



IBM ThinkPad 390 series Screen hinges reinforcement

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The European Society for Computer Preservation
<http://www.esocop.org>

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Introduction

The IBM ThinkPad 390 series. Among the first, if not the very first ThinkPad line which was not built by IBM itself, but by a 3rd party manufacturer under license. For the 390 series of ThinkPad notebook computers, the manufacturer was Acer.

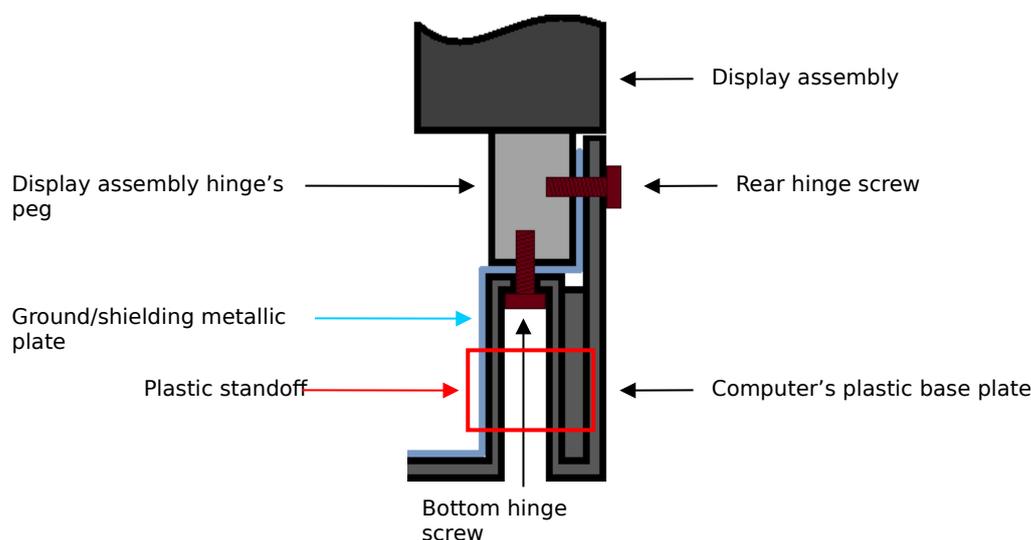
Acer was known mainly for their low-budget notebooks and IBM signed a partnership with the Taiwanese manufacturer to build the ThinkPad 390 series, which in fact was aimed at the entry/mid-level market. Unfortunately though, Acer was also known for the quite often questionable build quality of their products, being them made out of flimsy plastic, using weak mechanical parts and low-end electronics, with design choices where cutting the manufacturing cost was the priority over the product's good engineering and lifespan.

Despite this, the Acer-made ThinkPad 390 notebook computers were reasonably well built, in fact their build quality is pretty high for an Acer product. Of course having those notebooks to carry the IBM ThinkPad brand name, they had a certain manufacturing standard to be met.

However, they have a problem to an area which is quite critical for their mechanical integrity: the screen hinges.

The issue

The way the hinges are designed is neither the most durable nor robust. The two metallic pegs which protrude from the display assembly are mounted on small plastic standoffs which are attached to the case's base plate (they are actually an integral part of the whole base plate moulding):



This design is not one of the most durables. All the pulling/pushing forces that happen when the user open and closes the display must be sustained just by plastic parts in their weakest spots, namely the screw holes and the plastic areas immediately around them. The ground/shielding metallic plate is not strong enough to be of any help, actually you can bend it easily by fingers, and there is no other kind of reinforcement around these spots, neither in the form of thicker plastic structural supports nor hard metal reinforcement plates.

After years of strains, together with the plastic that often becomes increasingly brittle due to a mixture of probably not very high quality (aka: cost saving measures), this is what begins to happen in the zone of the case where the hinges are located:



This doesn't look good at all...

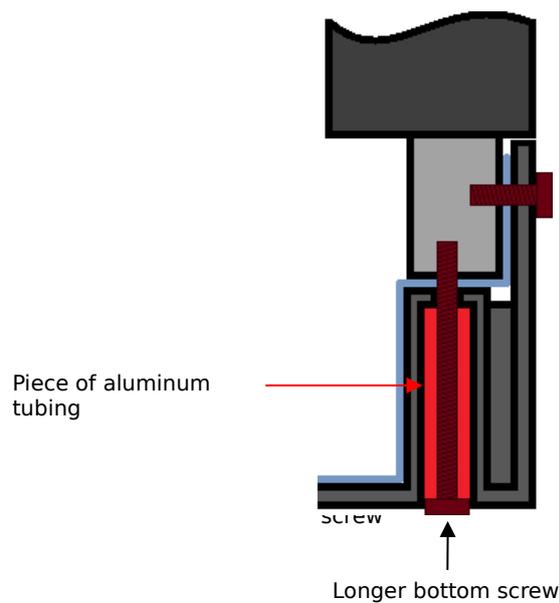
And some time after, you're going to end with this:



Now that hurts. OUCH!!!

