

## Marquee LC Tube Replacement

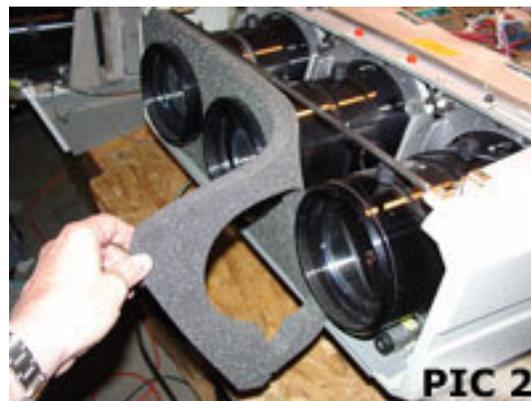
Applicable Models are M8500LC, M9000, and M9500LC and LC Ultra.

**These procedures are presented for reference by experienced projector technicians who may be new to the Marquee chassis or for those seeking a review of the steps needed to replace a Liquid Coupled CRT assembly. These procedures are not advised for beginners! Handling of Cathode Ray vacuum tubes entails the risk of injury from flying glass fragments. Also, the required yoke alignments following reassembly involve reaching next to Lethal Voltages on the tube neck. Anyone attempting any of the described procedures is doing so at their own risk.**

Disassembly will consist of several stages, including removal of some outer cosmetic covers, disconnection of anode and yoke lines to the tube, removal of the neck board from the tube, removal of the lens, and finally the removal of the tube or tubes that are in need of replacement. If employing replacement tubes acquired without magnetics or covers, those items can be transferred from the original tubes but this will necessitate alignment of the magnetics afterward, which does bring risk of electric shock. A fussy alignment of tube yokes after returning the projector to its' point of use is desirable for best image quality anyway. Removal of hot glue from the rear edge of the focus yoke and from the gap between focus yoke and convergence yoke is recommended, or alignment will be hampered.

Read our **Tech Tip 9, "Marquee Magnetics Alignment"** for more info. If your replacement tube(s) are second-hand then it is advised to inspect closely for excess glycol pressure in the bellows; test by pressing inward with fingers on each side of the black rubber bellows; if the bellows is firm, not spongy to the touch, then we advise venting an ounce or two of fluid out of the fill holes, or one faces the risk of having the excess pressure cause a cracked tube face (tube destroyed) or leaking of the glycol out into the chassis, two extremely bad problems that are worth avoiding. Tubes with clouded glycol or with debris in the glycol are better if the glycol is flushed and refilled with new glycol, contact us if you need this done.

**Okay, ready? UNPLUG the AC POWER CORD from the front panel!**



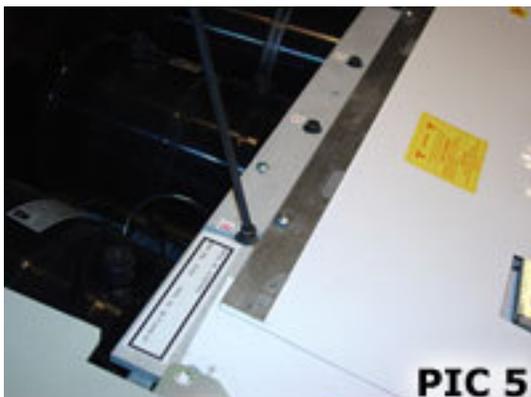
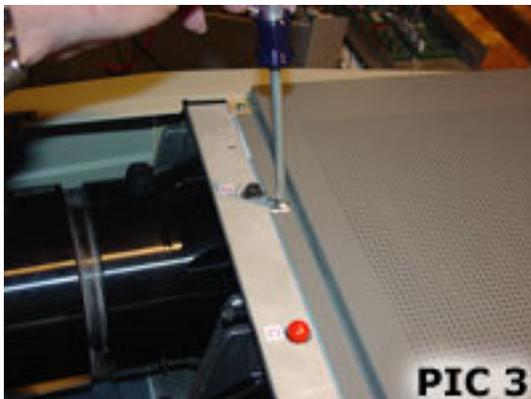
Begin by lifting up the front of the gray metal lens cover, it is held by snaps in front and tabs in the rear, pull it forward and set it aside. (see **PIC 1**)

