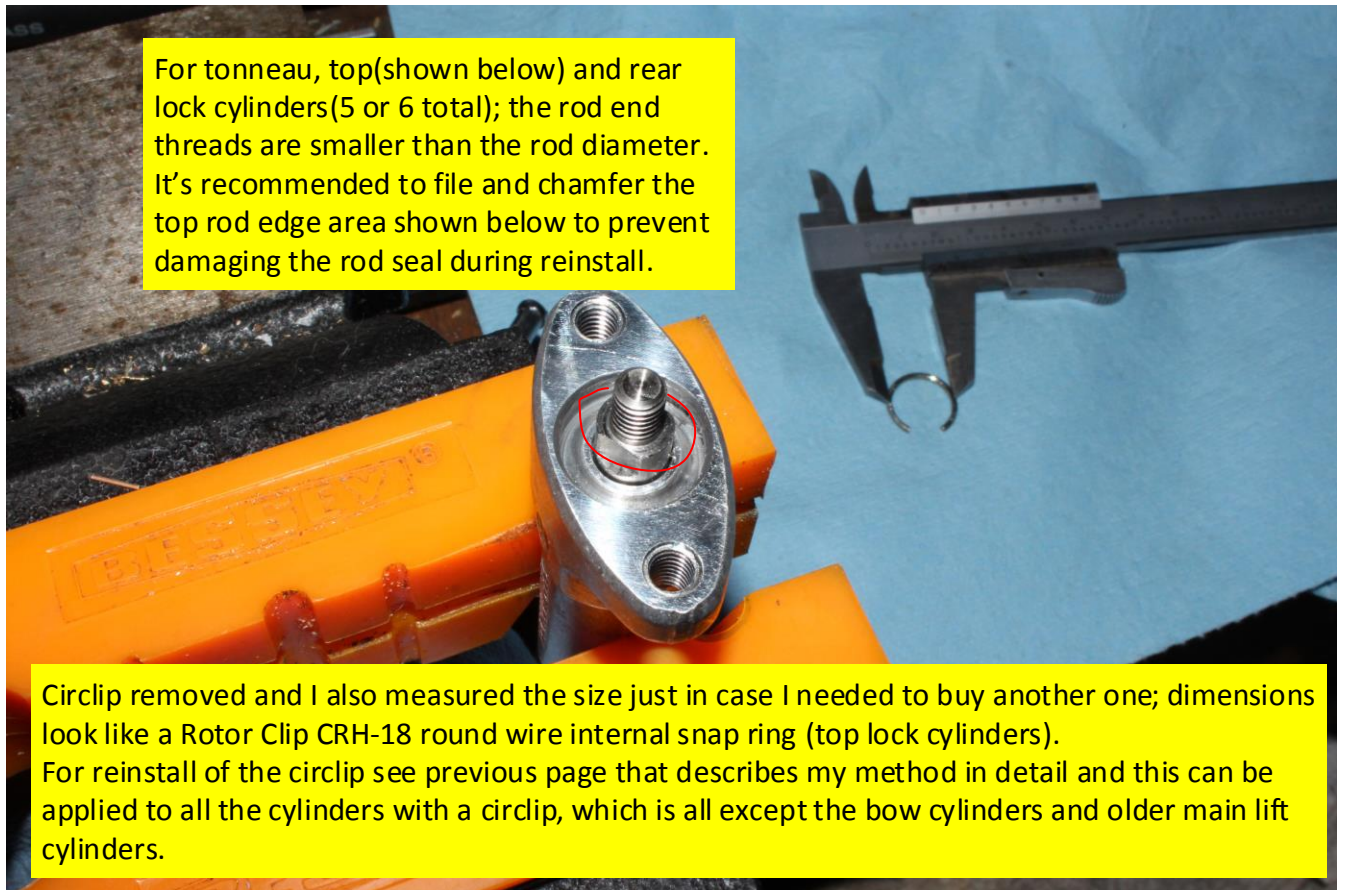


Once circlip has been removed the cylinder head cap and rod can be removed from cylinder to replace the rod seal and O-ring. Tonneau cover lock cylinder shown above. All except bow and older main lift cylinders have circlips.