My solution

The issue is due to the fact that a lot of forces are being applied on just two small and weak spots. What I thought is to increase the dissipation area of these forces, by filling the empty space in the plastic standoffs with a small piece of aluminium pipe which reaches the standoff's bottom hole, and a long screw which holds together all the stuff:



By doing this the structural rigidity of the plastic standoff is increased by a good extent, and the fact that both the aluminium pipe and the new and longer bottom screw reach down to the standoff's hole located at the bottom of the case, ensure the greatest possible dissipation area for the pushing/pulling forces.

NOTE: this modification has a drawback; you won't be able anymore to use the ThinkPad 390's external port replicator. This device has two pegs which actually fit inside the space that after this modification is being occupied by the aluminium pipe and the new longer screw. You'll have to decide between being still able to use the port replicator, or having a laptop of which you don't have to be worried to break down the case where the screen hinges are located, every time you open or close the lid. For me, the latter definitely wins.

Anyway, maybe cutting the port replicator's pegs makes it possible to use it again with a modified ThinkPad 390, but as I don't have such device I can't try by myself if this works.

And now, let's finish with the theory and proceed with the practical part.

How to do it (with photos)

Bill of materials

First of all, a list of what you'll need:

1. Aluminium pipe of 6 mm diameter, with a centre hole of 2.5 mm diameter.
2. M2.5 screw of 2.5 cm length (will have to be cut slightly).
3. Epoxy glue

In my case I had to use a 6 mm aluminium pipe together with a 4 mm brass one, as every 6 mm aluminium pipe I found at my local DIY shop had a 4 mm centre hole:



By putting the brass pipe inside the aluminium one I managed to achieve the correct centre hole diameter:



Let's go

Taking a measure of how much the aluminium pipe would fit into the standoff's hole...



...revealed that a 1.4 cm piece has to be cut:



A Dremel cutting session after, this is the result:



Looking if the piece fits correctly the standoff's hole both in diameter and length:



Actually I had to do some adjustments as I did cut a slightly longer piece of pipe, but after them it fitted the standoff's hole just right. Anyway it's better to cut a slightly longer piece that can be adjusted later rather than a too short one that have to be just thrown away. Adjust the pipe piece's length so that when fully inserted it's aligned with the case's bottom surface, or eventually just a bit under it (say 0.5 mm) if your screw has a quite thick head, to prevent it being taller than the rubber feet on the notebook's bottom.

If you see that fitting the pipe inside the standoff's hole requires too much force, don't insist and adjust the pipe's outer diameter by brushing away some material with sandpaper. Insisting to press it into the hole can damage the standoff's plastic, which after more than 20 years may be already weakened. Try to be as uniform as possible, one way to do that is to rotate the aluminium piece with a drill while pressing on it with the sandpaper sheet. Brush a bit and check if the piece now fits correctly into the hole, if not brush a bit more and check again, repeat all that until reaching the correct outer diameter.

Remember that the aluminium pipe piece mustn't wobble inside the standoff's hole, it must fit tightly.

Now take your M2.5, 2.5 cm long screw and cut it until its length is 2.2/2.3 cm:



Try to insert the screw into the piece you did cut before to see if it fits:



The screw also mustn't wobble inside the pipe piece and it must stick out of it for about 8 - 9 mm.

Now do the other piece:



and repeat all the steps above for it as well.

At this point you could already try to see if the whole thing works. Fit both the pieces inside the standoffs and screw back the display assembly to the notebook, using the new long screws. By gently moving the lid, now you should already feel that the hinges are a lot more robust than before. I noticed that with both my ThinkPad 390E and 390X.

Now it's glue time



By gluing the aluminium pieces inside the standoff's holes you prevent them from doing the slightest movements, and as the standoff's plastic will be glued to the pipe with the epoxy glue it would be less likely for it to break in the future.

Put away again the display from the notebook, remove the aluminium pieces and put some epoxy glue inside the standoff's holes:



Then fit back the pipe pieces into them:



Now put together the notebook again by mounting back the display assembly:



At this point leave alone your ThinkPad 390 for a day, to let the epoxy glue dry out.

You're done. Enjoy your ThinkPad 390 with its now reinforced hinges supports :)