Next, carefully remove the foam lens surround by pulling it forward and away, it is foam rubber and is easily torn, and remove the spreader bar just above it held by two small phillips screws. (see **PIC 2**)

Two phillips screws secure the main gray top cover (see **PIC 3**), loosen the screws and slide that cover rearward and set it aside. A machined plate is positioned across the tops of the tubes, just above and behind the lenses, this machined plate adds mechanical rigidity and provides pivot pins for the red and blue CRTs; it is held to the tubes by four allen bolts. (see **PIC 5**) The middle two bolts may have small red caps on them, pull the caps off if present and remove all four bolts and their washers with a 3/16" allen driver. When necessary to pivot the red and blue tubes for mechanical convergence, one loosens one allen bolt at the top, and two more bolts atop the foot of each tube casting just under the lens, marked "C" on our green tube, and one then tightens those bolts when aligned.

Remove one phillips screw (see **PIC 6**) atop each side panel to access the machined plate. If replacing red or blue tubes, the white plastic side panel and also the inner metal panel will need to be removed for that side, these are held by a few screws along each side. Do not mix coarse and fine threaded screws during reassembly.

The thin white sheet is a lead x-ray shield, it can stay with the plate.



The plate aligns the tubes with small pins facing down, these can bind a little so pry up just under the plate with a screwdriver if needed. (see **PICs 7 and 8**)

Note the bolt holes and locator pin holes atop each tube, the plate needs to mate with these pin holes later during reassembly. (see **PIC 9**)

Tube replacement can be done on a ceiling with a bit of care and someone to assist. This is made easier by first removing the lens for any tube being replaced. Each USPL lens barrel is near ten pounds in weight and is secured by allen bolts at the NE, NW, SE and SW compass angles, do not remove the other allen bolts!

Using a long 9/64" allen driver, remove the two allen bolts (see **PICs 10 and 11**) **closest to the floor first**, then the upper two while someone holds the weight of the lens barrel so not to fall. This applies to a projector on a table also.

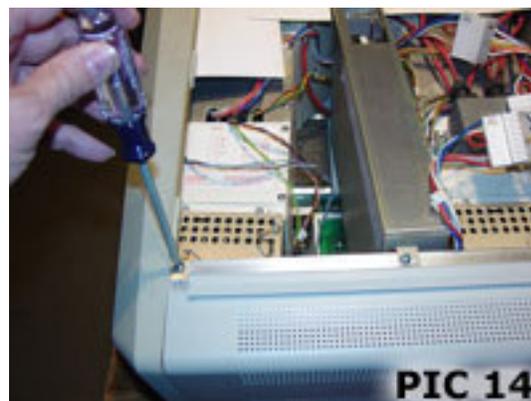
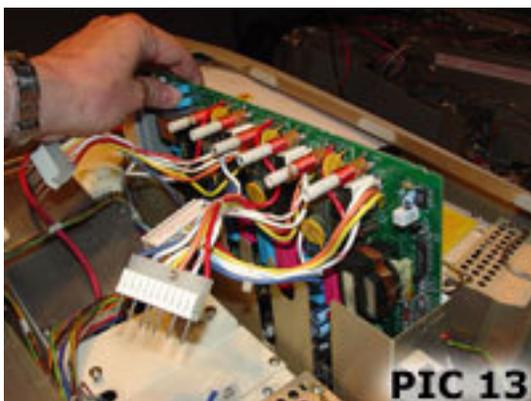
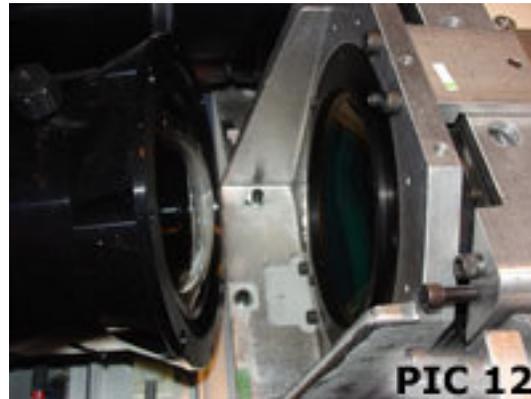
Pull the lens barrel straight forward and away (see **PIC 12**) so the element bulging out the rear does not scrape anything and become ruined; the lenses are very costly. If setting the lens barrel face down, take care it is not set down on a screw or anything that can touch the front element. Never set the lens down on the rear bulge, that will destroy it.