Circlip install

My method to reinstall round wire internal snap rings, use a vise and square shaft screwdriver, keep left thumb on ring and use both hands to pull screwdriver towards yourself, which compresses ring while angling shaft slightly to keep downward pressure on ring at same time and press ring into inside diameter when compressed enough





When installing new O-rings in the cylinder head caps be sure the backing ring is positioned on the correct side of the O-ring as shown below. Note, not every cylinder type uses backing rings. The backing ring prevents the O-ring from extruding into the clearance gap between the cylinder and head cap so it needs to be on the outside or the opposite side of the hydraulic pressure on the O-ring. For all cylinder types except the main lift cylinders the rod seal is a slide in press fit in the cylinder head cap. For the top front lock cylinder shown below the O-ring is fitted to the head cap, this applies to all cylinder types except the bow and main lift cylinders which have the O-ring installed in the cylinder housing.

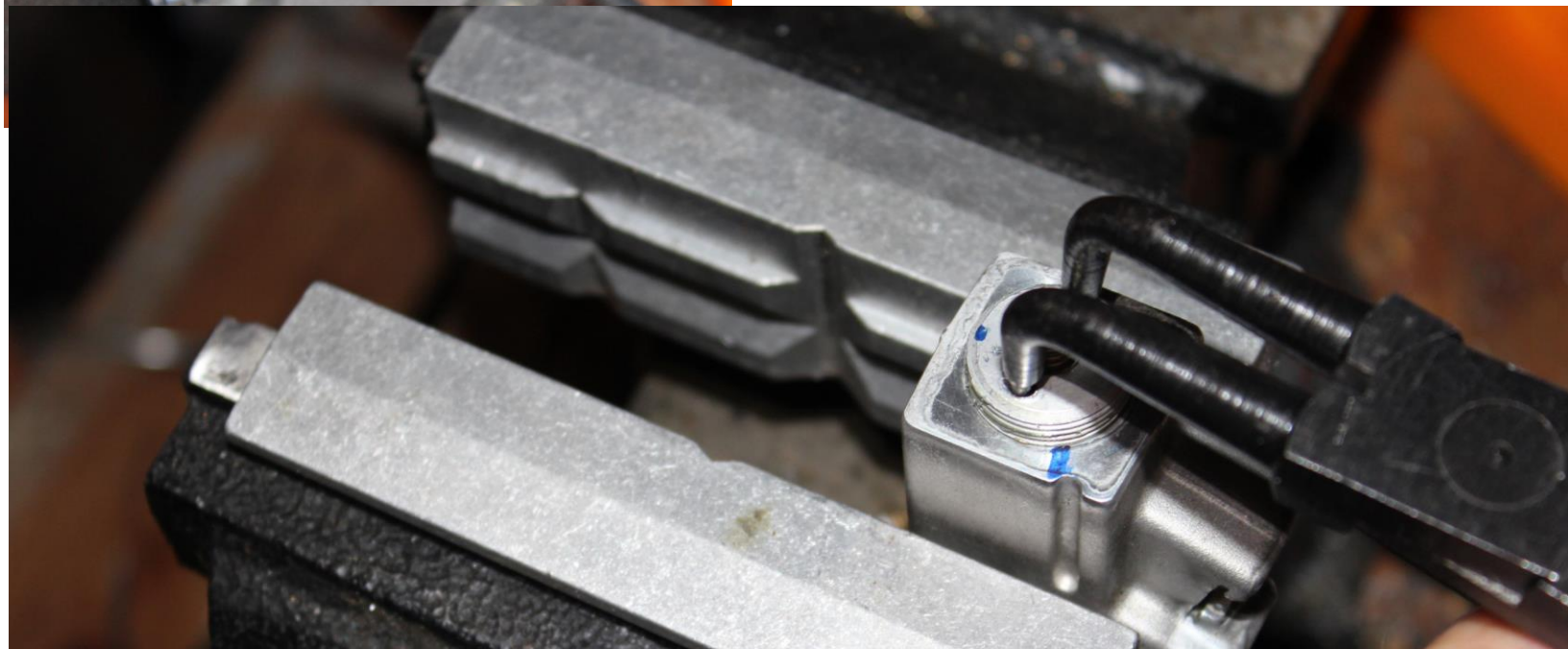


Bow extension cylinder type and differences in disassembly



Bow extension cylinders have no wrench flats on the rod so the rod must be held stationary in vise to remove the rod end eyelet. I used aluminum soft jaws and heated the rod end eyelet before removing.