The **Horizontal Deflection Module** rests in a metal sleeve between the green and blue tubes; it weighs several pounds and can fall from a ceiling; unplug the three yoke couplers, making note of the orientation at the coupler and also note that red is frontmost, green in the middle, and the blue yoke is at the rear. If these are mixed up then static horizontal convergence will not function correctly, as that is a DC offset voltage applied to the scan yokes, same for vertical. Remove the HDM board (see **PIC 13**) and set it aside.

We must now access the neck board to remove it; this is best done by opening the rear heat sink, it is on a hinge; remove four phillips screws across the edge of the heat sink. Note the braided grounding straps, they will need to be reinstalled later. (see **PICs 14 and 15**) If on a ceiling, tie the heat sink up out of the way with twine or wire. Neck boards must be removed from the tube necks to allow tube removal; the covers that secure the neck boards must be removed (see **PIC 16**), they are held by two small screws; note the grounding straps that need to be secured to the heat sink during reassembly.

Here we see the video final amplifier card, or "neck board" (see **PICs 17 and 18**) because it plugs onto pins protruding from the rear of the tube neck itself. The black lines with blue lug connections are called Aquadag grounds (see **PIC 19** operation of the tube without these will destroy a neck board instantly. The lugs must fit the ground tabs tightly, crimp the lugs some with a pliers to ensure very snug contact. Needlenose pliers are useful to remove or crimp these, pull the lug end upward to undo. (see **PIC 20**).



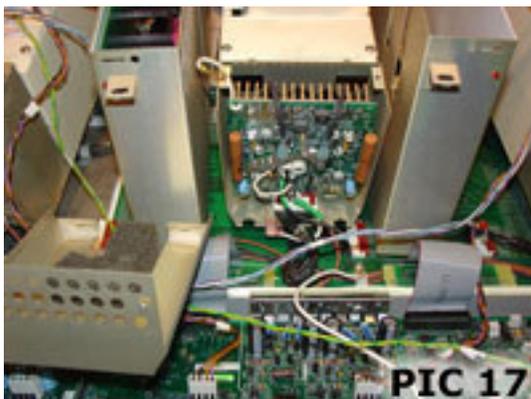
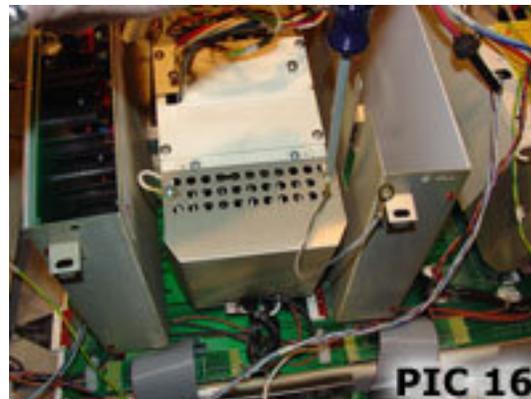
The white jumper wire into the end of the tube carries 500+ volts of G2 bias current, make sure to reconnect to the tube pin closest to the base of the jumper or the tube can be damaged. (see **PIC 21**). If connected wrong the tube will flash violently; power down at once and recheck all connections. At reassembly, **crimp** the round end of the jumper until slightly oval for a snug fit. (see **PIC 22**)

The green-tipped wire closest to the G2 jumper is the G2 feed, it is a lug and can only fit at that point. (see **PIC 23**) The G2 feed originates in the high voltage power supply.

The green-coded line with metal plug tip is low level video from the input section and it can only connect to the matching socket, the plug looks like a miniature phono or RCA type plug. (see **PIC 24**) This feed originates in the VIM input section on the rear panel.

The fourteen-pin molex connection below that carries power and ground connections and also some protection signal lines; the VNB can detect excess beam current in the tube and limit the current to shut down the beam before the tube is ruined. Tubes that have suffered phosphor scarring in small lines may have spot kill circuit problems; this circuit must be operating or the replacement tube will be similarly ruined, do not proceed without having spot kill function confirmed or repaired.

Note also on your neck board a ground wire at top that gets secured back to the cover screws, and a ground lug to the sheet metal below the fourteen-pin molex, this is a tab connection for ground.



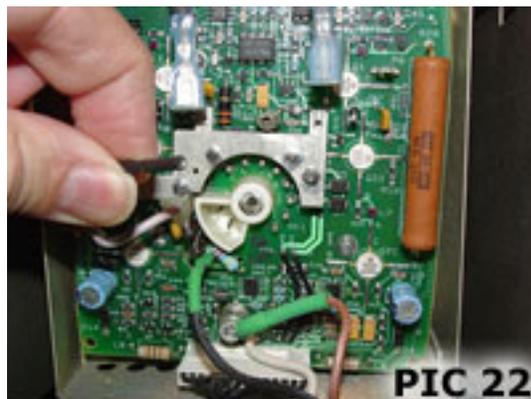
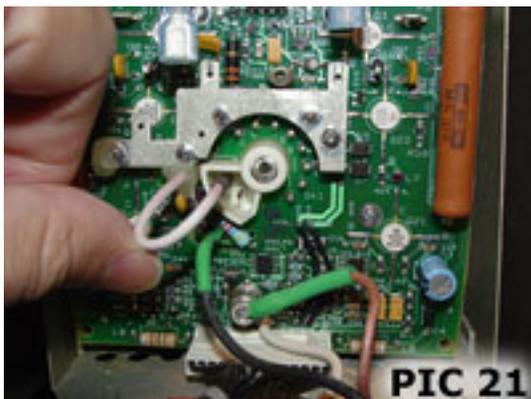
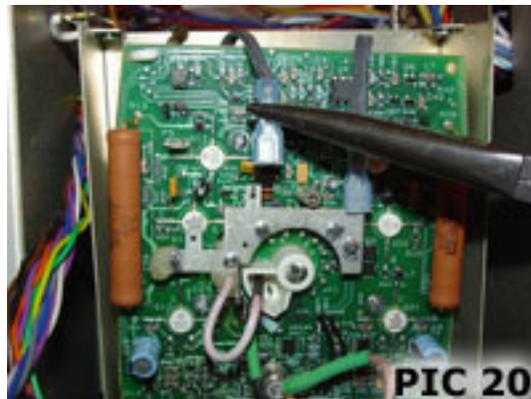
All electrical connections to the tube must be undone; the 34.9kv high voltage anode splitter sits atop the green tube cover and can be accessed by loosening two phillips screws that secure it. (see **PIC 25**)

The anode wires carry Hobson bayonet connectors (see **PIC 26**); turn them to the left and pull away. A pair of needlenose pliers can engage the grooves on each side for removal. The metal tip of the anode wire can carry several thousand volts stored inside the tube, even days after the tube was last operated, so be aware that a jolt is possible though not likely lethal. Hobson connectors must be firmly snugged on the anode lines of the replacement tubes, or high voltage arcing may occur.