Bow extension cylinders are expensive so use good judgement on whether to rebuild yourself or send off for rebuild. Head cap and rod can be damaged easily during disassembly.

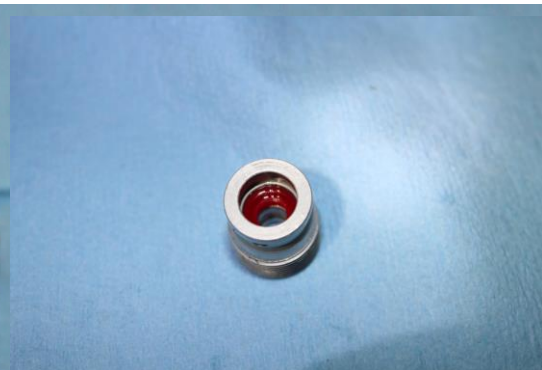


Bow extension cylinders have a screw in head cap with two 2mm holes. I drilled out the 2mm holes to 2.4mm (3/32) and used Knipex 90 deg internal circlip plies(44 21 J31) with 2.3mm tips and heat to remove the cap. Very tight with thread lock, heat is required and care must be used with the amount of heat if port seals are not being replaced. Port seals are near area heated for head cap removal so heat opposite side of port seals and keep it to the minimum needed.

Bow cylinder disassembly (cont.)



If you need to enlarge pin holes for tool tip size, measure depth and don't go any deeper. Tool pin holes easily deform if twisting force is too much. I kept heating a little at a time until threads broke free without deforming the tool pin holes from too much force.



New rod seal installed in cylinder head cap, just a slide in easy press fit. O-ring is installed internally in the cylinder.

Main lift cylinder disassembly

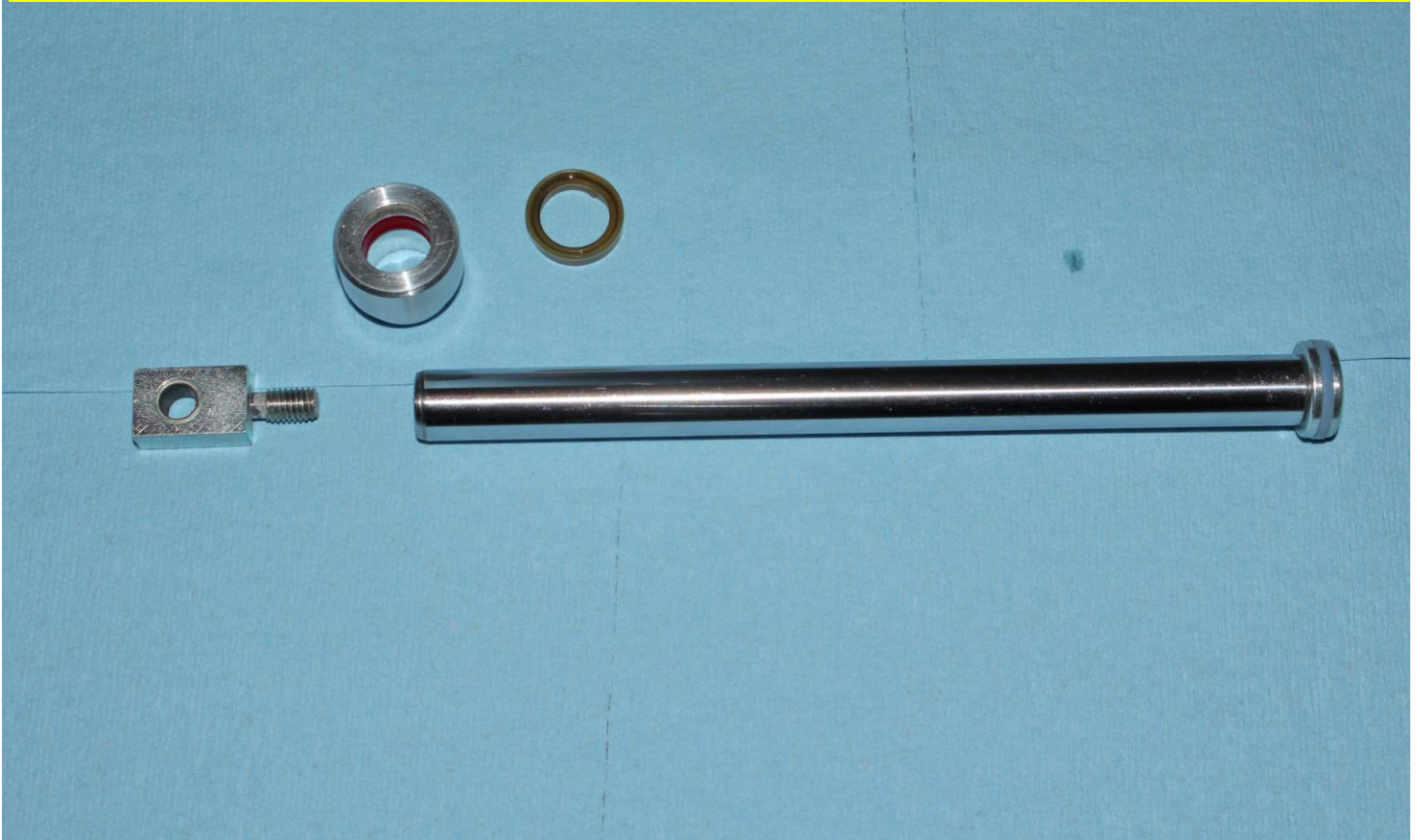
Main lift cylinder rod end removal. No wrench flats on the rod so the rod has to be held stationary in a vise.