Three focus yoke molex connectors (see **PICs 27 and 28**) plug into the focus board which sits opposite the HDM, also in a sleeve. Remove the focus molex for the tube being removed and for any yoke wires which are in the way.

Except for HDM and Vertical Sweep, the other Molex connectors are meant to only plug onto the pins in one orientation; if it needs to be forced then it probably is not turned correctly, try flipping the plug over. Do not mix red with green with blue; every Molex is tube-color-specific.

The stigmation yoke plugs have gray/blue/violet/white wires (see **PIC 29**), unplug each stig yoke for the tube(s) being removed; remove any small white nylon wire tie clips if installed.

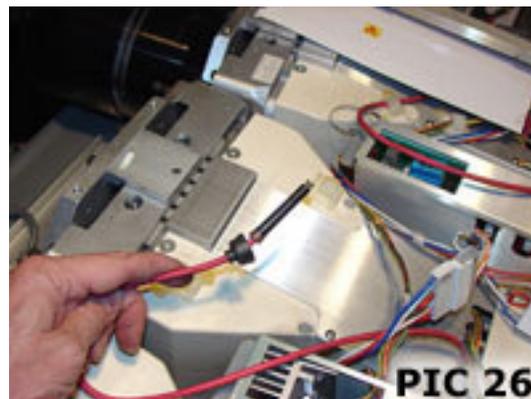
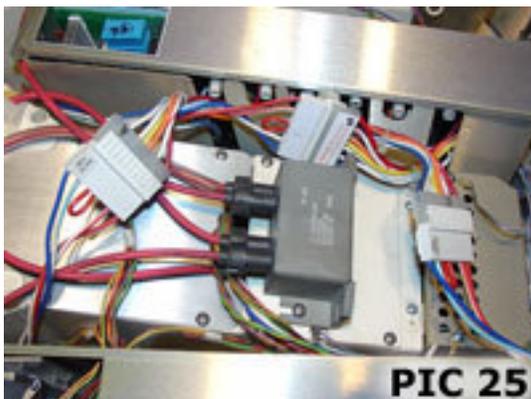
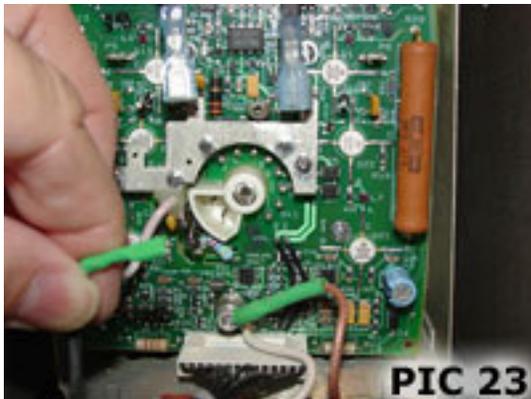


Next unplug the convergence yoke for any tube(s) being removed. (see PIC 30) These wires are orange/brown/violet/black.

The vertical yoke has a green/yellow wire pair which may be flipped to REV SCAN mode for some mounting positions; note the mode you are starting with if unplugging all three yokes at the same time; these are color-specific as static vertical convergence is delivered thru sweep with a DC offset voltage. (see PICs 31 and 32)

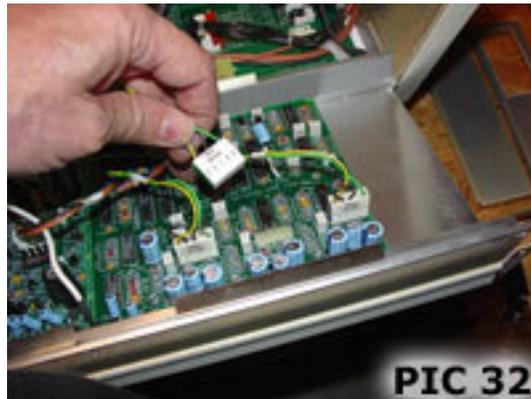
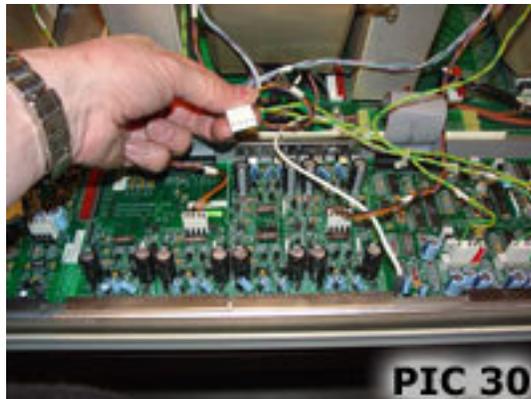
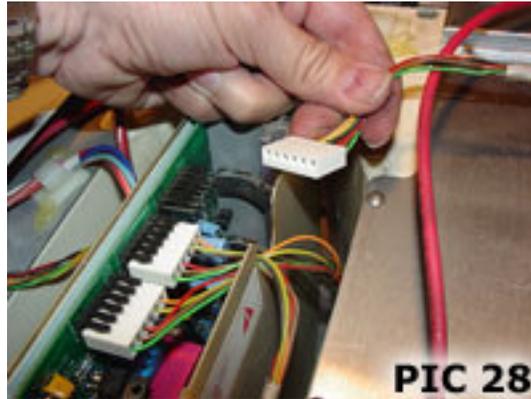
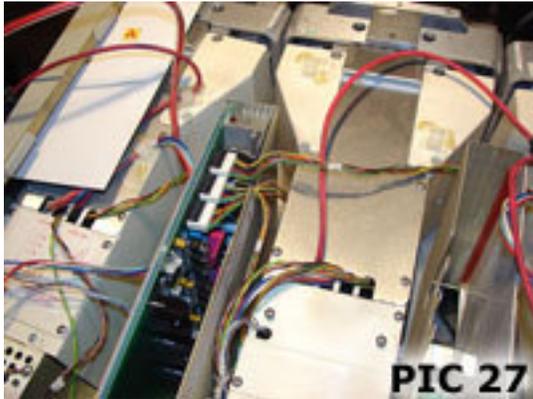
We should now be free of all electrical connections between tube and chassis. These lines can be bundled with tape or rubber bands to prevent snagging as the tube is removed, this is recommended if coming down from a ceiling. (see PIC 33)

With all electrical connections detached and the neck board removed, all that holds the tube in the chassis is two 1/4-20 allen bolts as shown. **If the projector is on a ceiling, one must get assistance to hold the 15 pound weight of the tube as these two bolts are removed; never try this without a helper.** Use a 3/16" allen driver to undo the bolts. (see PIC 34) They are labeled "C" on our green tube.