Main lift cylinders are expensive so use good judgement on whether to rebuild yourself or send off for rebuild. Rod can be damaged in vise.

I heated the end of the rod to break the thread lock hold. Main cylinder is only type where rod end eyelet has the threads and why I heated the end of the rod and not the eyelet.



Main lift cylinder disassembled



New rod seal installed. Note closed seal groove. Toughest seal to install, had to squeeze, bend and pressed in. Stiff seal, difficult to work with, use hydraulic fluid for lube to aid seal install. I used the rod inserted up to the groove edge in the head cap as a guide stop during installation. The rod stop aided in forcing the seal into the inner groove as the seal is elongated to fit the inner diameter during installation.



Main lift cylinder new rod seal installed,
bottom view.

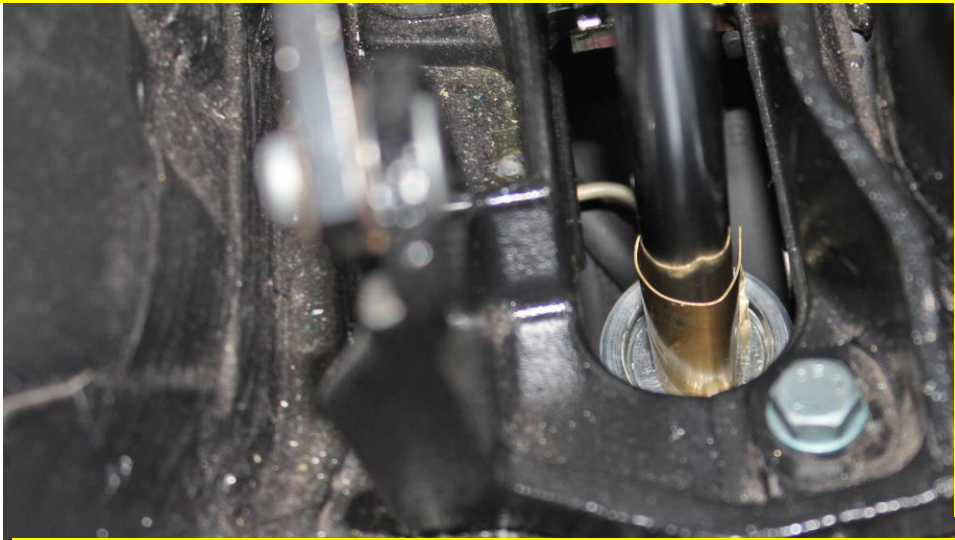


Main lift cylinder new rod seal installed,
top view.