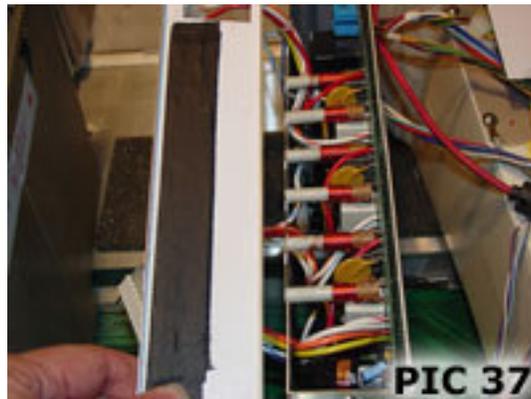
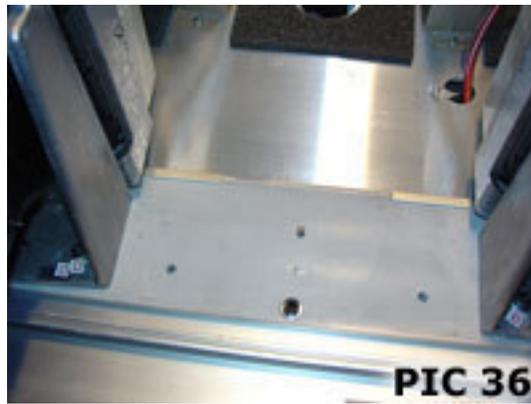
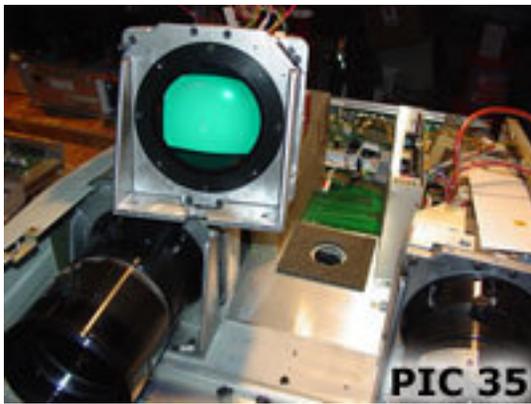
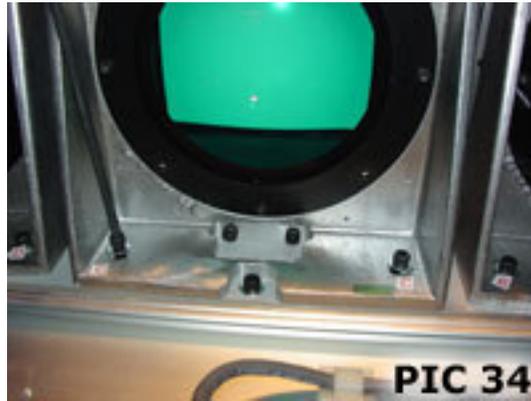
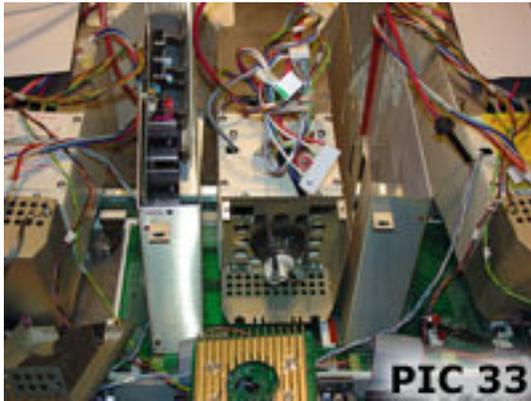
With the tube lifted (or lowered) clear, note the base it sat on, a locator pin on the plate below will need to engage a hole in the base of the replacement tube as a pivot pin and so the bolts can line up to the tube casting. (see PICs 35 and 36)

If re-using original tube covers or tube magnetics, they can be removed from the old tube now; a 3mm ballnose allen driver and a medium phillips screwdriver will be needed, see our website for a review of yoke alignments at <http://www.etechvideo.com/> and visit **Tech Tip 9**. See also our Tech Tip titled "**Preparing Marquee LC Tubes for Installation**".



**Red and blue tubes usually have X-Ray shields at one side, undo the two screws and small metal plate and move the shields to the tube(s) being installed.**

**LC lenses and adjustments** will be covered in a future Tech Tip, these can be found also in the Marquee Users Manual for LC models.



We also advise, for projectors mounted upside down, to redo the lid of the HDM sleeve cover by removing the white foam material, which is usually crushed and flimsy, and install 7 or 8 layers of duct tape or similar as a pad to support the weight of the HDM board so not to fall out of its' socket and cause a stoppage. A 3mm pad should do, and leave a small gap for the sleeve edge to contact the cover and still support the board edge. (see PIC 37)

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