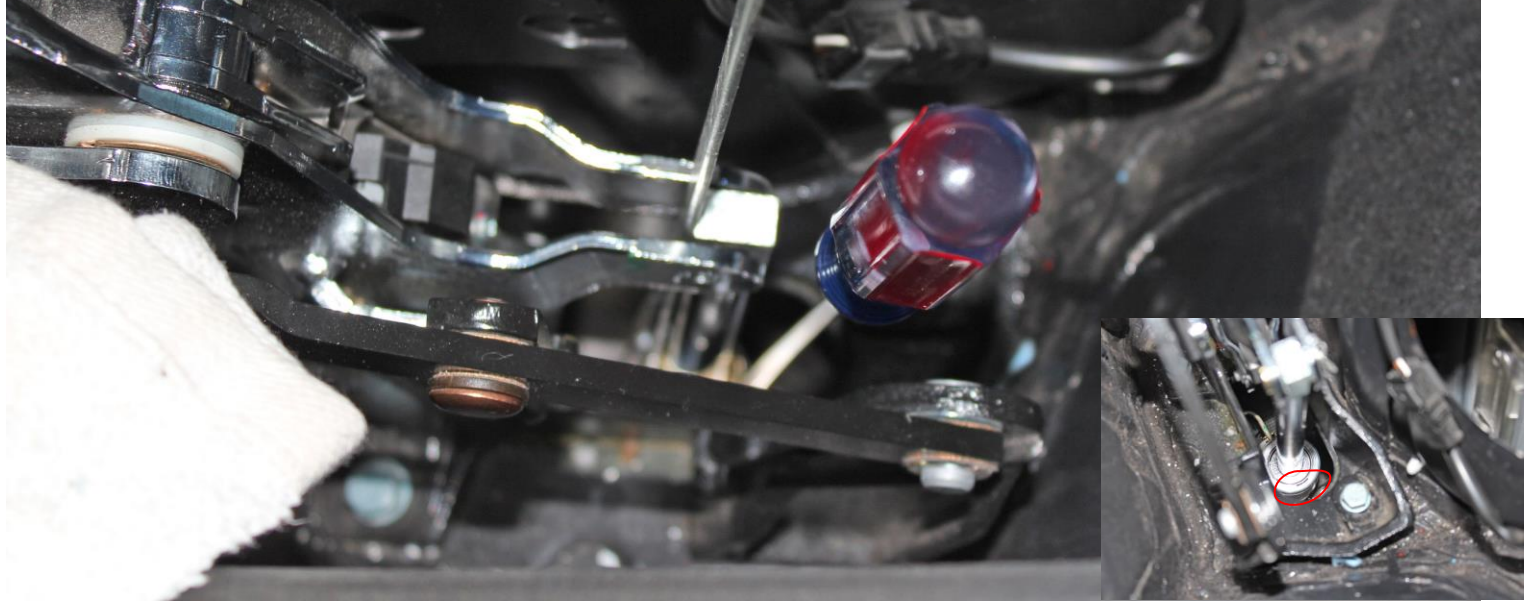
Not recommended but this is how I removed the main lift cylinder rods in-car.

I had read about this method in Benz world and I was running out of time to install main lift rod seals so I used this method. Older main cylinders don't have the cap retained with a circlip so this doesn't apply to those type of cylinders.



Main lift in-car rod removal, protective sleeve used during circlip removal. Rod extended to have better tool and sight access during circlip removal.

Used a long flat head screwdriver and an assist rod to remove/install circlip. Main lift cylinder has a convenient cut out for screwdriver tip and circlip removal. Thoroughly cleaned top of cylinder before removing rod. I modified the screwdriver tip by rounding edges and created a groove on the side to hook the circlip when the tip is rotated and clip is compressed, used groove to help hold circuit during removal and install. Long assist rod used to position and hold circlip in place while compressing circlip with screwdriver.



Original rod seals and O-rings removed from rear locks and tonneau cover lift cylinders. Wrench sizes used to remove rod end, 10mm and 11mm for the tonneau cylinders and a 7mm for the rear locks.



Original rod seals and O-rings removed and replaced, all 11 cylinders. New seals(not shown) were purchased from mbseals.com. Rod seals are high quality, they fit and seal well. Top has been cycled more than 50 times since seals were replace and all is good, no leaks. Port seals replaced in front locks.

